National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

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RIVM Report 2016-0065

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Preface

In the Netherlands, government policy is directed at curbing alcohol consumption. One example is the recent increase of the minimum age to buy alcohol from 16 to 18 years. Alcohol policies induce much debate in society, with parties defending and parties offending policies to further decrease alcohol consumption active in this debate.

The Ministry of Health, Wellbeing and Sports has commissioned a number of studies via the Netherlands Organization for Health Research and Development (ZonMw) with the aim to inform Parliament about different aspects of alcohol policies. The current research report concerns a study on costs and benefits of alcohol and alcohol policies. First, information on costs and benefits of alcohol consumption in the Netherlands is given. A great number of data and figures have been collected, e.g. about traffic accidents, productivity losses and costs of police and justice related to alcohol consumption. All costs and benefits of alcohol have been quantified for one year, 2013. Despite the fact that some evident societal benefits of alcohol are present, e.g. for producers and retailers of alcohol, alcohol appears to have net costs for our society.

A second research question concerns the social costs and benefits of further strengthening of Dutch alcohol policies. Costs and benefits of three policy measures have been estimated for a period of 50 years after introduction of such measures. These policies are (1) a further increase of excise taxes for alcohol, (2) a reduction of the number of sales venues of alcohol and (3) a total mediaban for alcohol. These policy measures will have net social benefits for society, but its magnitude differs for the different policies. Furthermore, policies differ with regard to the stakeholders in society that pay for its costs and profit from its benefits.

In this study, Social Cost-Benefit Analysis (SCBA) was used as analytic technique. Since a number of years, government asks the SCBA framework to be used in (ex-ante) evaluation of government policies. Although RIVM has ample experience with economic evaluation of (public) health policies, actual use of the SCBA framework was limited until recently. The current study was performed in close cooperation with three other research partners (Trimbos Institute, Ecorys and Maastricht University). Within this consortium, an SCBA on the subject of tobacco control was performed concurrently and within RIVM, several other SCBA projects are ongoing. These different research projects contribute to RIVM's knowledge base in the field of SCBA, as well as to good relationships with other research institutes.

However, this specific study could not have been performed without the close cooperation with the three other institutes. I would like to thank all colleagues involved for their effort. I hope that the current report will contribute to the discussion on alcohol policies in our country.

A.M.P. van Bolhuis, MA
Director Public Health and Health Services at RIVM

Synopsis

Social cost-benefit analysis of regulatory policies to reduce alcohol use in The Netherlands

If all costs and all benefits of alcohol are expressed in monetary terms, the net costs were 2,3 to 2,9 billion euro in 2013. Examples of the costs of alcohol are less productivity at work, costs of police and justice and traffic accidents. Alcohol also has benefits, for instance excise tax income for government. The feeling of wellbeing that consumers may experience from drinking alcohol has also been expressed in monetary terms. The monetary benefits of alcohol have been subtracted from the costs of alcohol to arrive at the final estimate of net costs for society.

Regulatory policies aimed at reducing the amount of alcohol consumed, such as a further increase of excise taxes, a reduction of the number of sales venues and a total mediaban, will result in savings for society at large. Some examples of such positive effects are less mortality and improvement of quality of life because some diseases associated with alcohol are prevented, more productivity, less traffic accidents and less efforts to be taken by police and justice.

In the long run, over a period of 50 years, an increase in excise taxes of 50% will result in societal benefits of 14 to 20 billion euro, an increase of excise taxes of 200% will result in societal benefits of 37 to 47 billion euro. The societal benefits of closure of 10% of sales venues are estimated at 3 to 5 billion euro after 50 years, and at 8 to 12 billion euro when 25% of sales venues would be closed. The societal benefits of a mediaban would amount to 7 billion euro after 50 years, but there is more uncertainty about this result.

This appears from a study led by RIVM. The three regulatory policies have been modelled using the Social Cost-Benefit Analysis (SCBA) approach. By expressing the net welfare effect of government policies and interventions, SCBAs can support policy makers in taking decisions on implementation of future policies.

Keywords: Social Cost-Benefit Analysis, alcohol, Cost of Illness, increase of excise taxes, closure of sales venues, mediaban

Publiekssamenvatting

Maatschappelijke kosten-batenanalyse van beleidsmaatregelen om alcoholgebruik te verminderen

Als alle kosten en baten van alcohol in geld worden uitgedrukt, waren de kosten in 2013 ongeveer 2,3 tot 2,9 miljard euro. Kosten kunnen bijvoorbeeld ontstaan door een lagere arbeidsproductiviteit, door inzet van politie en justitie, en door verkeersongevallen. Deze kosten zijn verminderd met de baten van alcoholgebruik, bijvoorbeeld in de vorm van accijnzen voor de overheid. Maar ook het geluksgevoel dat consumenten kunnen ontlenen aan alcohol is in dit onderzoek in geld uitgedrukt.

Maatregelen zijn mogelijk om mensen minder alcohol te laten drinken, zoals een accijnsverhoging, een beperking van het aantal verkooppunten en een totaalverbod op alcoholreclame en –sponsoring. Zulke maatregelen kunnen de samenleving forse besparingen opleveren en hebben daarmee netto een positief effect op de Nederlandse samenleving. Voorbeelden van die positieve effecten zijn minder sterfte en betere kwaliteit van leven doordat ziekten die met alcoholgebruik samenhangen worden voorkomen, een hogere arbeidsproductiviteit, minder verkeersongevallen en minder inzet van politie en justitie.

Op de lange termijn, over een periode van 50 jaar, levert een accijnsverhoging van 50 procent tussen de 14 en 20 miljard euro op, een accijnsverhoging van 200 procent 37 tot 47 miljard euro. Het saldo van kosten en baten na 50 jaar is 3 tot 5 miljard euro wanneer 10 procent van de verkooppunten worden gesloten. Dit bedrag loopt op tot 8 tot 12 miljard euro bij een sluiting van 25 procent van de verkooppunten. Een mediaban levert de samenleving circa 7 miljard euro op na 50 jaar, maar hierover bestaat meer onzekerheid.

Dit blijkt uit onderzoek geleid door het RIVM. Met een zogeheten maatschappelijke kosten-batenanalyse (MKBA) zijn deze drie beleidsmaatregelen doorgerekend. MKBA's zijn een hulpmiddel om de welvaartseffecten van maatregelen in kaart te brengen en kunnen beleidsmakers ondersteunen bij hun beslissingen over toekomstig overheidsbeleid.

Kernwoorden: MKBA, alcohol, Cost of Illness, accijnsverhoging, sluiting verkooppunten, mediaban

Contents

Summary

Alcohol consumption is very common in the Netherlands. Consumption of alcohol is associated with positive and negative effects for society. These effects stretch out in many domains / sectors of society, such as taxes, healthcare, productivity, education and police and justice. The study described in this report addresses two main research questions:

1. What are the economic costs and benefits of current alcohol use?
2. What is the (economic) impact of new policies to reduce alcohol use relative to a reference scenario without implementation of such new policies?

Question 1 has been answered by providing a cross-sectional analysis of costs and benefits for the year 2013. Question 2 entails a prospective analysis of changes in all societal domains associated with alcohol after implementation of these new policies. The three new policies considered are:

1. An increase of excise taxes with 50% and 200%.
2. A reduction in outlet density of 10% and 25%.
3. A total ban on advertisements (media ban) for alcohol.

This study uses the method of Social Cost-Benefit Analysis (SCBA). Within this SCBA, projections for a period of 50 years after implementation of new policy measures are made, using modelling techniques. This period was chosen to also include the long term effects of alcohol on health in the analysis.

Although some obvious benefits (i.e. income from excise duties) are present, alcohol is associated with a net cost to society. This net cost is estimated to be between 2.3 and 2.9 billion euro for the year 2013. Costs are mainly borne by consumers of alcohol, following costs of traffic accidents, premature mortality from diseases associated with alcohol, loss of quality of life associated with diseases that are associated with alcohol and productivity losses. At the same time, consumers experience a considerable benefit in terms of welfare gains associated with (the pleasure of) consuming alcohol, the so-called consumer surplus. Annual tax income for the government was over 1 billion euro. Producers and retailers experience benefits from production and distribution of alcohol, the so-called producer surplus, that was estimated at 0.7 billion euro in 2013.

Within the prospective analysis, the SCBA, policy measures were compared to a reference scenario, reflecting the current state of play and autonomous trends without implementation of the policy measures, that is the most likely changes in alcohol consumption without interventions. As current alcohol trends are pointing at different directions, we choose to keep current alcohol consumption patterns stable over time. Compared to this reference scenario with stable alcohol consumption patterns, annual (undiscounted) benefits of a 50% tax increase are expected to be roughly between 350 and

850 million euro over the 50 years considered. The cumulative discounted net monetary benefit over a period of 50 years is 17 billion euro (95%CI 14-20 billion euro). In the 200% tax increase scenario, annual benefits are between 1,000 and 2,300 million euro, with cumulative (discounted) social benefits of 42 billion euro (95%CI 37-47 billion euro). Both scenarios represent an overall benefit to society. These monetary benefits are unequally spread over the different stakeholders involved, with alcohol consumers being largest net payers. Benefits are redistributed to all consumers (including those who consume alcohol) because of reduced insurance premiums and higher wages following higher productivity. The government sector also experiences benefits from higher excise taxes, because of reduced costs in the fields of education and police and justice. These results are fairly robust in sensitivity analyses with regards to discount rate, valuation of QALY losses, either or not including productivity losses and different price elasticities.

The second policy scenario, focusing on less availability of alcohol through limiting the number of outlets where alcohol is sold, has positive social benefits as well, albeit somewhat less high than in the scenarios involving an increase in excise taxes. The cumulative discounted value to society of a 10% decrease in outlet density over a 50-year period amount to 4 billion euro (95%CI: 3-5 billion euro). All three main stakeholder groups (alcohol consumers, all consumers and government) experience benefits from this reduction in number of outlets that sell alcohol. In the 25% decrease in outlet density scenario, these effects are somewhat stronger, with a cumulative discounted value to society over a 50-year period amounting to 10 billion euro (95%CI:8-12 billion euro).

Finally, the third policy scenario involving a total media ban was modelled using limited evidence on effectiveness of such a ban for alcohol advertisements. Best available evidence points at a decrease of alcohol use with 4% after implementation of a ban. Our best guess, for the scenario that a media ban leads to a 4% reduction in alcohol consumption, shows that the yearly (undiscounted) benefits may fall roughly between 0.1 and 0.4 billion euro over the 50 years considered, corresponding to a cumulative discounted value to society over a 50-year period of 7 billion euro.

Overall, our estimates for the policy scenario of increasing excise taxes are rooted into sound evidence on the effectiveness of such policies. Sensitivity analyses consistently show societal benefits of such policies, with no major deviations from the results in the base-case analysis. Our results for the other two policy scenarios are more uncertain. Effects of a reduction of outlet density will most likely be positive (net benefits for society) but depend heavily on the expected reaction of consumers on the limitation of the number of sales venues. These so-called elasticities, that reflect the reaction of consumers to changes, are more uncertain for the policy scenario involving a reduction of the number of outlets selling alcohol than for the excise tax increase scenarios. Our best guess for the policy measure of a total media ban is that this will have net social benefits, but this result is only to be considered as a tentative result.

Calculations as made in this report may be used to underpin possible changes in alcohol policies in the Netherlands. However, final decisions on changes in policies are political decisions, and many more aspects than estimates of welfare effects of policies alone should be taken into account in such decisions. We have included some rather extreme scenarios, e.g. a 200% increase of excise taxes and closure of 25% of all sales venues. Social acceptability of such rigid measures may be sub-optimal. Nevertheless, our research shows that policy measures targeted at reducing alcohol consumption may lead to net social benefits.

Introduction

The Netherlands Organization for Health Research and Development (ZonMw) has commissioned this study to assess the costs to society of alcohol consumption, and to assess the effect of policy measures. The policy measures are evaluated using a Social Cost Benefit Analysis (SCBA) approach. The analysis is performed for the Ministry of Health, Welfare and Sports (VWS), with the aim to inform Parliament.

Alcohol consumption is very common in the Netherlands and most of the alcohol consumption is not problematic. Alcohol misuse and dependency, however, is often associated with a chronic course and is associated with a substantial disease burden. In 2014, 76.7% of Dutch adults consumed alcohol on a regular basis, with 10% of the population being classified as “heavy user”. A heavy user drinks at least once a week four (females) or six (males) glasses[1] of alcohol (Van Laar et al., 2015). Use of alcohol is associated with more than 60 different diseases, among which breast cancer, liver disease, cognitive decline and dementia, depression and anxiety disorders. According to the National Public Health Forecast 2014 (VTV, 2014), 2.8% of total Dutch disease burden expressed in Disability Adjusted Life Years (DALYs), is attributable to alcohol. This excludes the contribution of alcohol to accidents. The disease burden stemming from alcohol use not only affects lives of consumers and their families, but also has substantial financial and economic impact. According to the Global Burden of Disease study, the economic costs due to alcohol are estimated at 1.4% of the gross domestic product (GDP) in high income countries (Rehm et al., 2009). A Dutch study estimated these “Cost of Illness” at €2.5 billion in 2001 (KPMG, 2001). Alcohol consumption not only leads to costs in the health sector, but also for other government sectors, such as the criminal justice system, and in victims of alcohol related accidents and violence. Moreover, it affects productivity of the drinkers, thereby affecting economic production.

A recent RIVM review of cost-effectiveness studies of alcohol interventions concluded that an SCBA is needed to map all relevant costs and benefits of alcohol use (Suijkerbuijk et al., 2014). A social cost-benefit analysis takes a well-structured and systematic approach to reviewing all pertinent costs and benefits in order to be able to assess the full impact of an intervention on welfare at the macro level of a country. When the costs of the intervention are lower than the willingness to pay for its benefits, the intervention will increase general welfare. Such an evaluation demands that all consequences of a policy are being mapped and valued in monetary units, for all stakeholders, over a relevant period of time.

[1] Throughout this report, a glass of alcohol represents the Dutch standard glass per type of alcohol (beer, wine spirit), implying an intake of 10g of alcohol

The methodology of social cost-benefit analyses was only recently introduced in the field of (public) health, where cost-effectiveness analyses (CEA) and cost-utility analyses (CUA) are more commonly applied. Although guidelines for health economic evaluation state that a societal perspective should be taken, studies often do not include costs beside healthcare costs, productivity losses and patient costs. Other costs, e.g. costs related to reduced school attendance or costs incurred by the criminal justice system, often are not incorporated in analyses (van Gils et al., 2010). Traditionally, CEAs and CUAs include health outcomes as main outcome parameters. An SCBA evaluates all outcomes in monetary units and summarizes the results into a single net benefit estimate. Furthermore, small methodological differences exist between CEA/CUA guidelines and guidelines for SCBA, mainly regarding the valuation of productivity losses, discounting, and extent of uncertainty analysis. In 2013, a Dutch guideline ("leidraad") was published to assure the quality and methodological consistency of Dutch SCBAs performed in different sectors of society (Romijn & Renes, 2013). How this Dutch guideline for SCBA relates to methods for health economic evaluation as practiced within healthcare was discussed in a RIVM report by Pomp and colleagues (Pomp et al., 2014). Pomp et al. concludes that SCBAs are expected to make a useful contribution to informing healthcare policies and decisions therein.

The aim of this study is to assess the costs of alcohol consumption to society as well as to analyze the welfare impact of three different regulatory approaches to reduce alcohol consumption in the Netherlands, using the evaluation framework of SCBA. The analysis aims to support decision-making on possible regulatory policies. The following policy measures are analyzed:

(1) increasing prices of alcoholic drinks by taxation;
(2) reducing outlet-density for alcohol-selling venues; and
(3) a total ban on advertisements (media ban) for alcohol.

The choice for these three policy measures was made by the Ministry of Health and ZonMw.

The SCBA addresses two central research questions:

1. What are the economic costs and benefits of current alcohol use in the Netherlands?
2. What is the (economic) impact of new policies to reduce alcohol use relative to a reference scenario without implementation of such new policies?

Both costs and benefits have been mapped and are valued in monetary terms. These relate to, among others, healthcare use, changes in labor productivity, changes in traffic accidents costs, violence and crime, and changes in the government's tax revenues. Costs and benefits are analyzed for the short and longer-term, by comparing a reference scenario (current state of play and autonomous trends without policy changes) with an alternative scenario in which the new regulatory policy has been implemented.

A consortium consisting of RIVM, Maastricht University, Trimbos Institute and Ecorys has performed this SCBA. At the same time, several consortium members are involved in other SCBAs, on issues such as Tobacco control (led by Maastricht University, consortium members RIVM and Trimbos Institute), addiction care for alcohol addiction (RIVM) and addiction care for cannabis addiction (RIVM). These SCBAs studies use similar methods. Because the SCBAs have been commissioned by different parties, each SCBA is published separately. However, specific parts of these reports, mainly in the methods section, use similar wording, reflecting that similar methodological choices were made for the different SCBAs.

Structure of this report

Chapter 1 provides some general notes on the methods used to address the research questions, e.g. with regard to the approach to modelling. In this chapter, we discuss the general framework of an SCBA and the models used to estimate costs and benefits of alcohol policies. Detailed notes on methods will be provided in Chapter 2 discussing the welfare implications of alcohol consumption for society in one year (2013). Research question 1 is answered in Chapter 2. Chapters 3 through 6 cover the second research question, the economic impact of policy measures directed at diminishing alcohol consumption. In Chapter 3 the reference scenario is described, i.e. expected developments under the current set of policies including autonomous trends in alcohol use. Chapters 4, 5 and 6 present and discuss the results of the three different policy measures. Chapter 4 is concerned with the increase of excise taxes, chapter 5 covers the implications of decreasing outlet density and chapter 6 discusses the consequences of a total media ban. Chapter 7, finally, presents the main findings of this research project along with a discussion of these findings and a research agenda addressing the most important gaps in current knowledge.

1 Background to the methods used in this report

1.1 Background to social cost-benefit analysis (research question 2)

An SCBA is a systematic method to value the impact of policy measures. SCBA is rooted in welfare economics. Related to alcohol, this classical economic approach assumes that people consume alcohol to fulfill a (perceived) need: they derive utilities from alcohol use in terms of e.g. (perceived) well-being. Thus, in the short run, the expenses for alcohol are justified by consumers on the basis of this perceived well-being. Alcohol consumption leads to revenues for various parties involved in supplying the alcoholic drinks, such as the Government (taxes, duties), retailers, and producers of alcoholic beverages. Restrictions in the consumption of alcohol, e.g. by increasing excise taxes or restricting outlet points, will then lead to a loss of welfare for consumers; they suffer a loss of "consumer surplus". Producers and retailers may suffer a loss of welfare as well, as their revenues will be reduced, possibly affecting their "producer surplus". The effect on the Government's income will depend on the price elasticity of demand for alcohol, the relative change in consumption occurring with a relative change in price: it may reduce, because of lower consumption; alternatively, it may remain stable or even rise, when loss of sales is compensated for by the increase in duties. These economic concepts are explained in more detail in Appendix 1.

However, in the longer term, the welfare impact of a change in alcohol consumption is much wider. This is due to various reasons such as the occurrence of addiction to alcohol (making consumption a less voluntary choice) and social, psychological and medical effects of alcohol consumption. Effects of alcohol consumption do no only occur in the consumer of alcohol, but others in society may be affected as well, e.g. after traffic accidents or violence following alcohol use. Such effects can, in welfare theoretic terms, be called external effects. To illustrate: as alcohol may adversely impact on the health of individuals, this may lead to an increase in healthcare costs, which is only partially incurred by the consumer. Substantial effects of alcohol consumption are only visible in the long run and may be (largely) external to the consumer, as others in society also pay for the costs associated with these adverse health effects via health insurance premiums. Additionally, the consumer does not take these costs into account when deciding on consumption and may underestimate the risk of future healthcare costs rising as a consequence of his behavior. Similarly, changes in crime rates and labor productivity may occur, with substantial effects not only for the consumer, but also for other parties in society.

Following the Dutch guideline for SCBA (Romijn & Renes, 2013), we have structured our research strategy along the following eight steps:

1. Scoping the problem.
2. Determine the reference scenario based on current policies.

3. Define policy alternatives.
4. Define and value the benefits of the alternative scenario vis à vis the reference scenario.
5. Define and value the costs of the alternative scenario vis à vis the reference scenario.
6. Conduct sensitivity analyses to assess the robustness of outcomes.
7. Assess the present value of costs and benefits and their distribution over stakeholders.
8. Present the outcomes.

These steps are explained in more detail below.

Step 1: Scoping the problem
As a first step, we 'set the stage' by describing the width and breadth of alcohol use in the Dutch population in terms of its prevalence and consequences, and the trends under the current set of alcohol-related policies. The main aim of this step is to describe the state of affairs of the current regulatory policies for alcohol in the Netherlands. This serves as the starting point for the SCBA. In order to come to an assessment of policy options to reduce (excess) use of alcohol, an overview of the various economic consequences of alcohol use will be given first. Here, we benefit from the work that was done in the context of answering the first research question, the cross-sectional assessment of costs and benefits of alcohol for the year 2013 (Chapter 2). Much of the data collected to answer research question 1 show to be very relevant for the first step of the SCBA process.

To map out all these effects and their consequences is the prime task in step 1 of the SCBA (scoping the problem). These data relate to the following effects of alcohol:

Table 1.1 Inventory of effects to be quantified in an SCBA of alcohol policy measures, by stakeholder

Stakeholder	**Effects**
1. Consumers	• Consumer surplus • Accidents (traffic, work, etc.); • Acts of nuisance; violence; crime; etc. • Loss of productivity (labor productivity; unavailability for labor market); • Effects on quality of life / wellbeing / premature death
2. Producers, retailers	• Producer surplus • Revenues for bars, restaurants, sport canteens • Employment
3. Taxes and duties	• Revenues from taxes and duties • Social security benefits
4. Healthcare	• Emergency department visits • Costs of treatment of alcohol-related diseases and injuries
5. Education	• School results; counselling of students; repeating classes • Lifetime costs of early school dropout / lower qualifications and lower future income
6. Police, justice	• Reaction costs (police action etc.) • Detention costs
7. Public authority (Government)	• Regulatory costs / implementation costs for policy measures (campaigns etc) • Enforcement and control
8. Others in society (non-users of alcohol / victims)	• Alcohol-induced vandalism and (domestic) violence; • Wellbeing of close relatives • Damage from traffic accidents; damage from crime; violence • Healthcare costs for non-users of alcohol • Productivity losses for non-users of alcohol • Effects on quality of life / wellbeing / premature death

Step 2: Determine the reference scenario based on current policies
Defining the reference scenario is crucial, because this will be the scenario to which the impacts of the new regulatory policies will be compared. Therefore, the reference scenario describes the current state of affairs (status quo) and how this will autonomously develop over time, i.e. without changes in alcohol policy but taking into account the demographic changes and autonomous trends (if any). In this SCBA, the time horizon is set at 50 years. This time-horizon was chosen as we wanted to model the long-term impact of policy measures.

Step 3: Define policy alternatives (alternative scenarios)
In this step, the possible regulatory policies are described. Broadly speaking, policies may impact on alcohol use by (1) increasing prices of alcohol, (2) reducing outlet-density for alcohol-selling venues, and

(3) implementing a ban on advertising for alcoholic drinks. Details of these policies will be described in Chapters 4 to 6.

Step 4 and Step 5: Define and value the benefits and costs of the alternative scenario vis à vis the reference scenario

In this step, the economic costs of implementing and maintaining the new policies are assessed relative to the reference scenario. First, it is assessed to what extent the policy measure will affect future consumption of alcohol, and, if possible, by which groups of consumers (e.g., young adults, adults or elderly; incidental users, mild users, excessive drinkers, etc.). Next, the impact on alcohol use per type of consumer is translated into positive and negative consequences that may stem from the new regulatory policies. Here, we take the step of assigning a monetary value (in €) to the costs and benefits for the various stakeholders relative to the reference scenario. Whenever possible, we used standard unit costs, e.g. for health economic evaluations (Zorginstituut_Nederland, 2015) or for inter sector economic evaluations (Drost et al., 2014). Another source of information for cost estimates was the “Werkwijzer MKBA in het sociaal domein”, a guideline detailing methods and unit prices for SCBA within the social sector (Koopmans et al., 2016b; Koopmans et al., 2016a), commissioned by the Ministries of VWS, SZW, OCW and BZK. All costs and benefits are expressed in 2013 euros. Future costs and benefits are discounted at 3%, in line with a Government statement in reaction to the publication of Dutch guidelines for SCBA (Romijn & Renes, 2013; Dijsselbloem, 2015). At this stage, it is crucial to avoid double counting of benefits (e.g. preventing transplantations of the liver and preventing hospital admissions).

Step 6: Conduct sensitivity analyses to assess the robustness of outcomes

The main analysis conducted in step 4 and 5 is subjected to sensitivity analyses to assess the robustness of the study’s outcomes in relation to the different assumptions made.

Step 7: Assess the present value of costs and benefits and their distribution over stakeholders

At this step, we compute the net present value of all costs and benefits for the appropriate base year 2013. Costs and benefits are shown for each group of stakeholders. Costs and benefits will be reviewed over a time period of 50 years. Some intangible costs and benefits cannot be meaningfully converted into monetary terms. One example relates to family members of alcoholics, who may be potential victim of domestic violence. Those costs will be not be valued monetarily but listed as pro memori (PM) costs or benefits.

Step 8: Present the outcomes

We report the outcomes of the main analysis and the sensitivity analyses in agreement with the guideline for reporting economic evaluations in a transparent and replicable way (Husereau et al., 2013). This is done for each of the policy options under review and includes a list of the non-monetized costs and benefits.

1.2 SCBA modeling approach

Our SCBA model is implemented as a Microsoft Excel model. The Excel model synthesizes all available input and transforms this into the overall costs and benefits associated with the regulatory policies considered in this project.

The model includes:

1. The costs of implementing (and enforcing) alcohol policies.
2. The effects of alcohol policies on alcohol intake.
3. The costs and benefits associated with reduced alcohol intake for the different domains as listed in Table 1.1. For the domain "others in society", data were inadequate to split effects in consumers of alcohol from effects in non-consumers of alcohol. For instance, for traffic accidents we had access to the number of people affected by alcohol at baseline (before introduction of policies), but not at the level of detail required to split these numbers into alcohol consumers and non-consumers. A positive change in the number of alcohol-related traffic accidents following a policy measure could not be split the two groups of consumers. As this was quite often the case, we chose to discuss and value total effects under the domain "consumers", and to leave out "others in society" as a separate domain.

The RIVM-Chronic Diseases Model (RIVM-CDM) has been used to model the development of age- and gender-specific drinking behavior over time, which has consequently been used to estimate the costs and benefits in the different domains (see Figure 1.1). Further information on the RIVM-Chronic Disease Model is given in paragraph 1.3. of this report.

As the RIVM-CDM also generates QALYs and healthcare costs related to chronic diseases, this output is used to directly estimate the impact of alcohol policies in the healthcare domain. As the RIVM-CDM does not include all diseases that are linked to alcohol (see paragraph 1.3.), health effects of alcohol not covered through RIVM-CDM, e.g.Korsakov disease following heavy alcohol use, are covered in the Excel model.

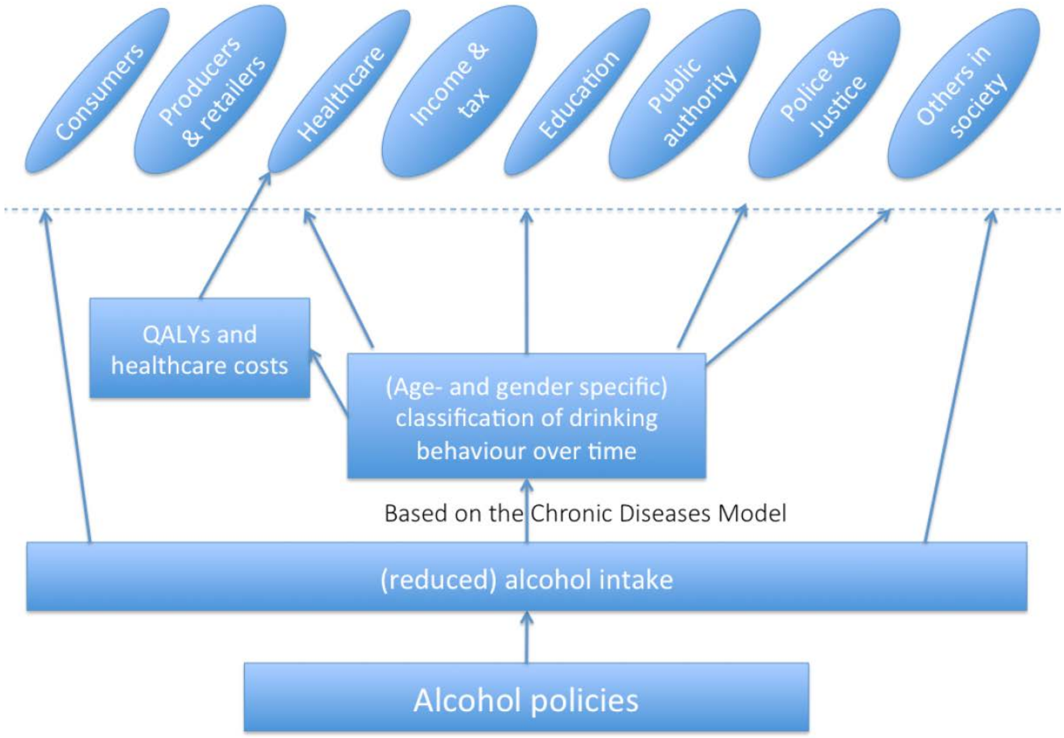


Figure 1.1: Conceptual model

For most domains, the development of effects has been linked to the highest, or highest two risk classes (see paragraph 1.3 for a definition of these risk classes). When the costs in a certain domain are fully alcohol-related and direct, the development of the costs in such a domain has been linked one-on-one with the development over time of the prevalence of the highest (or highest two) risk classes. If the costs in a domain are wider than just alcohol-related (as is the case in costs in the domains police and justice), or if the effects of alcohol were expected to develop over time rather than having a direct effect, correlation rates based on Wagenaar et al. (2010) have been applied, resulting in a cushioning of the effects. This implies that a reduction in the consumption of alcohol would lead to a smaller reduction in the costs in such domains. Lastly, certain effects, such as consumer surplus or taxes and duties, have been linked to the total number of consumptions, which was obtained by translating prevalence of the age- and gender-specific risk classes into a total number of alcohol consumptions.

The Excel model estimates the incremental costs and benefits of regulatory policies by comparing the reference scenario (with no additional policies) with alternative scenarios (with additional regulatory policies aimed at curbing alcohol consumption). The incremental costs and benefits are determined by simply looking at the difference between the costs in the alternative and the reference scenario. Within an SCBA, the incremental cost or benefit is presented as the main result of the analysis.

1.3 RIVM Chronic Diseases Model

The first step in the calculations is to model alcohol consumption in the Dutch population and the incidence and prevalence of chronic diseases that are related to alcohol consumption. This analysis has been performed with the RIVM-Chronic Diseases Model (RIVM-CDM) (Hoogenveen et al., 2010). The RIVM-CDM is a Markov-type, dynamic population-based model developed at the RIVM). The RIVM-CDM describes the Dutch population with age- and sex specific prevalence of risk factors for the occurrence of chronic diseases. Risk factors described by the model are e.g. smoking behavior, physical activity and hypertension. The most important chronic diseases related to lifestyle are incorporated into the RIVM-CDM. This includes diabetes, acute myocardial infarction and stroke. The model also describes mortality and morbidity associated with the diseases that are related to risk factors, among which alcohol consumption (Baal et al., 2005). The RIVM-CDM has been used extensively for economic evaluations of interventions to reduce risk factors for chronic diseases, e.g. in the field of smoking cessation and increasing physical activity (Baal, 2005; Feenstra et al., 2005; Jacobs-van der Bruggen et al., 2009).

Alcohol is included in the RIVM-CDM in four categories of alcohol consumption. For each class of alcohol consumption, background data on positive and negative health effects of alcohol consumption are specified in the RIVM-CDM.

There are several types of input data to the RIVM-CDM:

1. demographic data,
2. relative risk data,
3. alcohol prevalence data,
4. alcohol transitions data,
5. cost data,
6. quality of life data.

Demographic data contain information about birth, mortality, and migration. They originate from statline.cbs.nl. Alcohol prevalence and transition data were adapted from Health Survey [Gezondheidsenquête] 2011 (statline.cbs.nl) and Peilstationsonderzoek 2011 (peil.trimbos.nl). Data on relative risks associated with alcohol consumption are taken from meta-analyses as recently summarized by the Health Council (Gezondheidsraad, 2015a) and from a TNO report about lifestyle factors and cancer (Lanting et al., 2014a) (See Appendix 2A). Cost data are derived from the RIVM Cost of Illness Studies (www.kostenvanziekten.nl) and quality of life losses that result from having one or more of the chronic diseases are adapted from Dutch and global burden of disease studies (Stouthard et al., 2000). More information on these input data can be found in a background report on using the RIVM-CDM for cost-effectiveness analysis (Van Baal et al., 2005).

The RIVM-CDM distinguishes four categories of average alcohol consumption. The four categories of alcohol consumption in the RIVM-CDM are:

1. Class 1: <0.5 drinks per day, both for men and women.
2. Class 2: on average ≥ 0.5 and < 3.5 drinks per day (men), on average ≥ 0.5 and < 2.5 drinks per day (women),
3. Class 3: on average ≥ 3.5 and < 5.5 drinks per day (men), on average ≥ 2.5 and < 3.5 drinks per day (women),
4. Class 4: on average ≥ 5.5 drinks per day (men); on average ≥ 3.5 drinks per day (women).

The RIVM-CDM contains a number of diseases that is associated with alcohol use. To model this association between the risk of these diseases occurring and the average daily consumption of alcohol, we used data from published meta-analyses. Appendix 2A provides with background data on these risks as a function of consumption of alcohol. Each class is associated with different relative risks for the occurrence of:

- total mortality (independent of occurrence of diseases),
- acute myocardial infarction (AMI),
- stroke (cerebrovascular accident, CVA),
- cancer of the esophagus,
- breast cancer,
- cancer of the larynx,
- oral cavity cancer.

Depending on the disease associated with alcohol consumption and the class of alcohol consumption, risks may vary positively or negatively with alcohol consumption, i.e. a disease may occur more often or less often as a consequence of differing levels of alcohol use.

To calculate the incremental effects of policy measures on drinking behavior within the RIVM-CDM, it is important to know what the average number of drinks per day in each of the four categories of alcohol consumption is. Average numbers of drinks per day are usually not integer values, and therefore we set the boundaries between the different categories of alcohol consumption at 0.5/2.5/3.5/5.5 drinks per day, see Table 1.2. This implies that the average number of drinks in, for example, the lowest class is not equal to zero, but instead a number between zero and a half, corresponding to the fact that even in the “no alcohol on a daily basis” category (class 1), people occasionally may consume some alcohol. Table 1.3 presents the proportion of total alcohol consumption per class and per gender.

Table 1.2 Average number of alcoholic standard drinks per day per class of alcohol consumption, by sex (range of average drinks per day)

	Class 1	**Class 2**	**Class 3**	**Class 4**
Men	0.21 (0-0.5)	1.59 (0.5-3.5)	4.27 (3.5-5.5)	8.18 (>5.5)
Women	0.18 (0-0.5)	1.21 (0.5-2.5)	2.94 (2.5-3.5)	5.64 (>3.5)

Source: own calculations based on Health Survey [Gezondheidsenquête] 2012-2014

Table 1.3 Population numbers (proportion of total) that falls in each of the four drinking classes, by sex

	Class 1	Class 2	Class 3	Class 4	Total
Men	2,080,000 (0.144)	4,530,000 (0.312)	490,000 (0.034)	206,000 (0.014)	7,310,000 (0.504)
Women	3,490,000 (0.241)	3,230,000 (0.223)	278,000 (0.019)	190,000 (0.013)	7,190,000 (0.496)
Total	5,570,000 (0.385)	7,760,000 (0.535)	768,000 (0.053)	396,000 (0.027)	14,500,000 (1.000)

Source: own calculations based on Health Survey [Gezondheidsenquête] 2012-2014

From Table 1.3, it is clear that the vast majority of the population in the Netherlands belongs to classes 1 and 2 and thus that most citizens are moderate consumers of alcohol.

Successful policy measures aimed at lowering alcohol use will result in some downward changes between these four categories of alcohol use, as some people will shift to a lower class of alcohol use. The data from the Health Survey [Gezondheidsenquête] also enable to calculate the relation between an average decrease of alcohol consumption and a change in class distribution. We estimated this relation assuming a linear relation. Table 1.4 below shows the results:

Table 1.4 Class transitions because of drinking one glass per day less, with confidence intervals

	Class 4 -> class 3	Class 3 -> class 2	Class 2 -> class 1
Men	0.060 (0.059 - 0.060)	0.127 (0.126 - 0.128)	0.149 (0.147 - 0.151)
women	0.084 (0.083 - 0.085)	0.147 (0.146 - 0.148)	0.282 (0.279 - 0.285)

If the total population drinks on average 0.1 glass per day less, 0.6% of the total male population shifts from class 4 to class 3, 1.27% from class 3 to class 2, and 1.49% from class 2 to class 1. For women, 0.84% shifts from class 4 to class 3, 1.47% from class 3 to class 2, and 2.82% from class 2 to class 1. These shifts were used to implement the scenario calculations in the RIVM-CDM, along with the default input alcohol transitions of the RIVM-CDM.

Although the RIVM-CDM does not explicitly distinguish between binge drinking or not, binge drinking is comprised in the highest RIVM-CDM classes of alcohol consumption. Because relative risks as included in the RIVM-CDM (from meta-analyses, see Appendix 2A) have been derived from populations including both consumers with and without binge drinking patterns, health effects of binge drinking are assumed to be included (averaged) in the (highest) classes of alcohol consumption in the RIVM-CDM. In our calculations, we adopt the most commonly used Dutch definition for binge drinking of five or more standard drinks per occasion during the last two weeks (Van Laar, 2015). This definition results in 100% binge drinkers in the highest RIVM-CDM class of alcohol consumption, for both men and women. For men, the second highest class of alcohol consumption consists of 100% binge drinkers too, see Table 1.5.

Table 1.5 Proportion of binge drinkers in the alcohol consumption categories of RIVM-CDM

RIVM-CDM class (mean drinks per day)	**Male binge drinkers**		**RIVM-CDM class (mean drinks per day)**	**Female binge drinkers**	
	No	Yes		No	Yes
1 (0-0.5)	2187 (91%)	205 (9%)	1 (0-0.5)	3856 (96%)	152 (4%)
2 (0.5-3.5)	2692 (52%	2510 (48%)	2 (0.5-2.5)	2729 (74%)	979 (26%)
3 (3.5-5.5)	0 (0%)	563 (100%)	3 (2.5-3.5)	126 (39%)	193 (61%)
4 (>=5.5)	0 (0%)	237 (100%)	4 (>=3.5)	0 (0%)	218 (100%

Source: own calculations, based on Health Survey [Gezondheidsenquête] 2012-2014

The policy scenarios are implemented in the RIVM-CDM as a change in the initial prevalence of the alcohol consumption classes that corresponds to the expected altered alcohol consumption levels caused by the policy, with every drinking person consuming an equally smaller number of drinks. The policy scenarios therefore start with a smaller part of the population in the high alcohol consumption classes and a larger part in the low consumption classes. The demographic parameters are not altered, neither are the Relative Risks for disease and mortality, nor the transition probabilities between the classes of alcohol consumption. The fact that transition probabilities remain unchanged implies that in the course of time the prevalence of alcohol consumption classes will gradually return to the prevalence in the reference scenario.

1.4 Assumptions made for modelling costs and effects of alcohol policies (research question 2)

Below, we list some of the assumptions made to estimate effects of the policy measures.

Valuation of quality of life: Alcohol impacts on incidence and prevalence of a number of diseases and these diseases in turn impact on quality of life. Avoidance of disease through low alcohol consumption may have a positive impact on quality of life while occurrence of diseases that are associated with moderate to high intake of alcohol impacts negatively on quality of life. For all diseases that have an association with alcohol (see Appendix 2B), utility weights reflecting the impact that this disease has on quality of life have been incorporated in our models. A utility weight of 1 reflects good health, while lower utility weights, between 0 and 1, reflect the relative impact the disease has on quality of life. A utility weight of 0.82, for instance, reflects a disease with 18% loss of quality of life, relative to normal health. A utility weight of 0.37 reflects a 63% loss of quality of life. Hence, the lower the utility weight, the more serious the impact of disease on quality of life. As the average Dutch population also has disease and disorders, background quality of life is not set at 1, but somewhat lower. Here, the average utility for the Dutch population is taken from a recent publication of Versteegh et al. (Versteegh M, 2016), i.e. 0.869. For diseases occurring in relationship to alcohol consumption with utilities below this baseline value, the disease specific utility was used. For diseases above this baseline value, the baseline value was used in calculations. In case of more than one disease, utility values were taken as the cumulative value of diseases concerned. The effects on quality of life were considered for the average period that patients live with a certain disease. This has been modelled as total prevalence in year x divided by incidence in year x (see appendix 2B).

Valuation of Quality Adjusted Life Years: For each policy measure, the RIVM-CDM generates estimates of the incremental QALYs resulting from that policy measure, compared to the reference scenario. In addition, the SCBA model estimates QALYs for those diseases that were not modelled through RIVM-CDM. For calculations involving the monetary value of Quality Adjusted Life Years, we used an estimate of € 50,000 in base-case analyses, following guidelines for SCBA from SEO (Koopmans, 2016). SEO recommends to vary this value to € 100,000 per QALY in sensitivity analyses, as was done by us.

Consumer surplus following increase of excise taxes: Changes in consumer surplus have been estimated in the case of an increase in excise duties. An increase in excise duties leads to an increase in price and, through the price elasticity of demand, a decrease in demand. As consumers consume less at a higher price, this leads to a decrease in consumer surplus, equal to 50% of the average (before and after) consumption multiplied by the increase in total price ('rule of half'). In the RIVM-CDM, the effect of this policy is modelled as a change in the initial distribution of the population over the four risk classes of alcohol consumption. This new prevalence within the four risk classes then undergoes a yearly regression towards the initial pre-policy distribution, as annual transition probabilities remain unchanged in our modelling.

Consumer surplus following decrease in outlet density: Changes in consumer surplus have been estimated in the case of an decrease in outlet density. A decrease in outlet density is expected to result in a decrease of alcoholic consumption. This implies that the 'cost' (or effort needed) of buying an alcoholic consumption increases for some of the drinks, for instance because alcoholic drinks are not available at all times or because the average distance, as the average distance that consumers have to travel to their outlet increases. The loss of consumer surplus in this scenario has been calculated as if a price increase occurred that via the price elasticity would have resulted in the expected decrease in demand in this scenario. With this hypothetical increase in price (of acquiring the drinks) and the expected level of decrease in demand, the loss in consumer surplus could be estimated by taking 50% times the decrease in consumption multiplied by the 'increase' in price ('rule of half'). In the RIVM-CDM, the effect of this policy is modelled as a change in the initial distribution of the population over the four risk classes of alcohol consumption. This new prevalence within the four risk classes then undergoes a yearly regression towards the initial pre-policy distribution, as annual transition probabilities remain unchanged in our modelling.

Consumer surplus following a total media ban: Consumer surplus was assumed to be zero in case of a ban on marketing. For this latter regulatory policy, it is assumed that 100% absence of exposure to marketing for different alcoholic products leads to a true change in preference of consumers, which results in a change in demand, without affecting the total utility that consumers gain from their consumption.

Producer surplus: In line with the recommendations in the CPB Netherlands Bureau for Economic Policy Analysis guideline for SCBA, changes in producer surplus have been assumed to be zero in the scenarios considered. Following the introduction of alcohol policy measures, a decrease in alcohol consumption (sales, production) is to be expected. This will cause a reduction in production and a decrease in producer surplus within the alcohol producing industry and within the retail sector. However, the means of production (labor, capital, entrepreneurship, etc.) may be assumed to be redirected to other sectors and generate producer surplus in these sectors. Therefore, the decrease in producer surplus is expected to be compensated for by an increase in producer surplus of the same order of magnitude in other sectors, when the means of production are redirected to other sectors.

Duties and taxes: In every policy scenario, the total value of duties and taxes received by the tax authority changes as a result of changes in consumption. In case of a regulatory policy that increases excise duties, duties and taxes are additionally changed by a per-consumption increase in duties and taxes. The change in duties and taxes is therefore calculated in two steps. First, the 2013 level in duties and taxes is multiplied by the factor by which demand is expected to decrease as a result of the regulatory policy. Second, in the case of an increase in excise duties per consumption, an additional increase in excise duties is taken into account for the level of consumption in the alternative scenario. This overall change in duties and taxes as a result of the regulatory policy is then multiplied by 1.42, to include the resulting change in value added tax and other spin-off effects that are expected to arise from the change in consumption and price. This multiplication factor of 1.42 is taken from the 2016 guideline for SCBA within the social sector, published by SEO Economisch Onderzoek (Koopmans, 2016b).

Costs of alcohol-related traffic accidents: the development of the costs of alcohol-related traffic accidents was linked to the development of the prevalence of risk class 3 and risk class 4.

Productivity loss directly linked to alcohol consumption: We distinguish two routes by which a change in alcohol use can affect work productivity: (1) a direct route and (2) an indirect route. A *direct* impact of alcohol on productivity occurs when people stay absent from their work or are less efficient while working as a direct consequence of their drinking on the same or previous day(s) (i.e. absenteeism and presenteeism). For each of the four alcohol drinking severity classes in the RIVM-CDM, we have obtained estimates of their association with the number of working days lost. These estimates have been obtained from the literature, principally from Roche and colleagues (Roche et al., 2008). When a new regulatory policy generates a shift in the number of people in the alcohol drinking severity classes, then the corresponding changes in productivity can be assessed, as well as the economic value of these productivity changes. These costs were based on the prevalence of consumption classes 2, 3 and 4, which according to Roche et al. are all associated with productivity losses due to alcohol consumption.

Productivity loss due to indirect health effects of alcohol consumption:
An *indirect* impact of alcohol on productivity occurs when people experience a lesser degree of health-related quality of life as a consequence of illnesses or disorders that are caused by drinking alcohol over longer periods. This is relevant because harmful alcohol use is a risk factor for a range of illnesses and disorders that usually occur later in life (e.g. cancer of the larynx, cirrhosis of the liver). These illnesses, in turn, will have an impact on labor productivity via QALY changes. Hence, we need to know how QALY changes are associated with corresponding changes in productivity.

QALY changes as a consequence of policy measures are modelled in this SCBA both through the RIVM-CDM and through the SCBA model in Excel. For the estimation of the relationship between a change in QALYs and a corresponding change in productivity, we relied on a sub-sample from the Netherlands Mental Health Survey and Incidence Study (Nemesis-2 study), which was restricted to the Dutch workforce (de Graaf et al., 2010). Nemesis-2 has data on productivity losses (due to absenteeism and presenteeism) and has, in addition, data on QALYs. The latter were derived from the Medical Outcome Study Short Form (SF-36) (Ware & Sherbourne, 1992), and Brazier's algorithm (Brazier et al., 2002) was used to translate these SF-36 scores into QALYs. Finally, by regressing the number of annual workdays lost on QALYs, we obtained the parameter of interest: the degree in which productivity losses change as a function of a change in QALYs. This method was adapted from Krol (Krol et al., 2014). The following simple equation was obtained:

$$AWLDs = QALY * (-318.0672) + 234.599,$$

where AWLDs is the number of annual work-loss days (owing to both absenteeism and presenteeism) and QALY are quality adjusted life years. This equation is used to quantify how the impact of a new policy affects drinking and subsequently affects the quality of life of the working population, and how that, in turn, affects productivity.

To calculate the costs of productivity losses based on QALY changes, the difference in average QALY (relative to the reference scenario) per person within the labor force population are multiplied by the estimated mean work-loss days and the cost per workday lost as per the Dutch guideline for SCBA (Koopmans, 2016b).

Productivity costs (traffic-accident related): these costs were linked to developments in the prevalence of risk class 3 and 4, following implementation of policy measures.
Productivity costs due to domestic violence: No correction factor was applied, as the productivity costs due to domestic violence were deemed fully contributable to alcohol consumption and assumed to be immediate.

RIVM-CDM healthcare costs: The incremental healthcare costs as estimated by the RIVM-CDM following the implementation of policy scenarios are straightforwardly integrated in the Excel-model without any further modifications, except a consumer price index (CPI) correction to reflect 2013 price levels.

Primary healthcare costs: Primary healthcare costs of alcohol were modelled in the Excel SCBA model. The healthcare costs in primary care are linked to the prevalence of risk class 4. A change in consumption following policy measures does not immediately lead to a corresponding change in healthcare use, as detrimental health effects do not immediately disappear when alcohol consumption diminishes. A change in the prevalence of risk class 4 is moderated by the Wagenaar et al. (2010) factor, assuming that a decrease in the consumption of alcohol leads to a decrease in health-related morbidity that is about 70% of the decrease in consumption, thus “cushioning” the effect.

Emergency department visits: Emergency department visits following alcohol use were modelled in the Excel SCBA model. The costs relating to emergency department visits have been linked to the prevalence of risk class 4. No additional diminishing factor was applied as the effects of a decrease in alcohol consumption on the use of the emergency department were considered to be immediate.

Additional healthcare costs: The additional healthcare costs regarding diseases that were not modelled explicitly within the RIVM-CDM (see Paragraph 2.5), have been linked to the prevalence in risk class 4, while the change was diminished using the ±70% factor of Wagenaar et al. (2010), similar to the approach for primary healthcare costs. These costs were incorporated in the SCBA model in Excel.

Education: The cost of study delay have been linked to the prevalence of risk class 4, with no additional diminishing factor applied, as study delay was considered a fairly short-term effect following excessive drinking.

Police and justice: Costs of police and justice have been linked to the prevalence of risk class 4, while the resulting change in costs was then diminished using the Wagenaar et al. (2010) factor for a change in alcohol consumption on crime-related effects. This reduced the effect to only 14% of the reduction in the prevalence of risk class 4, under the assumption that alcohol is not the sole causal factor behind the costs related to police and justice.

Effectiveness of policy measures: For all policy measures, we will assume that once implemented, policy measures will not be changed anymore, implying continuation of these policies for the lifetime horizon of the model. However, the strength of the effects of the policy measure will fade out over time, as described above under "consumer surplus".

1.5 Approach to determining net contributors and net receivers

At the end of each chapter discussing the effects of regulatory policies, we will present how the costs and benefits are distributed across different stakeholders. To determine which stakeholders have net payments and which stakeholders have net monetary benefits, three different stakeholders were considered, namely:

- alcohol consumers;
- all consumers, including alcohol consumers (being a combination of "others in society" and "alcohol consumers");
- Government.

Each cost type is attributed to one of these three stakeholders. Here, we follow the reasoning that intermediate parties, such as insurance companies, will eventually adapt insurance premiums when, as a result of less consumption of alcohol, less traffic accidents occur and fewer people are absent from work. As long as the insurance market is an efficient market, with multiple supplying parties, this assumption holds. For example, a decrease in material damage as a result of less alcohol-related traffic accidents is redistributed to all consumers through a decrease in monthly payments. Another intermediate party, employers, will transfer increased productivity as a result of less alcohol related absenteeism and less alcohol related accidents at work in higher wages, benefiting all consumers, including those who drink alcohol. Table 1.6 shows the ultimate redistribution of costs to three stakeholder groups.

Table 1.6: Redistribution of costs and effects over different stakeholders

Stakeholder	**Type of costs / effects**
1. Alcohol consumers	• Premature mortality (traffic related) • Consumer surplus • Quality of life
2. All consumers	• Premature mortality (other causes / non-traffic related) • Productivity losses (accident related) • Productivity losses (violence) • Productivity losses (direct) • Productivity losses (indirect) • Duties and taxes • Healthcare costs • Alcohol related traffic accidents (material costs) • Alcohol related traffic accidents (traffic jams)
3. Government	• Education • Police and justice • Alcohol related traffic accidents (handling cost) • Implementation costs, enforcement and control

1.6 Approach to splitting monetary costs and benefits in financial and non-financial euros

Central to the concept of SCBA is that all costs and all effects are valued monetarily. This equally concerns "real" costs, such as damage to vehicles after a car accident and "virtual" costs, such as the value put on a Quality Adjusted Life Year. To accommodate for this difference, we will present the net cumulative costs and benefits over a 50 year time horizon for all stakeholders, split into financial and non-financial €'s. Non-financial euros are those that stem from premature mortality, QALYs lost or gained and congestion costs after traffic jams. Furthermore, a part of valuation of consumer surplus is non-financial as well. Consumer surplus consists of demand effects and price effects. Price effects reflect the fact that consumer surplus will be lower because of higher prices of alcohol in (some) policy scenarios, while demand effect reflects the fact that lower consumption results in lower consumer surplus. The demand effect will be covered as non-financial euros, the price effect as financial euros. All other costs and benefits are regarded as financial euros.

1.7 Sensitivity analyses

Probabilistic and one-way sensitivity analyses were performed to estimate the impact of uncertainty in model parameters. Probabilistic sensitivity analysis was based on the uncertainty regarding the development of the distribution of risk classes in the population throughout the time horizon of 50 years, as captured in the CDM. This results in one hundred random draws from the underlying distributions, resulting in one hundred possible risk class distributions, healthcare cost estimates, and quality of life estimates, over the time horizon of 50 years. For each of the 100 CDM draws, an additional 100 random draws are taken from each of the cost components for which a minimum and maximum estimate is known. Using these 10,000 simulations, outcomes in the SCBA are reported with 95% confidence intervals, representing the uncertainty in the outcomes as a result of the uncertainty in these underlying input parameters.

Next to probabilistic sensitivity analysis, one-way sensitivity analyses were performed by changing parameter values as used for the base-case analysis. The following parameters were changed in order to estimate their impact on the outcomes:

1. *Discount rates* are set at 3% in the base-case analysis. In one-way sensitivity analyses, results are presented when changing the discount rates to either 4% for both costs and effects or to 1.5% for both costs and effects.
2. One-way sensitivity analysis was performed with respect to impact of alcohol consumption on both *direct* and *indirect* productivity. In the base-case, such productivity losses related to alcohol consumption were included. In our calculations, we had to rely on foreign data on the relationship between alcohol use and productivity. However, Dutch data from the Nemesis population study (de Graaf et al., 2011) show a reverse relationship between alcohol abuse (not alcohol *dependence)* and productivity, implying a higher productivity in people with

a higher level of alcohol consumption. Such a relationship is most likely a result of correlation, rather than causation, and unmeasured confounders may be important to explain this finding. Given the uncertainty in our estimate of productivity, we performed a one-way sensitivity analysis in a situation where a link between alcohol consumption and productivity is assumed to be absent.

3. For calculations involving the monetary value of Quality Adjusted Life Years, we used an estimate of € 50,000 in base-case analyses, following guidelines for SCBA from SEO (Koopmans, 2016b). SEO recommends to vary this value to € 100,000 per QALY in sensitivity analyses. This has been done in a sensitivity analysis.
4. A final set of sensitivity analyses concerns the impact on demand as a consequence of policy measures. In the base-case analysis, we used a point estimate from Wagenaar et al (Wagenaar et al., 2009). In sensitivity analyses, we varied the impact on demand by using higher and lower price elasticiticities to reflect more impact on consumption (higher price elasticity) or less effect on consumption (lower price elasticity). These lower and higher elasticities were also taken from the same review of Wagenaar.

2 The costs and benefits of alcohol consumption in 2013

2.1 General methods for the cross-sectional assessment of costs and benefits of alcohol use (research question 1)

In Chapter 2, the first research question: “What are the economic costs and benefits of current alcohol use?” will be addressed. This question relates to the Cost of Illness (COI) of alcohol. Cost of Illness is the main method to provide an overall view on the economic impact of a disease or risk factor. Here, we present an overview of the economic costs and benefits of alcohol use in different domains of society for the year 2013. This year was chosen as the most recent year with good data availability.

Alcohol consumption leads to revenues for various parties, such as the government (taxes, duties) and producers and retailers of alcoholic beverages. In general, consumers derive utility (feeling of well-being) from consuming alcohol. Due to various reasons, such as addiction (making consumption a less voluntary choice) and social, psychological and medical effects of alcohol consumption, the effects of alcohol consumption are much wider than a sense of well-being alone. We describe and quantify the current (2013) situation in the Netherlands with regard to alcohol consumption and its costs and benefits. We distinguish these costs and benefits for eight different sectors (stakeholders) of society, namely (1) consumers of alcohol, (2) producers and retailers of alcohol, (3) tax authority, (4) healthcare sector, (5) education, (6) police and judicial authorities, (7) Government and (8) others in society (non-users of alcohol, including victims). Table 2.1 lists these costs and benefits for the different stakeholders.

Our estimates are based as much as possible on robust evidence, thus preferring meta-analyses over single primary studies and preferring empirical data over expert opinion. Nonetheless, data quality varies. Whenever available, we will quantify the degree of uncertainty in the input data we use. The costs of alcohol use to society are described in terms of ‘units’ attributable to alcohol use, such as number (%) of general practitioner (GP) visits, number (%) of cases with alcohol-*induced* illnesses (such as stroke, colon cancer and cancer of the larynx, etcetera.), and the number (%) of traffic accidents owing to drunk driving. Multiple sources of information are used to estimate these volumes, including scientific and grey literature and data from Statistics Netherlands (CBS) and other national databases. However, quantification depends on the availability of data. It sometimes may be difficult to distinguish the alcohol-related part from other causes of societal problems, e.g. for school dropouts. Once the ‘units’ have been identified and quantified, their economic value (in €) needs to be assessed. To that end, costs were calculated by multiplying each unit of a resource used by its corresponding full economic cost. Whenever possible, we used standard unit costs, e.g. for health economic evaluations (Zorginstituut_Nederland, 2015) or for inter sector economic evaluations (Drost, 2014). Another source of information for cost estimates was the “Werkwijzer MKBA in het sociaal domein”, a guideline detailing methods and unit prices for SCBA within the social sector (Koopmans, 2016b; Koopmans, 2016a), commissioned by the Ministries of VWS, SZW, OCW and BZK. All costs and benefits are expressed in 2013 euros.

Table 2.1 Alcohol-related costs and benefits for several domains of society, to be valued in a Cost of Illness approach / cross sectional assessments of costs and benefits of alcohol

Sectors / Stakeholders	**Costs**	**Benefits**
1. Consumers	A. Traffic accidents B. Violence C. Productivity losses D. Premature mortality E. Loss of quality of life	A. Consumer surplus
2. Producers, retail		A. Producer surplus, retail industry, agriculture B. Producer surplus, supermarkets, liquor stores, bars, restaurants C. Employment D. Revenues for sports canteens
3.Tax authority		A. Taxes and duties
4. Healthcare	A. Health care costs of alcohol-related diseases	A. Healthcare savings from alcohol consumption (related to diseases averted)
5. Education	A. Study delay B. School dropout C. Study support	
6. Police, justice	A. Police efforts B. Prison system	
7. Public Authority (Government)	A. Education / campaigns B. Costs of enforcement	
8. Others in society (victims)	A. Vandalism B. Domestic violence C. Traffic accidents D. Premature mortality E. Loss of quality of life F. Productivity losses G. Healthcare costs	

For each of these categories, wherever available, we present Dutch data to quantify the cost and benefits in 2013. When data from previous or later years are used, costs and benefits are indexed to 2013 using the Dutch Consumer Price Index (CPI) (www.statline.cbs.nl). The final estimate of the net costs of alcohol in 2013 is a summation of the net costs and net benefits over the different sectors.

2.2 Consumers

This section deals with the welfare effects that consumers of alcohol experience in the Netherlands in the year 2013. It outlines both the aspects of consumption that contribute to the welfare of the consumers, and the aspects of consumption that reduce their welfare. In this section we concentrate on the effects that consumers themselves experience. The effects that their consumption inflicts on others in society are as much as possible separated and dealt with in section 2.9. In some cases, though, available information does not allow such a strict distinction.

2.2.1 Benefits: Consumer surplus

The consumption of alcohol is based on a need that consumers desire to be satisfied. In economic terms, this means that they derive utility from the consumption of alcohol. The utility (or benefit) they derive from it has, at least, the value of costs that they have to make in order to be able to consume the alcohol, i.e. the price they have to pay in the shop, bar, restaurant or elsewhere. Also, the costs associated with going to the shop, bar or restaurant (i.e. the time spent in travelling, the out-of-pocket expenses of the trip) may be included in the total costs of consumption, although in many cases such costs are perceived to be low (e.g. most consumers will attach a low negative value to the time spent to go to a bar or restaurant).

Many consumers are willing to pay even more for alcohol, as the value they attach to it is higher than the price they actually pay. This extra value that consumers attach to consumption, above the price actually paid, is called consumer surplus. This consumer surplus is not actually paid for by consumers, but is the extra surplus they would be willing to pay to satisfy their needs. The higher the price of alcohol, the fewer consumers would be willing and able to pay in addition to what they already pay. Some consumers may already decide to drink less with a slight price increase. Other consumers may decide to continue drinking, even at much higher prices.

The actual consumer surplus for consumption cannot be measured exactly. It is usually derived from the demand curve of alcohol consumption. However, as the demand curve is not fully known (it is unknown what the willingness to pay of the last consumer of alcohol would be), assessments of consumers surplus can only be tentative. An assessment starts, however, with information on actual consumption of alcohol and evidence on the price elasticity of demand for alcohol.

Consumption of alcohol in the Netherlands
Information on consumption of alcohol has been collected from various sources. Total spending of consumers on alcohol in 2013 amounted to € 3.8 billion. This included about € 1 billion in excise duties, or 28% of total spending on alcohol. The distribution over the various types of alcohol is shown in Table 2.2.

Table 2.2 Alcohol spending in 2013 (million €) by type of alcohol

2013	Consumer spending	Excise duties	Excise duties as % of consumers spending
Beer	1,121	413	37%
Wine	1,740	321	18%
Spirits	916	306	33%
TOTAL	3,777	1,040	28%

Sources: (Detailhandel.info, 2016), CBS, own calculation.

Consumer spending includes all types of spending: in shops, bars, restaurants, sports canteens and other venues.

Price elasticity of demand
To estimate the consumer surplus, a demand curve has to be specified. A demand curve gives the relation between the price of an alcoholic drink and its consumption. In economics, this relationship is summarized by the concept of price elasticity of demand (for explanation see Appendix 1).

Anderson et al., cite three meta-analyses in which average price elasticities were obtained (Anderson et al., 2012). These three meta-analyses are summarized in Table 2.3.

Table 2.3: Price elasticity for different types of alcohol

Source / Type of alcohol	Spirits	Wine	Beer	All alcohol
Fogarty, 2006	-0.70	-0.77	-0.38	n/a
Gallet, 2007	-0.68	-0.70	-0.36	-0.50
Wagenaar e.a., 2009	-0.80	-0.69	-0.46	-0.51

One of the three studies mentioned by Anderson has been carried out by Wagenaar et al. This is the most comprehensive meta-analysis that takes into account information from 112 studies.

Nelson (2013) reviewed the evidence from previous studies and corrects them for outliers and publication bias (Nelson, 2013). He concludes:
For individual beverages, corrected price elasticities are smaller (less elastic) by 28-29 percent compared with consensus averages frequently used for alcohol beverages. The average price and income elasticities are: beer, -0.30 and 0.50; wine, -0.45 and 1.00; and spirits, -0.55 and 1.00. For total alcohol, the price elasticity is -0.50 and the income elasticity is 0.60

Thus, although at the individual level lower price elasticities are found, the price elasticity of total alcohol consumption is expected to be close to the results of Gallet (2007) and Wagenaar (2009), as shown in Table 2.3.

Consumer surplus
The above also implies that 99.5% of alcohol consumption would not be affected by 1% price increase. Thus, for 99.5% of the consumption the actual willingness to pay of consumers is at least 1% above the actual price level. The price elasticity of demand usually only applies to the actual level of consumption and prices. It may thus not be applied straightaway to all consumption. In other words, it may not be concluded that a 200% increase in price means that total consumption of alcohol would drop by 100% (i.e., that alcohol consumption would disappear completely). Even at much higher price levels, some consumers are still likely to consume.

Nevertheless, it is clear that using a constant price elasticity of demand, i.e. a linear demand curve, can give a rough indication of the magnitude of welfare that consumers may attach to consumption of alcohol. For instance, if a 200% increase in price indeed means that alcohol consumption disappears completely, the consumer surplus of alcohol consumption would be close to actual spending, i.e. € 3.8 billion. As indicated, assuming a linear demand curve is a simplification of reality. But given the knowledge on alcohol consumption it is the best estimate possible on the consumer surplus. On the one hand, this could be a conservative estimate as some consumers still continue consuming alcohol even at 200% higher prices. On the other hand, some consumers may consume alcohol because they are addicted. This part of alcohol consumption may have an involuntary character. In the case of addiction to alcohol, consumers are not drinking alcohol following a well-considered choice and the approach followed above may not stand. If consumption takes place because of addiction, one could argue that there is no consumer surplus at all because consumption no longer results from a free and deliberate choice but from imperative forces steered by the addiction. Also, in those not addicted, social norms and social pressure may make alcohol consumption a less voluntary choice. Given the large amount of alcohol consumed by non-addicted users, though, the majority of the population is expected to consume alcohol out of free will.

For the year 2013, the conclusion is that there is a consumer surplus with respect to alcohol consumption in the Netherlands. As it is unknown how the demand curve for alcoholic consumptions is shaped along the full consumption range, the actual size of consumer surplus cannot be exactly quantified. Assuming a linear demand curve, consumer surplus could be equal to €3.8 billion. For our 2013 net welfare estimate, we will also specify a minimum and a maximum scenario, with 30% deviations from the point estimate of €3.8 billion, implying a minimum value of consumer surplus of €2.7 billion and a maximum estimate of €4.9 billion.

Table 2.4 Summary of value of consumer surplus for consumers of alcohol in million € (2013)

	Point estimate	**Minimum**	**Maximum**
Net benefit			
Consumer surplus	- 3,800	- 2,700	- 4,900

2.2.2 *Costs: Traffic accidents*

The role of alcohol in traffic accidents

The consumption of alcohol may have various effects on the consumer. One of those consequences is that consumers of alcohol may be involved in traffic accidents when having consumed alcohol just before taking part in traffic. In fact, drink driving is known to be one of the major causes of traffic accidents (Houwing et al., 2014).

The most in-depth study on the relationship between traffic accidents and alcohol has been carried out by Houwing et al. (Houwing, 2014). They conclude that the share of alcohol-intoxicated drivers in all seriously injured traffic participants is between 11 and 18% or between 16 and 24% (95% CI), depending on the scenario used. The two scenarios differ with respect to the expectation of the researchers concerning the recent trends in alcohol use. In one scenario (16-24%) a relatively small reduction is considered. In the other scenario (11-18%) a relatively high reduction is taken. Obviously, the 11-18% estimate results in lower estimates of welfare losses associated with traffic accidents than the 16-24% scenario, as a higher percentage of the damage of all traffic accidents is attributed to alcohol in the latter scenario.

A second conclusion of this study is that out of the 570 traffic deaths in 2013 in the Netherlands, 63 (11%) to 137 (24%) deaths can be attributed to the use of alcohol (CBS, 2015) (Houwing, 2014). This includes both fatal accidents of drunk drivers themselves, as well as traffic deaths caused by drivers under the influence of alcohol.

With respect to serious injuries due to traffic accidents, a similar range applies. Given the absolute number of seriously injured traffic participants in 2013 (18,800) (SWOV), 2,070 (11%) to 4,510 (24%) serious injuries can be attributed to alcohol use, according to Houwing et al (Houwing, 2014).

Other studies show that the majority of alcohol-related accidents are caused by traffic participants with a high level of alcohol consumption (blood alcohol concentration –BAC- level of more than 1.3 g/l). The majority of these accidents can be attributed to young males (binge drinking) and chronic heavy users of alcohol. Based on Dutch data from the international DRUID study we assume that the share of such heavy users in total alcohol related accidents is 67% (Isalberti et al., 2011).

Welfare costs of traffic accidents

To calculate the total welfare impact of alcohol-related traffic accidents, the following elements need to be taken into account (de Wit & Methorst, 2012):

- Costs of medical treatment, based on medical expenses;

- Loss of labor productivity, using average productivity in all sectors;
- Premature mortality, based on estimates of Value of a Statistical Life;
- Material costs (damage to vehicles, road infrastructure), based on actual data;
- Accident follow-up costs: costs of police, emergency services, insurance companies, etc., based on actual data;
- Congestion, based on assessment of extra congestion hours and a valuation of the travel time, following the willingness-to-pay (WTP) principle.

Of these six types of costs, it is difficult to disentangle costs in consumers of alcohol and non-consumers of alcohol (all other consumers). The first three types may predominantly apply to alcohol consumers. The latter three types of costs, material costs (through insurance premiums borne by all consumers), accident follow-up costs (through taxes and insurance premiums), and congestion costs are mostly borne by all consumers. However, there is a lack of data to make a more precise distinction between costs borne by alcohol consumers and costs borne by other consumers.

The most recent assessment of total costs of traffic accidents (both related and non-related to alcohol use) carried out in the Netherlands relates to data of 2009 (de Wit & Methorst, 2012). They estimate €12.5 billion of total costs (price level of 2009), corresponding to €13.6 billion at 2013 price levels. Hence, a first estimate of the total welfare costs of traffic accidents due to alcohol use is 11% to 24% of the total costs to society (i.e. €13.6 billion), or €1.5 to €3.3 billion based on traffic deaths and price level of 2013. This includes all cost items indicated above.

For the present purpose, it is important to split this estimate into the different cost components, to avoid double counting with costs as estimated in other sections of this chapter. Hence, the costs of traffic accidents related to alcohol use are split in various elements:

- Premature deaths due to traffic accidents are discussed in section 2.2.3.
- The productivity losses due to non-severe and severely wounded traffic participants are included in the section on productivity losses (2.2.4).
- Medical treatment costs for injured persons are covered in section 2.5.

The remaining costs items relate to material costs, handling costs, and costs of congestion. Although these costs are mainly inflicted on all consumers, e.g. through insurance premiums (material costs) and taxes (handling costs), these costs are covered in this section because it is impossible to split costs in a part for alcohol consumers and a part for all consumers. These costs amount to €0.7 to €1.4 billion (point estimate €1.0 billion) when adjusted to 2013 prices. Table 2.5 shows a breakdown of these costs. As the number of injured traffic participants in 2013 (i.e. 18,000) was almost equal to the 2009 level (i.e. 18,800), it has been assumed that the cost data of 2009 also apply for 2013. As it appeared impossible to split most costs in a “consumer of alcohol” and “all consumers” part, we present the welfare costs of alcohol-related traffic accidents in this section.

Table 2.5 Summary of welfare costs of alcohol-related traffic accidents, exclusive healthcare costs, premature mortality and productivity losses (million €)

Cost categories	**2009 estimate (de Wit & Methorst, 2012)**	**2013 indexed costs**	**Minimum costs 11% attributable to alcohol (2013€)**	**Maximum costs 24% attributable to alcohol (2013€)**
Net costs				
Material costs (property damage)	3,866	4,206	462	1,009
Accident follow-up costs	1,293	1,407	155	338
Congestion costs	300	326	36	78
Total costs			653	1,425

Source: (de Wit & Methorst, 2012), own calculations

2.2.3 *Costs: Premature mortality*

Alcohol use may lead to premature mortality in a large number of situations, such as traffic accidents, alcohol-related cancer deaths and death from alcohol addiction. According to Jellinek, the total number of deaths caused by alcohol was 4,579 in 2012 (excluding traffic related mortality). Alcohol-related cancer is responsible for about 2,900 deaths. In addition, a total number of 1,679 people died from alcohol dependency, mental disorders and liver disease (Jellinek, 2015).

Hence, adding the number of alcohol-related mortality in traffic (section 2.2.2) to the total number of 4,579 alcohol deaths as cited above, it is estimated that a total number of 4,642-4,716 deaths can be attributed to alcohol use. The concept of value of a statistical life (VOSL) is used to value life foregone. Key figures for the VOSL are provided by a 2016 practical guide for SCBA within the social sector, published by SEO Economisch Onderzoek (Koopmans, 2016b). The value of a statistical life based on 2015 prices is € 3 million (Koopmans, 2016b). This amount stems from contingency valuation research (stated preferences) in the field of traffic safety. The value of a statistical life year can be derived from the value of a statistical life by dividing the latter value by the life expectancy. Life expectancy of men in 2014 was 79.87 years and for women it was 83.29 years. The average life expectancy was 81.58 years (CBS, 2016a). From these figures, it follows that the mean value of a statistical life year is € 36,774 in 2015 prices and € 36,193 in 2013 prices.

For those who die from alcohol, it is unknown at what age death occurs. Some may die at a very young age (e.g. after a traffic accident), while others may die following cancer at more advanced age. Based on data from Statistics Netherlands, it was calculated that the average age of dying from a traffic accident was 51.1 over the period 2000-2014. Those who die from cancer, liver disease and mental disorders may die at an age closer to the average age of dying in the Netherlands (77.6 years according to Statistics Netherlands). Indeed, cancer deaths occur at an average age of 71.5 years (own calculations based on data from Statistics Netherlands). In the absence of detailed data on the age of alcohol related deaths, we assume that alcohol related deaths (other than by traffic accidents) occur at this age of 71.5 years. People of this age have a remaining life expectancy of 15 years, while those who die at an age of 51 (traffic) have a remaining life expectancy of 32 years.

Hence, a weighted average life expectancy foregone of (((63+137)/2) * 32 years) + (4579 * 15 years)) / ((63+137/2)+4579) = 15.36 years is associated with every death occurring following alcohol use. Therefore, an approximation of the costs of one premature death would be € 36,193 * 15.36 = € 555,924. This undiscounted amount transfers into a discounted value of € 453,392, which was used in the calculations.

Table 2.6 Summary of number and costs of premature mortality related to alcohol (year 2013, million €)

Category	**Number**	**Point estimate**	**Minimum**	**Maximum**
Net costs				
Traffic accidents	63 - 137	46	29	62
Other causes	4,579	2,076	2,076	2,076
Total	4,642 - 4,716	2,122	2,105	2,138

2.2.4 *Costs: Productivity losses*

Absenteeism and presenteeism

After drinking alcohol or after developing diseases caused by alcohol, workers may both be absent from work (absenteeism) or be present at work but with reduced productivity caused by illness (presenteeism). The RIVM-CDM generates a distribution of the population over four risk classes of drinking (see Paragraph 1.3) and this distribution was projected on the Dutch workforce in the year 2013 (see table 2.7, first three columns). We rely on Pidd et al. who used comparable risk classes as the Chronic Diseases Model and observed that the number of workdays lost increases with increasing intake of alcohol (Pidd et al., 2006). Those increases ranged from 0.22 days in drinkers in risk class 2 up to 1.71 lost workdays in risk class 4 (see table 2.7). It is worth noting that Pidd's analysis was based on a sample of 13,582 Australian workers (Roche, 2008). We had to make the assumption that the data from the Australian workforce have adequate resemblance with absenteeism in the Dutch workforce.

Table 2.7 Number of lost workdays per drinker due to absenteeism and presenteeism in 2013

Risk class [a]	Exposure [a]	Drinkers [a]	Absenteeism days / drinker [c]	Presenteeism days / drinker [d]	Total work-loss days / drinker [e]
1	3.3%	272,000	0.00	0.00	0.00
2	89.6%	7,407,000	0.22	0.67	0.89
3	5.6%	460,000	1.06	3.40	4.35
4	1.5%	126,000	1.71	5.32	7.03

[a] Source: CDM. [b] CDM and Statistics Netherlands (CBS, 2016b) [c] Pidd et al (2006). [d] Assuming a ratio of days absent to work-loss days due to lesser efficiency while at work of 1:3.11 (York_Health_Economics_Consortium, 2010) [e] Sum of workdays lost due to absenteeism and presenteeism

Drinkers do not only generate productivity losses when feeling too ill to go to their work (absenteeism), but also when they suffer the consequences from drinking and still go to their work; they are then less efficient while at work (presenteeism). A survey undertaken in 2004 by reed.co.uk suggested that workers turn up at work with a hangover on average two and a half days per year (York_Health_Economics_Consortium, 2010). These workers reported that they were 27% less efficient on these days. This translates in 2.5 * 0.27 = 0.675 lost workdays per year per drinker. We have adopted these figures and created a distribution over the risk classes by assuming that the ratio of workdays lost to absenteeism and presenteeism is similar to the weighted average of 0.22 lost workdays due to absenteeism and 0.67 lost workdays due to presenteeism. In other words, for every day absent there is an additional 3.11 workdays lost due to alcohol-related presenteeism.

Multiplication of the number of drinking people in the workforce in each of the risk classes (Table 2.7) with the per-worker number of lost workdays stemming from alcohol-related absenteeism and presenteeism gives an estimate of the total number of lost workdays in the Dutch workforce in the year 2013 (see table 2.8).

Table 2.8 Workdays lost in the Dutch labor force due to absenteeism and presenteeism in 2013

Risk class	Absenteeism days	Presenteeism days	Total work-days lost
1	0	0	0
2	1,600,000	4,985,000	6,585,000
3	487,000	1,563,000	2,004,000
4	216,000	673,000	889,000
All	2,303,000	7,221,000	9,478,000

The €-value of one day of work was estimated at € 181.42 in 2015 (Koopmans, 2016a), or € 178.55 in 2013 prices. Multiplication of the number of lost workdays with the cost of a lost workday gives an estimate of the total costs in 2013 stemming from alcohol-related absenteeism and presenteeism. Table 2.9 reports this estimate.

Table 2.9 Costs (in 2013 million €) due to absenteeism and presenteeism in 2013

Risk class	Cost due to absenteeism	Cost due to presenteeism	Total Cost
1	0	0	0
2	286	890	1,176
3	87	279	358
4	39	120	159
All	411	1,289	1,692

In sum, the costs of productivity losses due to drinking alcohol in the year 2013 were estimated at € 1.7 billion. Of these, € 0.4 billion were caused by alcohol-related absenteeism and the remainder € 1.3 billion was related to presenteeism.

Alcohol-related accidents
Here, we reproduce the figures as estimated in the report by de Wit & Methorst, as discussed in section 2.2.2 (de Wit & Methorst, 2012). In 2009, productivity losses caused by alcohol related traffic accidents were estimated to be € 152 - € 221 million (2013: € 165 - € 241 million). Furthermore, productivity costs caused by alcohol related accidents other than traffic accidents were in 2013 € 11.1 million.

Domestic violence
In the Netherlands, an estimated 200,000 persons are victims of domestic violence conducted by 100,000-110,000 persons annually (Movisie, 2013; van der Veen & Bogaerts, 2010). In this source, 16% of all cases of domestic violence is attributed to alcohol misuse. This translates into a figure of € 23 million (in € 2013) (Movisie, 2011).

Unpaid work
Besides having an impact on the ability to be productive at work, alcohol may also impact on the ability to perform unpaid work (voluntary work). As no data on the association between alcohol consumption and unpaid work are available, this is included as a P.M. in our estimate.

All productivity losses for 2013 are summarized in Table 2.10.

Table 2.10 Summary of costs of productivity losses related to alcohol (million €, year 2013)

Category	**Point estimate**	**Minimum**	**Maximum**
Net costs			
Absenteeism and presenteeism	1,692	1,692	1,692
Traffic accidents	203	165	241
Other accidents	11	11	11
Domestic violence	23	23	23
Unpaid work	p.m.[+]*	p.m.[+]*	p.m.[+]*
Total costs	1,929	1,891	1,967

* p.m.[+] = These costs could not be valued quantitatively but are expected to increase the total cost estimate

2.2.5 *Loss of quality of life*

QALY losses associated with illnesses caused by alcohol consumption are both generated by the RIVM-CDM (for diseases modelled through RIVM-CDM), and through the Excel SCBA model (for remaining diseases). The QALY estimate from the RIVM-CDM is a net estimate of QALY losses, taking account of the fact that QALYs are lost through disease, but at the same time, QALY losses may be prevented because some diseases are partially prevented by alcohol use (see section 2.5). Current alcohol consumption levels in the Netherlands are associated with a total loss of about 21,000 QALYs for the diseases that are not modeled with CDM (DM II, liver cancer, colorectal cancer, addiction, alcohol related brain damage, and FASD). It also leads to a small loss of 74 QALYs compared to a situation wherein all persons would be in the lowest category of alcohol consumption (less than half a glass per day) for the chronic diseases modeled with the CDM (CHD, stroke, breast cancer, oral cavity cancer, larynx cancer, and esophagus cancer). The latter QALY gain is the difference between the reference scenario and a scenario with everyone in alcohol consumption class 1. Table 2.11 shows the loss of quality of life and the associated costs (valued at € 50,000 per QALY; Koopmans, 2016b) of current alcohol consumption.

Table 2.11 Summary of loss of quality of life (QALYs lost) and costs related to these QALY losses (million €, year 2013)

Category	**Number of QALYs**	**Costs**
Net costs		
QALY-loss non-CDM diseases	21,109	1,055
Net QALY-loss CDM diseases	74	4
Total costs	21,182	1,059

2.2.6 *Summary costs and benefits for consumers of alcohol*

In this paragraph 2.2., different types of costs borne by consumers have been presented. Table 2.12 summarizes the costs and benefits of alcohol use for consumers of alcohol. As specified in the text above, some costs also cover costs for victims and non-consumers of alcohol (discussed in section 2.9). Because it often is impossible to break down costs into costs for alcohol users themselves and other consumers, including victims of alcohol use of others, some categories of costs covered in Table 2.12 may be somewhat blurred by costs incurred by others. However, the majority of costs in Table 2.12 relates to consumer costs, that are estimated to be in the range of 1,7 to 3 billion €.

Table 2.12 Summary of costs and benefits for consumers of alcohol in million € (2013)

Paragraph / Cost type	**Point estimate**	**Minimum**	**Maximum**
Net costs			
2.2.2 Traffic accidents	1,040	653	1,425
2.2.3 Premature mortality	2,122	2,105	2,138
2.2.4 Productivity losses	1,929	1,891	1,967
2.2.5 Loss of quality of life	1,059	1,059	1,059
Total costs	*6,150*	*5,708*	*6,589*
Net benefit			
2.2.1 Consumer surplus	- 3,800	- 2,700	- 4,900
Total benefit	*- 3,800*	*- 2,700*	*- 4,900*
Total costs (2013) [a]	2,350	3,008 [a]	1,689 [a]

[a] Minimum and maximum is referring to the minimum and maximum estimates for the different categories of costs. As total costs result from a subtraction of total benefits from total costs, the definition of minimum and maximum reverses here

2.3 Production and distribution of alcohol

The consumption of alcohol generates not only effects for consumers, but also has implications for producers and distribution channels (bars, shops etc.). Alcohol production results in employment (wages), rent for premises (restaurants, cafes), interest on capital, and may generate profit for entrepreneurs. A description of the economic value of the production and distribution of alcohol to Dutch society is handicapped by the lack of data at the level of detail required. Often, generic data for all activities, including those not related to alcohol, are available. The tables in the sections below show generic data for the three major distribution channels for alcoholic beverages. From these generic data, tentative estimates are made for similar indicators in relation to the sale of alcoholic beverages.

2.3.1 Turnover and profit

Distribution of alcohol

The sale of alcohol in the Netherlands takes place via three main distribution channels. A recent estimate shows that 21% of alcoholic beverages are sold via bars and restaurants, 53% is provided via supermarkets and 21% is sold by specialized liquor stores (Detailhandel.info, 2016). A small part of sales (around 5%) is derived from other sources, such as imports, from wholesale sellers (not primarily addressing consumers) or in sports canteens.

Apart from liquor stores that by definition specialize in alcohol, the two other distributing channels also sell other goods and services.

Total sales and operating profits of these sectors are shown in the table below.

Table 2.13 Total sales and profit by distribution channel (2013)

	Sales (billion €)	**Operating Profit (billion €)**	**Operating profit as %**
Bars, cafes	3.0	0.4	13.3%
Supermarkets	32.9	1.4	4.3%
Liquor stores	1.0	0.05	5.0%
Total	36.9		

Source: CBS, NB the data relate to total sales, not only to sales of alcoholic beverages

Table 2.13 shows that the joint turnover realized by the three main distribution channels is € 36.9 billion. The table also shows that the profit margin varies considerably between these sectors. Given that the majority of sales of alcoholic beverages goes via these three channels (and restaurants), some 5.5% of the above-indicated sales may be assumed to relate to alcoholic drinks. The latter figure is derived from the total net sales (excluding taxes and excise duties) of alcohol that amount to €2 billion (see table 2.17).

No specific information is available on the profit margin realized on alcoholic beverages. Only by making some assumptions a rough indication can be given. For instance, if the profit margin realized by liquor stores (5%, see table 2.13) applies to all alcohol sales, the operating profit on total sales of alcoholic beverages would be around € 100 million.

Sales via sports canteens

Not much information is available on the alcohol sales related revenues of sports canteens. The most recent study on this subject dates back to 2007 (Tiessen-Raaphorst & Breedveld, 2007). The report describes that canteens are an important source of income for 82% of the amateur sports organizations. It also shows that 18% of total income of sport organization was derived from sales in canteens in 2003, while 36% of these sales was derived from alcoholic beverages (Tiessen-Raaphorst & Breedveld, 2007). In other words, sales of alcoholic drinks are responsible for 6-7% of total income of sports organizations. The profit margin related to these sales is unknown, but is expected to be relatively large, as the majority of employees in sports canteens works on a voluntary basis.

Employment

CBS also reports overall employment within the sectors involved in sale of alcoholic beverages, see Table 2.14.

Table 2.14 Employment and turnover in the retail market (2013)

	Employment (1,000 fte)	**Turnover / fte (1,000 €)**
Cafes, bars	44	44
Supermarkets	274	120
Liquor Stores	4	214

Source: CBS

The data reported above refer to the sectors in general and may not necessarily relate to alcohol sales (except for liquor stores). Panteia uses the indicator 'gross turnover per fte to assess employment in case of liquor stores (Scheltes et al., 2013). Applying the same indicator to other sales channels, a tentative estimate can be derived on employment involved in alcohol sales in the Netherlands, of around 15,800 fte.

Besides employment in the distribution channels, also part of the employment of the drinks industry is related to alcohol consumption in the Netherlands, in particular in distilleries and breweries. For both sectors around 40% of production is sold domestically. Total employment in the production of alcoholic beverages in the Netherlands amounted to 6,400 fte in 2013. Applying the above ratio of 40%, some 2,600 fte may thus be related to domestic consumption.

In summary, it is assessed that around 18,400 fte of employment in bars, restaurant, liquor stores, breweries and distilleries in the Netherlands is directly related to the consumption of alcohol by the Dutch population. As the net profits of producers and retailers of alcohol are arrived at taking account of the labour costs of these 18,400 employees, we will not value employment separately in our cost estimate for 2013.

Production of alcohol
Data on sales and operating profits are not readily available for the alcohol beverages industry. However, CBS registers turnover and gross profit margins for the drinks industry as a whole. CBS figures show that the drinks industry had a turnover of € 5.3 billion in 2011, with operating profits of € 0.6 billion. The operating profit thus equaled 11.3% in this year.

The above paragraphs give an approximation of the profit generated by production and sales of alcoholic beverages in the Netherlands, as a proxy for the producer surplus. These indicative values are summarized in Table 2.15.

Table 2.15 Summary of value of producer surplus from production and distribution of alcohol in million € (2013)

	Point estimate	**Minimum**	**Maximum**
Net benefit			
Distribution of alcohol	- 100	- 100	- 100
Production of alcohol	- 600	- 600	- 600
Total benefit	- 700	- 700	- 700

2.3.2 *Summary costs and benefits from production and distribution of alcohol*

In this paragraph 2.3, producer surplus has been presented. Table 2.16 summarizes the costs and benefits of alcohol use for consumers of alcohol. Total producer surplus for 2013 is tentatively estimated to be 0.7 billion €.

Table 2.16 Summary of producer surplus in million € (2013)

	Point estimate	Minimum	Maximum
Net benefit			
Production and distribution of alcohol	-700	-700	-700
Total benefit	-700	-700	-700

2.4 Taxes and duties

The Dutch tax authorities received around €1 billion in excise duties on the sales of alcohol in 2013 (source: CBS). Total expenditures on alcoholic beverages were estimated at € 3.8 billion € for the same year (Scheltes, 2013). Besides the excise duties, the tax authorities also received revenues from value added tax (VAT). The VAT revenues are not reported separately. In order to be able to show the government revenues related to alcohol consumption, the VAT revenues involved in alcohol sales have been estimated, on the basis of total consumer spending and assuming an average VAT of 21% on net sales and excise duties. The table below gives the overview of the situation in 2013.

Table 2.17 Government revenues (taxes and duties) for three different types of alcohol (2013), (in million €)

2013	Consumer spending [a]	Excise duties [b]	Value added tax [c]	Total revenues government [c]	Net sales sector [d]
Beer	1,121	413	195	608	513
Wine	1,740	321	302	623	1,117
Spirits	916	306	159	465	451
TOTAL	3,777	1,040	656	1,696	2,081

Sources: [a] Panteia; [b] CBS [c] own calculations; [d] a - d.

From Table 2.17 it appears that excise duties account for 18 to 37% of the sales price of alcoholic beverages (average 28%: 1,040 out of 3,777). Total revenues for the government are 45% of total spending on alcohol. However, if consumers would not spend their money on alcohol but on other consumer goods, VAT would be generated as well. VAT is to be regarded as transfer payments, hence, VAT related to alcohol sales does not independently contribute to welfare level. Therefore, it is excluded from the 2013 estimate in this chapter.

2.4.1 Summary taxes and duties

Main estimates are summarized in Table 2.18. Total benefits are estimated to be €1,040 million in 2013.

Table 2.18 Summary of costs and benefits of taxes and duties (2013 prices (in million €)

Benefit type	Point estimate	Minimum	Maximum
Net benefit			
Excise duties	- 1,040	- 1,040	- 1,040
Total benefit	- 1,040	- 1,040	- 1,040

2.5 Healthcare

2.5.1 *Costs of diseases associated with alcohol use*

A large number of diseases is associated with consumption of alcohol. However, the strength of evidence on this relationship differs for each disease. In 2015, the Health Council of the Netherlands published a comprehensive advice on nutrition, including alcohol (Gezondheidsraad, 2015b; Gezondheidsraad, 2015a). In this advisory report, the strength of the evidence on positive and negative health effects of alcohol is summarized. However, the Health Council report only includes the 10 most important chronic diseases. We therefore collected additional evidence on diseases firmly related to alcohol use, e.g. as described in a report from TNO about life style factors and cancer (Lanting, 2014a; Lanting et al., 2014b) and on use of addiction care for alcohol related problems (Boonzajer Flaes, 2015). If there is only limited evidence on the causal relationship between alcohol consumption and a disease, the effect has not been taken into account in the current report. In addition to diseases listed in the Health Council and TNO reports, we include two diseases because of their (almost) 100% relationship with alcohol. These diseases are Korsakov syndrome and Fetal Alcohol Spectrum Disorder (FASD).

The relationship between alcohol consumption and occurrence of diseases is twofold. Some diseases may be caused by alcohol, others may be prevented by alcohol. For a number of diseases it is known that moderate use of alcohol is associated with a reduced risk of disease, when compared with no consumption of alcohol at all. Such moderate consumption prevents the occurrence of coronary heart diseases (CHD), stroke, diabetes mellitus type 2 and dementia (Gezondheidsraad, 2015a). On the other hand, high levels of alcohol intake lead to an increased risk of stroke, colon cancer and breast cancer (Gezondheidsraad, 2015a), the Korsakov syndrome (Hersenstichting) and FASD (Popova et al., 2015; Van Wieringen et al., 2010). The risk of CHD increases when there is binge drinking (Gezondheidsraad, 2015a).

Here, we present data on the cost of diseases related to alcohol consumption, either with positive or negative health benefits. Large groups in the population show moderate consumption patterns of alcohol (see Table 1.3). In these groups, diseases as CHD, type2 diabetes mellitus and stroke occur less often compared to a situation without alcohol use. This implies that less consumption of alcohol would lead to higher incidence and prevalence of these diseases and, as a consequence, to higher health care costs. Following this notion, an estimate of healthcare costs of diseases associated with alcohol use for one year (2013) also takes account of diseases that would have occurred if no alcohol was consumed at all, i.e. the monetary value of diseases prevented through alcohol use. This estimate has been made by comparing a scenario with the entire population in CDM class 1 (no alcohol use to a maximum of half glass per day) and the baseline distribution over the 4 drinking classes as reported in Table 1.3. The estimate of healthcare costs associated with alcohol use for 2013 therefore is comprised both of costs of diseases that are caused by alcohol and of savings for diseases that are prevented by alcohol use. In the special case of stroke, which has both positive and negative relations to alcohol consumption, the costs and savings of stroke caused and prevented by alcohol were estimated with two separate PAR calculations (Population Attributable Risk; see Appendix 2B): one with Relative Risks larger than 1 (for costs), and one with Relative Risks smaller than 1 (for savings). All Relative Risks that were used in the calculations are documented in Appendix 2A.

We use several sources to estimate both healthcare costs and healthcare savings for 2013. Appendices 2B and 2C provide detailed background to these estimates. In short:

- The number of cases and healthcare costs related to CHD, DM 2 and stroke are taken from the RIVM-Chronic Diseases Model (see section 1.3).
- The number of alcohol related cancers were taken from a study by Lanting et al. (Lanting, 2014b). According to this report, from the total number of oral cavity cancer, 36.4% is caused by alcohol. For larynx cancer this is 19.8% and for esophagus cancer 44.1%. From the total occurrence of breast cancer 7.7% is caused by alcohol, for liver cancer this is 17.2% and for colorectal cancer 10.8%. These percentages are applied to incidence and prevalence of cancer, as registered in the database of IKNL (Dutch Cancer Registration). For breast cancer and colorectal cancer, total annual costs are taken from RIVM-"Costs of Illness" studies (RIVM, 2015) . For liver cancer, costs are based on a study by Kieran et al (Kieran et al., 2015). For other cancers, costs were based on data in the RIVM-CDM that were in turn derived from earlier versions of the RIVM-"Costs of Illness studies". More details are provided in Appendix 2C.
- The number of patients involved in and associated costs of addiction care were provided by Mental Healthcare Netherlands.
- The estimate of the prevalence of the Wernicke/Korsakov syndrome is between 8,000-10,000 patients. This number is stable (Korsakovkenniscentrum, 2015). Costs of nursing and care, including day time activities are € 166.33 per patient per day (Zorginstituut_Nederland, 2015), this equals annual costs of care of
- € 61,000 per patient.
- The prevalence of the Fetal Alcohol Syndrome Disorder (FASD) is almost 1% of the total population (Sampson et al., 1997). Costs are unknown for the Dutch situation. As a proxy for costs of FASD, we used the cost data from a recent Canadian report (Popova, 2015), where average annual costs for FASD are estimated to be € 3,985.

Table 2.19 summarizes the healthcare costs related to alcohol use. Here, we distinguish in costs for diseases that are positively associated to alcohol (i.e. savings following moderate alcohol use), in diseases with mixed associations between health and alcohol use (i.e. diseases that are both positively and negatively associated with alcohol) and diseases for which negative associations between alcohol use and health are reported (i.e. diseases with net costs related to alcohol use).

Table 2.19 Diseases included in the estimate of healthcare costs and savings for the year 2013, with their utility weight to correct for diminished quality of life

Disease	Incidence	Prevalence	Utility weight	Costs (million €)
Net positive effect on health				
CHD	- 17,800	- 241,000	0.712	-584
DM 2	- 11,100	- 179,000	0.802	-288
Subtotal positive effects				***-872***
Positive health effect of moderate alcohol intake and negative health effect of high intake				
Stroke (moderate alcohol intake)	- 564	- 3,990	0.391	-41
Stroke (high alcohol intake)	503	3,760	0.391	34
Subtotal mixed effects				***-7***
Net negative effect on health				
Breast cancer	1,315	17,200	0.744	45
Oral cavity cancer	637	1,400	0.44	10
Larynx cancer	142	3,800	0.44	104
Esophagus cancer	228	3,700	0.407	105
Liver cancer	106	162	0.45	4
Colorectal cancer	1,419	12,500	0.7	74
Addiction	n.a.	29,247	0.855	293
Alcohol related brain damage (Wernicke/Korsakow)	900	9,000	0.37	546
FASD	51	5,100	0.47	20
Subtotal negative effects				***1,201***
Total net costs				**322**

n.a.= not applicable

2.5.2 Costs of primary healthcare

Total costs of misuse and dependency of alcohol, drugs and medicines in primary healthcare are estimated at € 5.3 million in 2011 (www.kostenvanziekten.nl). This adds to the costs that were estimated in the previous section, as these were based on cost data from specialized mental health care for addiction problems. To unravel these costs into costs related to alcohol use, we used data from NIVEL Zorgregistraties. NIVEL provides data on prevalence of disorders in general practice via the corresponding International Classification of Primary Care (ICPC) codes.

The following codes contribute to the € 5.3 million estimate (www.nivelzorgregistraties.nl):

- ICPC code P15: chronic alcohol misuse: 4.9 per 1,000 patient years.
- ICPC code P16 acute alcohol misuse/intoxication: 0.9 per 1,000 patient years.
- ICPC code P18: misuse of medicines: 1.7 per 1,000 patient years.
- ICPC code P19: drugs misuse: 3 per 1,000 patient years.

Hence, the prevalence of chronic and acute alcohol misuse (P15 and P16) includes 55% of the four ICPC codes in general practice. Costs for alcohol misuse in primary care are therefore estimated to be 55%* € 5.3 million is € 2.9 million in 2011. At 2013 price levels, this would be € 3.1 million.

2.5.3 *Costs of accidents*

Medical expenditures as a result of visits to an emergency department caused by alcohol related accidents were in 2013 € 32.8 million (excluding traffic accidents). Most of these costs were caused by fall accidents (85%) (Veiligheid.nl, 2015).

The Rijkswaterstaat report (de Wit & Methorst, 2012) specifying costs of traffic accidents that was already quoted in section 2.2.2 was used to estimate the healthcare costs of traffic accidents related to alcohol. They report total costs of accidents of €350 million in 2009 (2013: 381 million€). This includes healthcare costs both in drunk-drivers themselves as in victims. As was described in section 2.2.2, 11-24% of all costs for traffic accidents are related to drunk driving. This results in a cost estimate for the year 2013 of € 42 - € 92 million or € 67 million averaged.

2.5.4 *Costs of diseases not valued in this section*

In this section, we have summarized healthcare costs for diseases with clear associations with alcohol consumption and quantitative data available to estimate costs, including data on the fraction of total disease that can be attributed to alcohol use. However, many more diseases have been linked to alcohol use, such as liver cirrhosis, alcohol poisoning, acute mental and/or behavioral disorders, chronic pancreatitis and spontaneous abortion. We could not value the cost of these diseases separately as insufficient data were available. However, we include these diseases as pro memori, acknowledging that our estimate would have been higher if all those diseases were valued properly as well.

2.5.5 *Summary of healthcare costs*

Table 2.20 summarizes healthcare costs related to alcohol use. Consumption of alcohol was associated with healthcare costs of about 0.4 to 0.45 billion in 2013.

Table 2.20 Summary of the impact of alcohol use on healthcare costs in 2013 (million €)

Cost type	Point estimate	Minimum	Maximum
Healthcare costs diseases positively related to alcohol	872[&]	872[&]	872[&]
Healthcare costs diseases both positively and negatively related to alcohol	7[&]	7[&]	7[&]
Healthcare costs diseases negatively related to alcohol	1,201	1,201	1,201
Primary healthcare costs	3	3	3
Healthcare costs emergency department	33	33	33
Healthcare costs traffic accidents	67	42	92
Healthcare costs for diseases not valued in this section	p.m.[+]*	p.m.[+]*	p.m.[+]*
Total costs (2013)	425	400	450

[&]: Negative costs mean that healthcare costs for this group of diseases are lower due to alcohol consumption.
*: p.m.[+] = These costs could not be valued quantitatively but are expected to increase the total cost estimate

2.6 Education

2.6.1 Study delay

Primary and secondary education

At early age, pupils have experience with the use of alcohol. One out of ten pupils has ever drunk alcohol in the last grade of elementary education (de Looze et al., 2014). This proportion increases rapidly between the age of 12 and 16. Almost 80% of all 16 year olds have ever drunk alcohol, two-third drank alcohol in the last month and 45% of these children have ever been drunk in their lives.

Ter Bogt et al. describe the relationship between alcohol use and school performance (ter Bogt et al., 2009). Young students who often drink alcohol are less motivated at school and are less successful in completing high school. Moreover, frequently drinking young people are less likely to start higher education after high school. In summary, alcohol consumption poses a risk for motivation of students, school performance and skipping school (school dropout). However, data on the numbers of pupils with lower school performances due to alcohol consumption are lacking.

Tertiary education

According to CBS, 29.8%, 25.9%, and 17.9% of all students at University (WO), higher vocational training (HBO) and intermediate vocational training level (MBO), respectively, is a heavy drinker (men drinking at least 6 glasses or more once a week and women drinking at least four glasses at one occasion during the week) (Van Dorsselaer & Goossens, 2015).

In order to estimate the annual cost of study delay related to alcohol consumption it is important to know the relative share of alcohol related causes for study delay to all other causes of study delay. We assume that an alcohol related cause of study delay will only appear in those students engaging in binge drinking. In addition, we need absolute numbers of students with study delay and data on the cost of study delay per student who experiences delay.

Data on study delay are provided by (http://www.onderwijsincijfers.nl): the annual number of students with delay or students without diploma is 85,616 at MBO level (intermediate level vocational training), 64,000 at HBO level (higher level vocational training) and 26,000 at WO level (universities). Assuming that binge drinking is equally spread over students with and students without delay, 15,325 students MBO students, 16,576 HBO students and 7,748 WO students with delay engage in binge drinking.

Next, we have to estimate the fraction of these binge-drinking students with delay where alcohol is the primary cause for the delay. The crude Odds Ratio of study-delay (at least for one semester) for students drinking more than 6 glasses once a week was 1.42 (1.07-1.89) in a Dutch study performed at Windesheim University (Korf et al., 2012). From the data in Table 1 in the report by Korf et al (Korf, 2012), it can be inferred from the OR 1.42 that the ratio of study delay caused by alcohol to all study delay is 0.20, with minimum and maximum boundaries of 0.17 and 0.23, which are based on the confidence interval of the OR (1.07-1.89).

The mean total costs are calculated as the number of delayed heavy drinking students due to alcohol multiplied by the annual costs for study delay. The costs of study delay (full year, 2013) are estimated to be €7,300 at MBO level, € 9,813 at HBO level and € 8,900 at WO level (http://www.onderwijsincijfers.nl).
The minimum and maximum total costs are the results of using the lower and upper bound of the confidence interval around the OR, and the corresponding interval around the ratio of study delay primarily caused by alcohol. Table 2.21 shows the total costs with minimum and maximum boundaries.

Table 2.21 Calculation of costs of school delay attributable to alcohol consumption (2013, million €)

School type	Number of binge drinking students with delay	Delay primarily caused by alcohol	Cost per year of delay per student (€)	Expected total costs (€)	Total costs Min. (€)	Total costs Max. (€)
Intermediate vocational training	15,325	0.20 (0.17-0.23)	7,300	22	17	28

School type	Number of binge drinking students with delay	Delay primarily caused by alcohol	Cost per year of delay per student (€)	Expected total costs (€)	Total costs Min. (€)	Total costs Max. (€)
(MBO)						
Higher vocational training (HBO)	16,576	0.20 (0.17-0.23)	9,813	33	24	41
University	7,748	0.20 (0.17-0.23)	8,900	14	10	17
Total	39,649			69	52	86

2.6.2 *School dropout*

No quantitative information on the number of school dropouts related to consumption of alcohol is available. School dropout is associated with lifetime restricted earnings, compared to peers who leave school with a diploma. As a rule of thumb, the SEO report quotes 5% less earnings annually for every year of education foregone (Koopmans, 2016b). However, in the absence of data on the quantitative role of alcohol in school dropout, it is impossible to make estimates. This category of costs is therefore represented as Pro Memori costs in our estimates.

2.6.3 *Study support*

No quantitative information on the amount of study support related to consumption of alcohol and prevention of study delay and school dropout is available. This category of costs is therefore represented as Pro Memori costs in our estimates.

2.6.4 *Summary of costs and benefits in the field of education*

Total costs of alcohol related problems in education are summarized in Table 2.22. As important costs could not be quantified, the amount of 52 to 86 million € is regarded as a conservative estimate. True costs of alcohol related problems in education will be higher.

Table 2.22 Summary of costs and benefits of alcohol consumption to education in million € (2013 prices)

Cost type	Point estimate	Minimum	Maximum
Study delay	69	52	86
School dropout	p.m.[+]*	p.m.[+]	p.m.[+]
Study support	p.m.[+]	p.m.[+]	p.m.[+]
Total costs (2013)	69	52	86

* p.m.[+] = These costs could not be valued quantitatively but are expected to increase the total cost estimate

2.7 Police, justice

2.7.1 *Costs of prevention, tracing and justice*

The financial expenses that are associated with activities of police, legal authorities and other governmental and private organizations involved in prevention, persecution and detention of crimes are well documented by WODC in the annual report series “Criminaliteit en Rechtshandhaving” [Crime and Law Enforcement] (WODC, 2014). In this report, the total financial expenses of the sector were attributed to various types of crimes. For our study, the crime types vandalism, assault, and sexual offences are most relevant as various sources show that the use of alcohol has an impact on the prevalence of such types of crime (Zhang et al., 2015; Anderson et al., 2014; Corman. et al., 2015).

WODC assesses the costs of police (prevention, tracing) and justice (courts, legal assistance, etc.) in relation to the three types of crime as follows:

Table 2.23 Costs of police, justice (€ million, indexed to 2013 price levels)

	Prevention (police)	**Tracing (police)**	**Persecution (courts, legal counselors, etc.)**
Vandalism	1,420	352	60
Assault	511	246	357
Sexual offences	171	25	35
Total	2,102	622	452

Source: WODC, 2014

The total costs of reaction, i.e. prevention, tracing and persecution together, to these types of crime amount to € 3.2 billion. Only a part of these costs can be attributed to the consumption of alcohol, as it is likely that other factors, such as use of drugs or personality disorders, contribute to these crimes as well. However, information is lacking what part of total costs is attributable to consumption of alcohol. The international literature suggests that alcohol consumption plays a significant role in all of these offences (IAS). For the individual types of crime, percentages ranging from 30 (domestic violence) to 75% (nightlife violence) are quoted (Lemmers, 2014). The fraction of alcohol related crimes to total crime is described in a fact sheet of Trimbos Institute, in which it is estimated that possibly 32 to 50 % of various types of crime can be attributed to the consumption of alcohol (Lemmers, 2014). Extrapolating this range to the financial expenses as shown in Table 2.23, the contribution of alcohol consumption to the financial costs of tracing and persecution (€ 1.1 billion in total) can be assessed to be € 343 to € 537 million in prices of 2013.

This estimate excludes police efforts in the field of prevention. One could argue, though, that also more prevention is needed due to alcohol use and its potential negative effects on vandalism, assault and sexual offences. If the same range is also applied to the financial expenses on prevention, implying prevention costs of € 0.67 to € 1 billion, € 1 to 1.6 billion would in total be attributable to consumption of alcohol (Lemmers, 2014).

It may also be that other types of crimes should be taken into account when assessing the impact of alcohol consumption, like murders, economic crimes, and drug-related crimes. However, as even less information is available on the role of alcohol in these types of crimes, such crimes are excluded from the present analysis.

2.7.2 *Detention*

Based on the WODC report quoted above (2014), the total costs of detention for the three types of crime that have a clear relation with alcohol consumption, amounted to € 483 million. Table 2.24 shows the detention costs per category of crime.

Table 2.24 Total detention costs (year 2012, indexed to 2013) per category of crime (million €)

	Detention costs
Vandalism	10
Assault	276
Sexual offences	197
Total	483

Source: WODC, 2014

As indicated in the previous paragraph, a range of 32 to 50% is mentioned as the fraction of total costs of the legal system pertaining to some types of crime attributable to alcohol. If the same range is applied to the detention costs as shown in Table 2.24, the alcohol related detention costs due to vandalism, assault and sexual offences can be assessed at € 155 to € 242 million (price level of 2013).

2.7.3 *Summary of costs and benefits in the field of police, justice*

The different types of costs in the field of police and justice attributable to alcohol are summarized in Table 2.25. Total costs are estimated to be in the range of 1.1 to 1.8 billion €, with €1.5 billion as a point estimate. This may be an underestimate as the role of alcohol in other types of crime could not be estimated.

Table 2.25: Summary of costs and benefits of police and justice in million € (2013 prices)

Cost type	**Point estimate**	**Minimum**	**Maximum**
Net costs			
Prevention	862	673	1,051
Tracing	255	199	311
Persecution	185	145	226
Detention	199	155	242
Other types of crime	P.M. (+)	P.M. (+)	P.M.(+)
Total costs (2013)	1,501	1,172	1,830

2.8 Government

2.8.1 *Education/campaigns*

Health promotion and health education measures targeted at prevention and reduction of alcohol use are paid for by the Government sector. The expenses for health education and campaigns targeted at the prevention of alcohol (mis)use were estimated at € 11.1 million (2013 price level)(Post et al., 2010).

2.8.2 *Costs of enforcement*

In the present situation, municipalities are responsible for enforcement of the “Drank- en Horecawet (DHW)” in the Netherlands. The DHW regulates licensing of premises where alcohol may be sold and to whom alcohol may be sold. Information on the number of staff engaged in enforcement of alcohol related laws can be found in documents that were sent to Dutch Senate in the preparation of the new age limit policy for alcohol sales (2014). According to these documents in total some 100 full time enforcers are required at municipal level to be able to inspect locations (Kamer_der_Staten-Generaal, 2013). These enforcers spend about 60% of their inspection time in enforcing the age limit for sales, and 40% in inspecting premises.

Based on the assessment of the number of enforcers needed, and the financial information from an evaluation report on a pilot carried out by some municipalities, the total annual enforcement costs have been assessed in 2010 (NovioConsult, 2010). Including wage costs of enforcers, the costs of training and the support costs needed, the annual enforcement costs for municipalities are tentatively assessed at € 7 to 10 million.

In addition to enforcement, government officials, e.g. civil servants of the Ministry of Health, Welfare and Sports and the Ministry of Finance, may be involved in preparing policies. At present, no clear information is available on the time spent by government officials at national and local level on developing policies related to alcohol. It is therefore not possible to assess these costs.

2.8.3 *Summary of costs and benefits for Government*

Table 2.26 shows an overview of the costs for Government. Total costs in 2013 were found to be between € 18 and € 21 million.

Table 2.26 Summary of costs for the government in relation to alcohol consumption in million € (2013 prices)

Cost type	**Point estimate**	**Minimum**	**Maximum**
Net costs			
Education / campaigns	11.1	11.1	11.1
Enforcement	8.5	7	10
Policy making	P.M.(+)	P.M.(+)	P.M.(+)
Total costs (2013)	20	18	21

2.9 Others in society (victims)

Costs and effects of alcohol use are not only of importance for the consumer of alcohol but also for others in society, such as close relatives of the alcohol users, and people who become victim of alcohol abuse. However, for most types of costs, data were not available to allocate costs and effects to consumers and to others in society separately. This applies to the domains vandalism (part of police and justice), traffic accidents, premature mortality, productivity losses, and healthcare. In all these cases, costs and effects for others in society are incorporated in the total costs estimates as described in the respective sections of this chapter. Productivity losses for others due to domestic violence are described in the paragraph ‘productivity losses’. As a consequence, no separate costs for the sector “others in society (victims)” are summarized in our report.

However, some more intangible costs borne by others in society were not yet covered in previous paragraphs. This relates to quality of life losses in family members of alcohol users, e.g. for those with a family member addicted to alcohol. This may also include fear, anxiety and feelings of social insecurity in the general population that is related to vandalism and violence. Furthermore, there may be psychological damage in victims of accidents and violence. As no quantitative data are available, these costs are included as P.M. costs only. Costs are summarized in Table 2.27.

Table 2.27 Summary of costs borne by others in society / victims in million € (2013 prices)

Cost type	Point estimate	Minimum	Maximum
Net costs			
Vandalism	Included in Section 2.7		
Domestic violence	Included in Section 2.7		
Traffic accidents	Included in Section 2.2		
Premature mortality	Included in Section 2.3		
Intangible costs: loss of quality of life, fear, anxiety, social insecurity	P.M.[+]*		
Productivity losses	Included in Section 2.2		
Healthcare costs	Included in Section 2.5		

* p.m.[+] = These costs could not be valued quantitatively but are expected to increase the total cost estimate

2.10 Overview of costs and benefits of alcohol in 2013

The table below gives an overview of the costs and benefits for each of the domains covered in Chapter 2.

Table 2.28 Summary of total costs to society of alcohol consumption in The Netherlands in million € (2013 prices)

Cost	Point estimate	Minimum[&]	Maximum[&]
Section 2.2.2: Traffic accidents	1,039	653	1,425
Section 2.2.3: Premature mortality	2,122	2,105	2,138
Section 2.2.4: Productivity losses	1,929	1,891	1,967
Section 2.2.4: Productivity losses from unpaid work	p.m.[+]*	p.m.[+]*	p.m.[+]*
Section 2.2.5: Loss of quality of life	1,059	1,059	1,059
Section 2.5: Healthcare costs	425	400	450
Section 2.5: Healthcare costs for diseases not	p.m.[+]*	p.m.[+]*	p.m.[+]*

Cost	**Point estimate**	**Minimum&**	**Maximum&**
valued			
Section 2.6: Study delay	69	52	86
Section 2.6: Study dropout	p.m.[+]*	p.m.[+]*	p.m.[+]*
Section 2.6: Study support	p.m.[+]*	p.m.[+]*	p.m.[+]*
Section 2.7: Police and justice	1,501	1,172	1,830
Section 2.7: Other types of crime	p.m.[+]*	p.m.[+]*	p.m.[+]*
Section 2.8: Government	20	18	21
Section 2.8: Costs of policy making	p.m.[+]*	p.m.[+]*	p.m.[+]*
Section 2.9: Intangible costs: loss of quality of life, fear, social insecurity	p.m.[+]*	p.m.[+]*	p.m.[+]*
Total cost	8,164	7,350	8,976
Benefit			
Section 2.2.1: Consumer surplus	-3,800	-2,700	-4,900
Section 2.3: Producer surplus	-700	-700	-700
Section 2.4: Excise taxes	-1,040	-1,040	-1,040
Total benefits	5,540	4,440	6,640
Net costs	2,624	2,910	2,336

* p.m.[+] = These costs could not be valued quantitatively but are expected to increase the total cost estimate

& Minimum and maximum is referring to the minimum and maximum estimates for the different categories of costs. As total costs result from a subtraction of total benefits from total costs, the definition of minimum and maximum reverses here

This chapter presented an overview of costs and benefits to society of alcohol consumption for one year, 2013. Although some obvious benefits (i.e. income from excise duties and producer surplus) are present, the consumption of alcohol overall represents a net cost to society of € 2.3 to 2.9 billion per year. These costs are mainly borne by consumers and consist among others of premature mortality and loss of quality of life from diseases associated with alcohol. Other negative impacts relate to traffic accidents, costs of police and justice, and productivity losses.

At the same time, consumers experience a considerable benefit in terms of the excess utility associated with (the pleasure of) consuming alcohol. However, this (short term) benefit is outweighed by the loss of quality of life, premature mortality, productivity losses and other adverse effects of alcohol that they experience.

Compared to the premature mortality and loss of quality of life, the additional healthcare costs are relatively small, about 400 to 450 million €. This is mainly due to the mixed effect of alcohol consumption on various types of diseases, with considerable “savings” related to the fact that without alcohol consumption, more cases of coronary heart disease would be present in 2013. Furthermore, we could not value all diseases that are associated with alcohol. The considerable number of diseases that were not covered in our cost calculation may further add to the cost estimate of 400 to 450 million €.

It is important to realize that this is a crude estimate, arrived at by making assumptions, translating foreign sources or data to the Dutch situation and using older data as if they remained unchanged until 2013. The final estimates should be treated with caution. Chapter 7 discusses our methods and findings in more detail.

3 Describing the reference scenario

The definition of the reference scenario is an important step to be taken within an SCBA (Romijn & Renes, 2013). All policy scenarios will be compared to the reference scenario. By definition, an SCBA projects the future costs and benefits of policy measures that are implemented now or in the near future. However, in a world without these policy measures, costs and benefits of alcohol use would develop over time as well. This chapter describes the reference scenario, or the most likely development of costs and benefits of alcohol use without the implementation of additional policies targeted at curbing alcohol use. First, it is important to study what trends in alcohol use are to be expected in the (near) future.

Current alcohol policies
At present, several national and local policy measures have been implemented to restrict the consumption of alcohol. The most important is the Licensing and Catering Act ('Drank- en Horecawet'). This law regulates the sale of alcohol in the Netherlands. Under this Act, it is prohibited to sell alcohol to people under 18 years of age since January 1, 2014. This measure is supported by a media campaign called NIX18. Local governments supervise compliance with the Licensing and Catering Act through special control officers that visit premises unexpectedly. In addition to the Licensing and Catering Act, other legal measures directed at curbing alcohol use and its consequences are:

- criminal law: public drunkenness and disturbance of public order in a state of intoxication is punishable. Also, it is prohibited to give alcohol to someone who is visibly intoxicated.
  - Road Traffic Act: This Act states that drivers are not allowed to have a higher Blood alcohol content than 0.05 (% by volume of blood). For novice drivers (operation of motor vehicles) the limit is lower at 0.02 (% by volume of blood).
  - Media Law: Between 6:00 AM and 09.00 PM, no alcohol advertising on TV and radio is allowed.
- Furthermore, excise taxes have to be paid for every purchase of alcohol.
- See https://www.rijksoverheid.nl/onderwerpen/alcohol.

Autonomous trends
In the last decade there has been a decline in per-capita alcohol consumption in the Netherlands. Since 2011, the number of people with alcohol-related problems seeking for help in mental healthcare is declining as well (IVZ, 2015). It is however unsure whether this is related to less prevalence of problems or to other causes. At present, there are multiple autonomous trends that are to be expected to take place in the future, pointing to different directions, and it is unclear which of these trends will dominate (www.alcoholinfo.nl). On the one hand, there is a trend that young people are drinking less than they used to. In addition, the Muslim population, increasing its share in the total population, drinks less than the non-Muslim population. At the

same time, the older population at present shows a trend of increasing alcohol consumption. As it is unclear which of these trends will dominate, it was chosen not to incorporate an autonomous trend in the reference scenario, but to assume no further change in alcohol consumption for the reference scenario. This implies that within the reference scenario, current levels of age-specific per capita alcohol use, as described in Section 1.3, will remain unchanged. Changes over time result from demographic developments, such as birth, migration and death, and the 2050 population will obviously be different from the population in 2013 as a result of these demographic developments.

How will the costs and benefits of alcohol as presented in paragraph 2.10 develop over time? In order to present a reference scenario of costs and benefits over time without additional policies targeting at reduction of alcohol use, we used much of the 2013 cost data presented in chapter 2 in our calculations. However, the cross-sectional assessment of costs and benefits for 2013 obviously is not enough to serve as a reference scenario within the context of an SCBA. What is needed here is a projection of (developments within) these costs for the entire time horizon of the SCBA, namely 50 years.

From the eight domains within society that are affected by alcohol use (see Chapter 2), one was left out of the calculations. This concerns the domain “others in society”, as we had inadequate evidence to split cost data into a part related to consumers and a part related to others in society. Consequently, the consumer domain in figure 3.1 below also includes data related to others in society (victims and other non-users of alcohol). Figure 3.1 depicts the development of the undiscounted social benefits of the reference scenario (with no additional regulatory policies). The overall effects, as outlined by the blue line, are negative, indicating that the reference scenario is associated with a net cost to society in the domains considered in the model. Obviously, assuming no major changes in drinking trends, alcohol will be associated with net costs over the entire time horizon. Yearly (undiscounted) total costs are expected to be roughly between €1.8 and €2.6 billion over the 50 years considered.

Alcohol consumption bears a cost to society in most domains except for taxes and duties and producers. All domains are fairly stable in terms of their contribution to the overall costs and benefits to society, reflecting the fact that the drinking behavior of the population is modelled to be stable over time and only to be influenced by demographic developments. The effects in the consumer domain dominate the picture. This is a composite of different types of costs, as discussed in section 2.2., i.e. consumer surplus (positive costs), premature mortality (negative costs), productivity losses (negative costs), loss of quality of life (negative costs) and traffic accidents (negative costs).

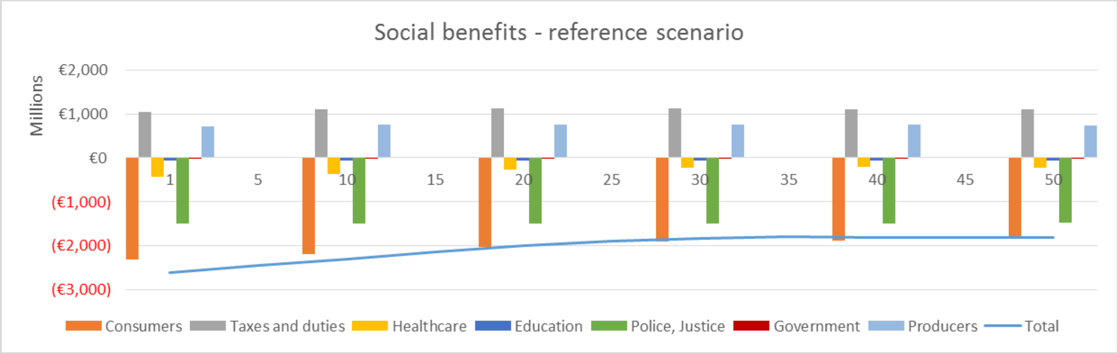


Figure 3.1 Development of annual social costs of alcohol consumption in the reference scenario (undiscounted figures)

As a result of demographic changes over time, the total number of units of alcohol consumed by the population of 10 years and over will develop from 7.9 billion to 8.3 billion, which represents an average per capita consumption change from 537.5 in year 1 to 532 units of alcohol per year in year 50.

4 Social Cost-Benefit Analysis of a policy measure to increase alcohol excise taxes

4.1 Evidence on effectiveness of excise taxes

There is much evidence that an increase in price affects the consumption of alcohol (Wagenaar, 2009; Wagenaar et al., 2010; Sassi & Belloni, 2014; Doran et al., 2013; Hollingworth et al., 2006; Holm et al., 2014b; Holm et al., 2014a). Existing evidence from meta-analyses on the price elasticity of alcohol (total alcohol and separately for beer, wine and spirits) is summarized in section 2.2. of this report.

To estimate the effects of changes in alcohol consumption after an increase of excise taxes, we use the price elasticity as summarized in Wagenaar et al., who performed a meta-analysis comprising about 90 individual studies on price elasticity of alcohol (Wagenaar, 2009). The overall price elasticity presented in this study is -0.51. This figure was used in our analyses.

4.2 Policy scenarios with regard to excise taxes

We will implement an excise tax increase at two different levels, namely a 50% and a 200% increase. Note that this does not correspond to an increase of the price of the alcoholic consumption of 50% or 200%; it is the excise part of the total price of the alcoholic consumption that is increased. Of course, this results in an increase in prices of alcohol, unless producers or retailers react with price measures in response, i.e. reducing prices or keeping them equal by accepting lower profit margins. In this report, we have assumed that producers and retailers do not react to price increases by lowering their profit margin and that consumers react to a price increase as indicated by the meta-analyses about price elasticity as cited above.

4.3 Assessing the costs of the policy measures

The costs of the policy measure to increase excise duties on alcoholic beverages are difficult to assess, as there is no empirical evidence on the costs of such a measure. These costs include the costs of the policymaking process itself and costs within the fiscal authority. Most costs are expected to be related to the time involved in adjusting pricing and taxing information and systems. The time involved of all parties together might sum up to several person-years. In the absence of Dutch evidence on the costs of increasing excise taxes, we use an international figure as given by Anderson and Chisholm (Anderson et al., 2009a). They state that increasing excise taxes is associated with annual costs of I$ 0.67 (2013€ 0.70) per capita, which amounts to € 12 million per year. This figure has been incorporated in the calculations.

4.4 Main appraisal of costs and benefits

Social benefits of a 50% increase in excise taxes

Figure 4.1 depicts the social benefits of a 50% increase in excise tax (undiscounted values). The overall effects, as outlined by the blue line, are positive, indicating that this regulatory policy is associated with overall benefits to society in the domains considered in the model compared to the reference scenario. Undiscounted benefits are expected to be roughly between €350 and €850 million per year over the 50 years considered.

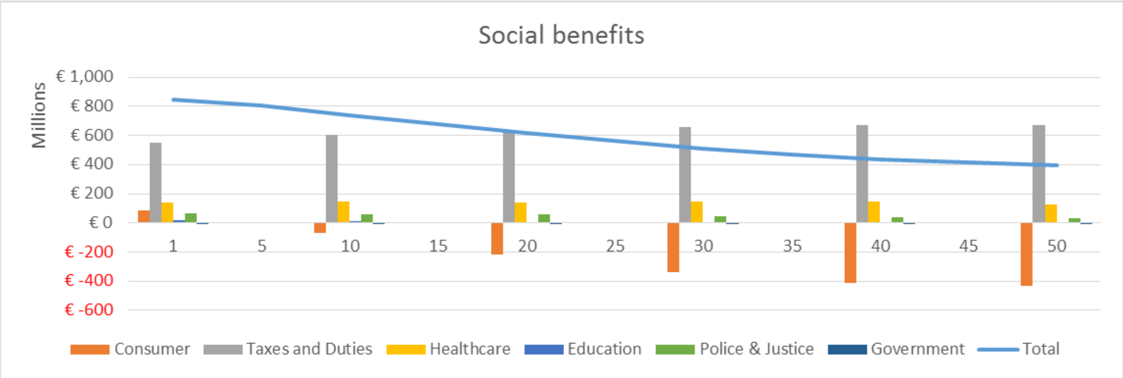


Figure 4.1 Social benefits of a 50% increase in excise duties (undiscounted figures)

The effects of the domain taxes and duties stand out, as this type of regulatory policy is expected to generate substantial additional income for the government. However, as pointed out below, government is expected to redistribute this additional excise tax to all consumers (see section 1.5). The additional tax is paid for by the alcohol consumers, resulting in a simultaneous cost to society due to a decrease in consumer surplus (see figure 4.2). Compared to effects within the tax and duty and consumer domain, the effects in the remaining domains healthcare, education, government, and police and justice are relatively small, as can be seen in figure 4.1. In addition, the effects in these domains are fairly stable over the 50 years considered.

Figure 4.2 illustrates the costs and benefits of the consumer domain in more detail. Within the consumer domain, benefits arise from a gain in QALYs and improved productivity, and fewer traffic accidents. Over time, these benefits gradually become less prominent. The steepest decline appears to be in the benefits from a gain in QALYs that are associated with less alcohol-related diseases. A shift to less alcohol consumption is associated with an increased incidence of coronary heart disease; see Appendix 2A for detailed RRs. The relatively high numbers of incidence for CHD result in a cancelling out of the positive effects for the other diseases that relate to alcohol consumption. CHD is associated with both mortality and a reduction of quality of life. Since most CHD patients initially survive, the quality of life effects remain present over time.

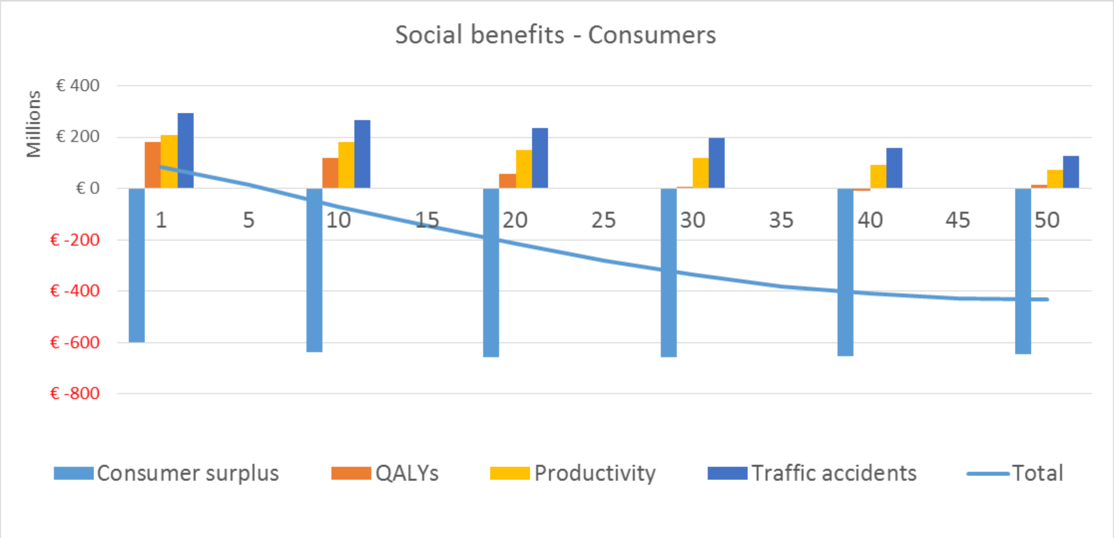


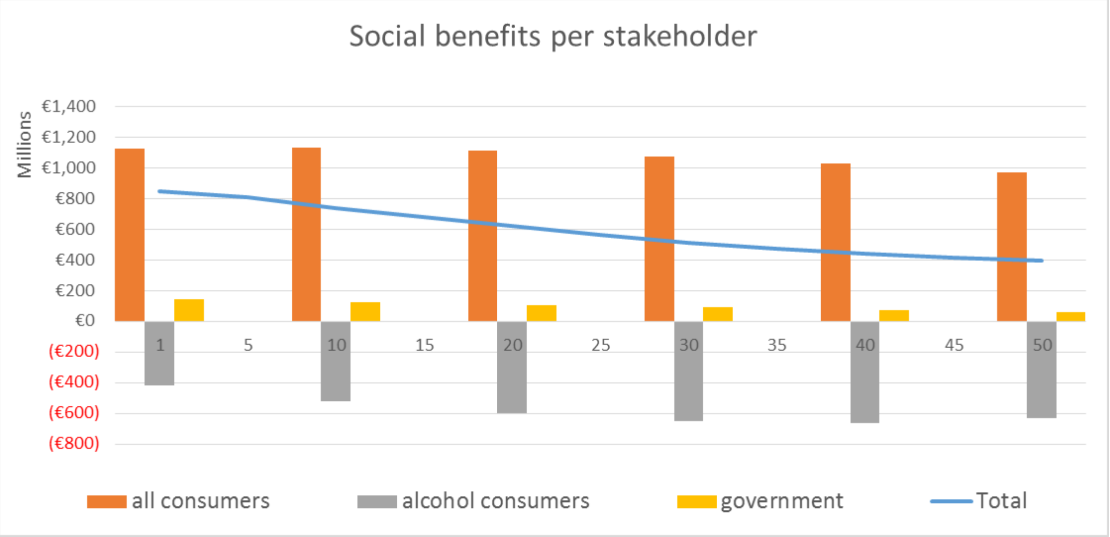
Figure 4.2 Social benefits of a 50% increase in excise duties for the consumer domain (undiscounted figures)

Table 4.1 shows the cumulative and discounted figures for all domains over the 50 years considered. The cumulative discounted value of the expected benefit to society in these domains over a 50-year period amounts to 17 billion € (95%CI € 14-20 billion). Over these 50 years, consumers of alcohol consistently experience costs, as explained above. The domain of taxes and duties stands out in cumulative benefits. Other domains have consistent benefits over time, although not as high as the domain of taxes and duties. Less alcohol consumption has a positive impact on the education and police and justice domains. The effect in the healthcare domain needs some further explanation. Over all diseases considered, healthcare savings are observed, despite the fact that more coronary heart disease will develop over the years. Savings occur from fewer occurrences of alcohol related cancers and other diseases associated with alcohol, such as FASD. However, costs in life years gained (indirect medical costs) were not consistently considered in our modelling. These costs were incorporated in the RIVM-CDM calculation, but not integrated in the Excel based SCBA model. Therefore, cost savings in the health care domain are expected to be less prominent than shown in Table 4.1. The costs in the government domain, finally, relate to continued costs of implementation of these policies (see Section 4.3 above).

Table 4.1 cumulative (50 year), discounted social benefits of a 50% increase in excise duties, in million €

	1	**10**	**20**	**30**	**50**
Consumers	80	80	-880	-2.250	-4.770
taxes and duties	550	5.080	9.180	12.340	16.550
Healthcare	140	1.270	2.200	2.910	3.800
Education	20	140	190	220	260
police justice	70	570	950	1.210	1.470
Government	-10	-100	-180	-240	-310
Total	850	7.040	11.450	14.180	17.000

Besides specifying the different domains and their involvement in costs and benefits of policy measures aimed at curbing alcohol intake, costs and benefits can also be attributed to different stakeholders (see Section 1.5), distinguishing between alcohol consumers, all consumers (including those who consume alcohol) and the government. Figure 4.3 depicts the development of the social benefits for each of these stakeholders. As can be seen from the figure, alcohol consumers will pay for the costs of this policy measure, while most of the benefits of the policy go to all consumers, e.g. through higher wages following increased productivity and through reduced insurance premiums, e.g. for car insurance. However, it should be noted that there is a large overlap between both groups of consumers, implying that a large part of the benefits for all consumers will also come back to alcohol consumers. The government experiences some small benefits, e.g. from less school dropout and less crime and violence following a reduction in alcohol consumption.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

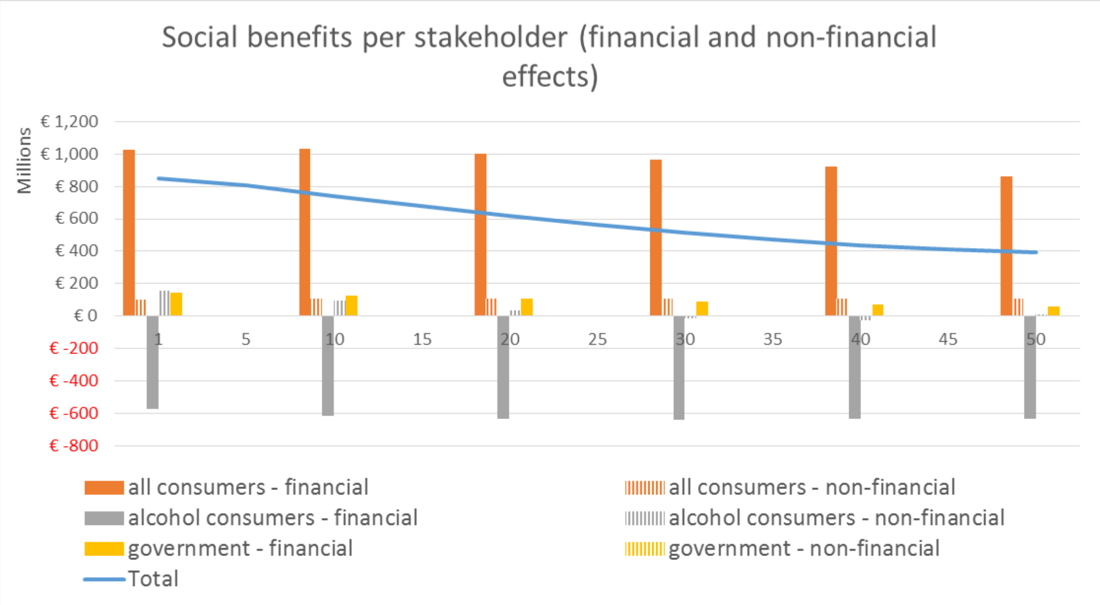
Figure 4.3 Social benefits per stakeholder (after redistribution), scenario with a 50% increase in excise duties (undiscounted figures)

Cumulated, discounted costs and benefits after 50 years are shown per sector in table 4.2.

Table 4.2 Cumulative (50 year), discounted social benefits of a 50% increase in excise duties, in million €

	1	**10**	**20**	**30**	**50**
all consumers	1.120	9.970	17.320	22.630	29.120
alcohol consumers	-420	-4.120	-7.810	-10.870	-15.010
government	150	1.200	1.940	2.420	2.880
Total	850	7.040	11.450	14.180	17.000

Figure 4.4 shows the specification of the social benefits per stakeholder into financial and non-financial (intangible) effects. The government experiences exclusively financial effects, while both all consumers and alcohol consumers experience mainly financial effects and relatively small non-financial effects.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 4.4 Social benefits per stakeholder (after redistribution), specified into financial and non-financial effects (undiscounted figures)

A final result pertains to the number of drinks consumed less as a consequence of introducing higher excise taxes. Figure 4.5 shows the total number of drinks in the reference scenario and in the scenario simulating a 50% increase in excise duties over a period of 50 years. In the first year, consumption is decreased by 8.5%, and in year 50 by 4.3% compared to the reference scenario. The average reduction over 50 years is 6.1%.

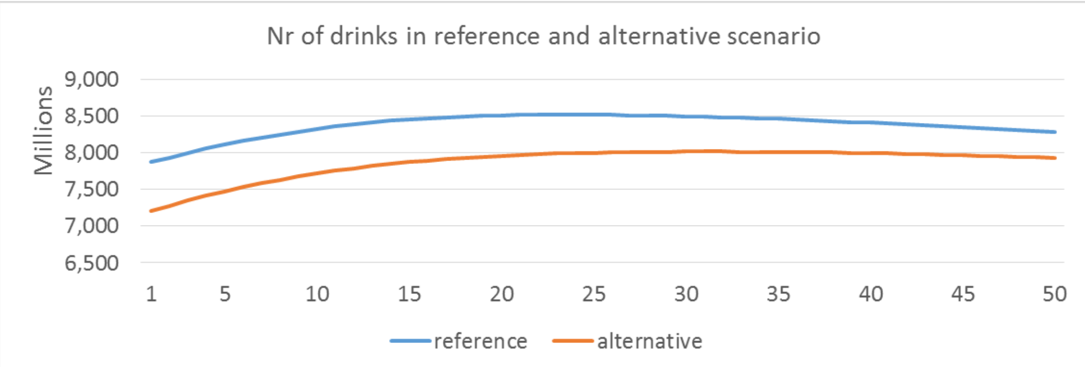


Figure 4.5 Total number of drinks in the reference scenario and in the alternative scenario, after implementation of a 50% increase in excise duties

Social benefits of a 200% increase in excise taxes
In case of a 200% increase in excise taxes, the type of social benefits is similar compared to the previous scenario of a 50% increase in excise tax, however, the benefits are of a larger magnitude. Figure 4.6 depicts social benefits of the 200% increase in excise tax scenario.

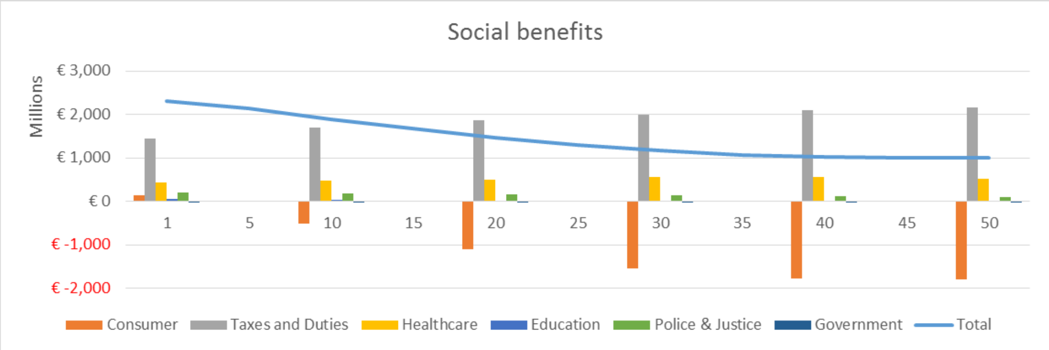


Figure 4.6 Social benefits of a 200% increase in excise duties (undiscounted figures)

The overall effects, as outlined by the blue line, are positive, indicating that this regulatory policy is associated with overall benefits to society in the domains considered in the model and compared to the reference scenario. Yearly (undiscounted) benefits are expected to be roughly between €1,000 and €2,300 million over the 50 years considered. The cumulative discounted value to society over a 50-year period amount to €42 billion (95%CI 37 – 47 billion), thus representing an overall benefit to society.

The composition of the underlying benefits for consumers is depicted in figure 4.7.

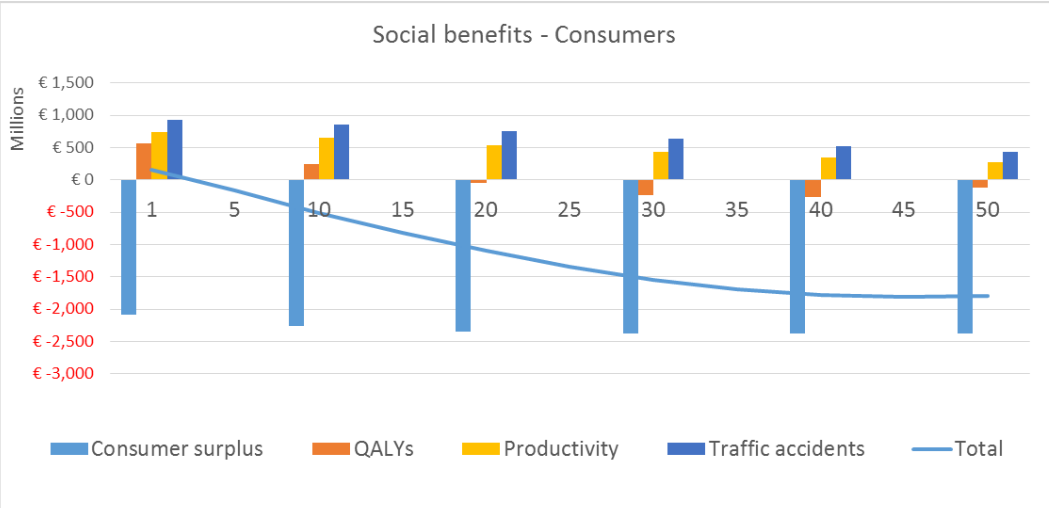
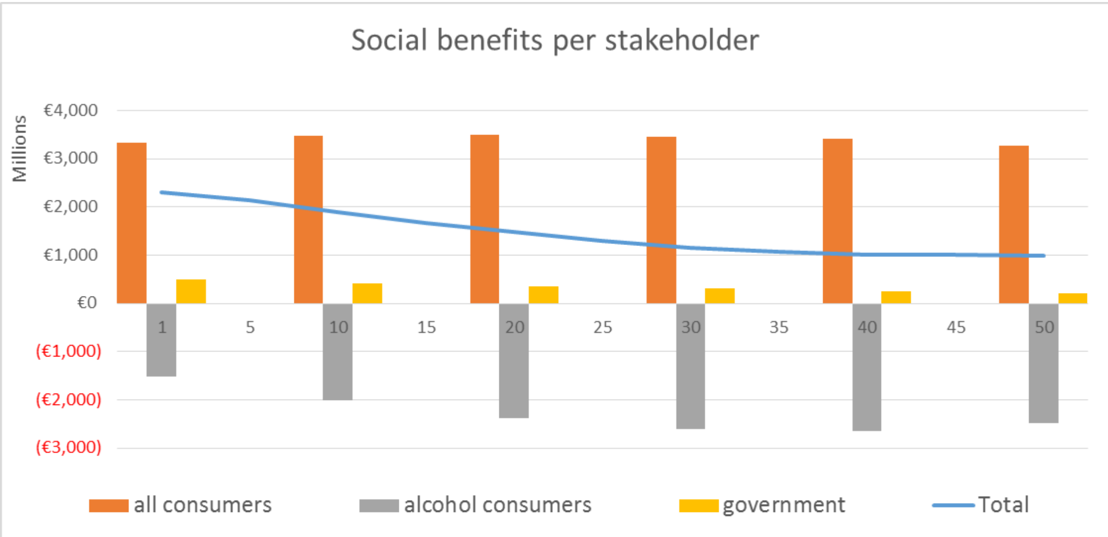


Figure 4.7 Social benefits of a 200% increase in excise duties for the consumer domain (undiscounted figures)

Within the consumer domain, benefits arise from a gain in QALYs and improved productivity, and from less traffic accidents. Over time, these benefits gradually become less prominent. As explained in section 1.3, RIVM-CDM modeling starts with a change in distribution over the 4 risk classes, but transitions between risk classes are unchanged. This results in a gradual return of drinkers to the higher drinking classes, with associated gradual declining effects in the domains of traffic accidents and productivity losses. The decline over time is especially clear for the gain in QALYs that is associated with alcohol-related diseases. A gradual shift to less alcohol consumption after introduction of the increased excise taxes is associated with a gradual increase in coronary heart disease over time as more people shift from higher drinking classes within RIVM-CDM to the group of moderate or no alcohol consumers. The implication of this shift is that more incidence of coronary heart disease will develop over time.

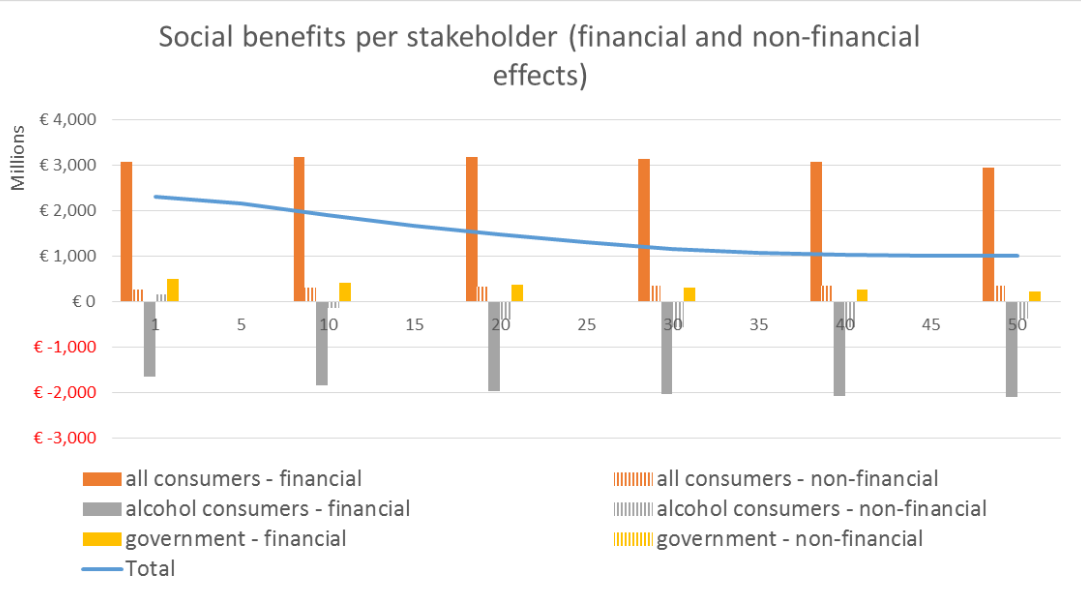
Split out into the three different stakeholders, this means that most of the benefits go to all consumers (including those who consume alcohol), while the alcohol consumer bears a net cost, see figure 4.8.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 4.8 Social benefits per stakeholder (after redistribution), scenario with a 200% increase in excise duties (undiscounted figures)

Figure 4.9 shows the specification of the social benefits per stakeholder into financial and non-financial effects. The government experiences only financial effects, while both all consumers and alcohol consumers experience mainly financial effects and relatively small non-financial effects.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 4.9 Social benefits per stakeholder (after redistribution), specified to financial and non-financial effects (undiscounted figures)

Finally, results of this policy measure can be expressed in terms of the development in the number of drinks consumed in the Netherlands over the 50 year period. Figure 4.10 shows the total number of drinks in the reference scenario and in the scenario simulating a 50% increase in excise duties over a 50 year period. In the first year, consumption is decreased by 34.0%, while in year 50, 20.1% of alcoholic drinks are consumed less, compared to the reference scenario. The average reduction over the 50 year period is 26.0%.

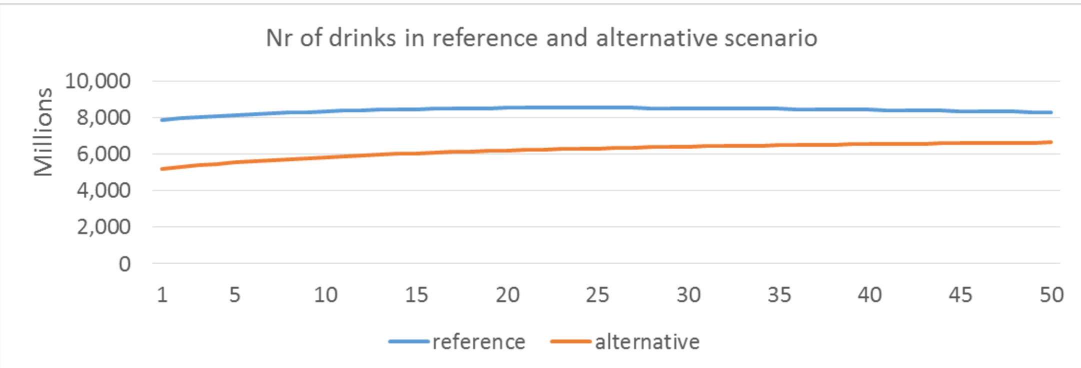


Figure 4.10 Total numbers of drinks in the reference scenario and in the alternative scenario of a 200% increase in excise duties

4.5 Sensitivity analyses

A number of sensitivity analyses were performed to investigate the impact of uncertainty in the input parameters (see Section 1.7 for general description of sensitivity analyses). Table 4.3 summarizes the results of these univariate sensitivity analyses. Detailed results can be found in Appendix 3A.

Table 4.3 Overview of sensitivity analyses for the scenarios that simulate an increase in alcohol excise taxes

	+50% excise taxes		**+200% excise taxes**	
	Cumulative discounted net monetary benefit (€ billion)	**Relative change compared to main analysis**	**Cumulative discounted net monetary benefit (€ billion)**	**Relative change compared to main analysis**
Main analysis	17	-	42	-
Discount rate 4%	14	-15%	36	-15%
Discount rate 1.5%	23	+34%	57	+34%
No productivity losses associated with alcohol	15	-13%	34	-19%
QALY valuation €100,000	19	+12%	44	+5%
Price elasticity -0.414	15	-14%	43	+2%
Price elasticity -0.625	20	+20%	37	-13%

From the results as shown in Table 4.3., it can be concluded that the results from the main analysis hold even when other choices would have been made. The upward change (maximum 34% change for lowering the discount rate), implying higher social benefits than estimated in the main analysis, is larger than the downward change. The downward change reaches a maximum of 19% in case no productivity losses linked to the consumption of alcohol were taken into account. One counterintuitive result is found, namely the downward change with a higher price elasticity for the reaction of consumers to the 200% increase of excise taxes. With a higher price elasticity, one would expect a stronger impact on changes in drinking behavior, resulting in higher societal benefits. However, even in the base-case analysis, with a price elasticity of -0,51, this relatively extreme scenario results in the entire RIVM-CDM class 4 moving to lower drinking classes, which in reality obviously will not occur easily, even after extreme price changes. We therefore consider this result as an artefact of the modelling choices that were made by us.

4.6 Conclusions

Yearly (undiscounted) benefits are expected to be roughly between €350 and €850 million over the 50 years considered (in the 50% increase of excise tax scenario) and between €1,000 and €2,300 million in the 200% increase of taxes scenario. The cumulative discounted net monetary benefit over a period of 50 years is € 17 billion (95%CI € 14-20 billion) in the 50% tax increase scenario and € 42 billion (95%CI 37 – 47 billion) in the 200% tax increase scenario, thus representing an overall benefit to society. These monetary benefits are unequally spread over the different stakeholders involved, with alcohol consumers being the largest net payers and all consumers, including those who drink alcohol being net benefactors in these policy scenarios. Sensitivity analyses showed that these results are fairly robust. Even in the case of a 19% lower social benefit, when productivity losses are not taken into account, social benefits are expected to be substantial over the considered time period of 50 years.

5 Social Cost-Benefit Analysis of reducing availability of alcohol

5.1 Evidence on the effectiveness of reducing the number of venues where alcohol is sold

Limited evidence is available on the effects of sales restrictions on alcohol consumption, e.g. by reducing the number of outlets where alcohol is sold or by reducing the hours of alcohol sales.

Some information is available with regard to the opposite situation, namely when previous restrictions on day and timing of alcohol sales were relieved. Hahn et al. and Middleton et al. describe in their reviews what happens after relieving the restrictions of day and time of alcohol sales (Hahn et al., 2010; Middleton et al., 2010). All involved studies show an increase in road accidents, mortality from road accidents etc. Furthermore, a review by Chikritzhs et al (Chikritzhs et al., 2007) concluded that “outlet density (independent of how this was measured exactly) had a positive association with all the harm indicators measured – that is, as the outlet density increases so too does harm”. However, the studies reviewed report converse proof of evidence as the review was not targeted at reporting effects after restrictions of day and time of alcohol sales have been implemented.

Reducing the number of outlets where alcohol is sold may affect travel time and costs to travel to an outlet, but also waiting time within an outlet. The best available evidence on effects of reducing the number of outlets is available from Purshouse et al., who show that outlet density reductions have been proven to reduce both consumption and harm (Purshouse et al., 2009). According to Purshouse et al., a reduction in outlet density of 10% leads to a -2.3% change in alcohol consumption, corresponding to an elasticity of 0,23 (Purshouse et al., 2009).

5.2 Policy scenarios to reduce the number of venues where alcohol is sold

We will implement this policy option as a reduction of outlet density of 10% and 25%, with corresponding reductions in alcohol consumption following the relationship as quantified by Purshouse et al., i.e. a reduction in outlet density of 10% leads to a -2.3% change in alcohol consumption. We do not specify how this decrease in outlet density will be realized in practice and whether this decrease in outlet density will be on a voluntary basis or enforced by legal or administrative actions. The effect of a 25% decrease in number of outlets is modelled as linear to the effect of a 10% decrease in number of outlets.

5.3 Assessing the costs of the policy measures

The costs of the policy measure to reduce the outlet density of alcohol-selling venues for alcoholic beverages are difficult to assess, as there is no empirical evidence on the costs of such a measure. These costs include the costs of policy makers (costs involved in preparation and implementation of new national or local laws related to the (number of) outlets with a permit to sell alcohol) and furthermore consist of the costs of enforcement of the new regulation. The time involved in enforcement may be substantial and add up to several person-years. In the absence of Dutch evidence on the costs of decreasing the outlet density, we use an international figure as given by Anderson and Chisholm (Anderson, 2009a). They state that decreasing outlet density is associated with annual costs of I$ 0.47 (2013€ 0.49) per capita, which amounts to € 8 million per year for the Netherlands. This figure has been incorporated in the calculations.

5.4 Main appraisal of costs and benefits

Social benefits of a 10% decrease in outlet density
The undiscounted social benefits of a 10% decrease in outlet density are depicted in figure 5.1. The overall effects, as outlined by the blue line, are positive over the entire time period considered. Yearly undiscounted benefits are expected to be between € 50 million and € 250 million over the 50 years considered.

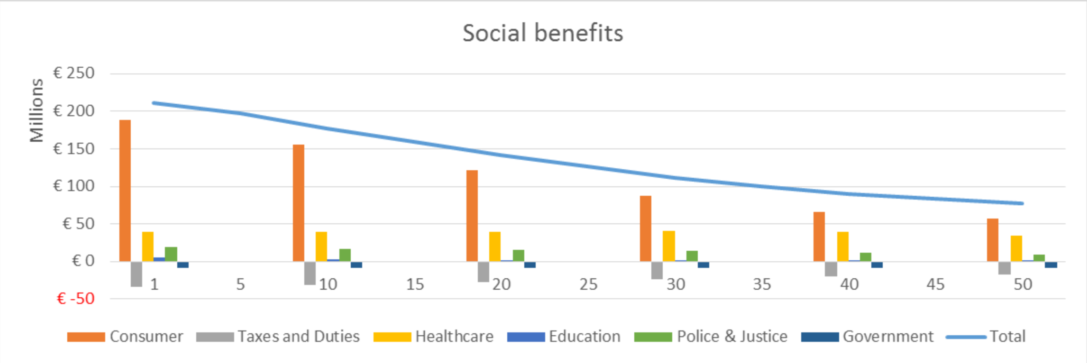


Figure 5.1 Social benefits of a 10% decrease in outlet density (undiscounted figures)

Most domains stay fairly constant over the years, with the negative benefits for the taxes and duties domain becoming somewhat less prominent over time. The effects in this domain are negative due to an expected decrease in sales. The change in social benefits over the years is mainly due to a decreasing benefit in the consumer domain. Figure 5.2 illustrates the costs and benefits of the consumer domain in more detail. However, as the general level of social benefits is much lower as seen in the excise taxes scenario in the previous Chapter, the absolute magnitude of these changes over time is modest. As in Chapter 4, we observe a gradual fade out of effects of the policy measure, as drinkers gradually return to their previous drinking patterns. As explained in Chapter 4, effects on QALYs change over time because more people develop coronary heart disease, with associated long-term effects for their quality of life and survival.

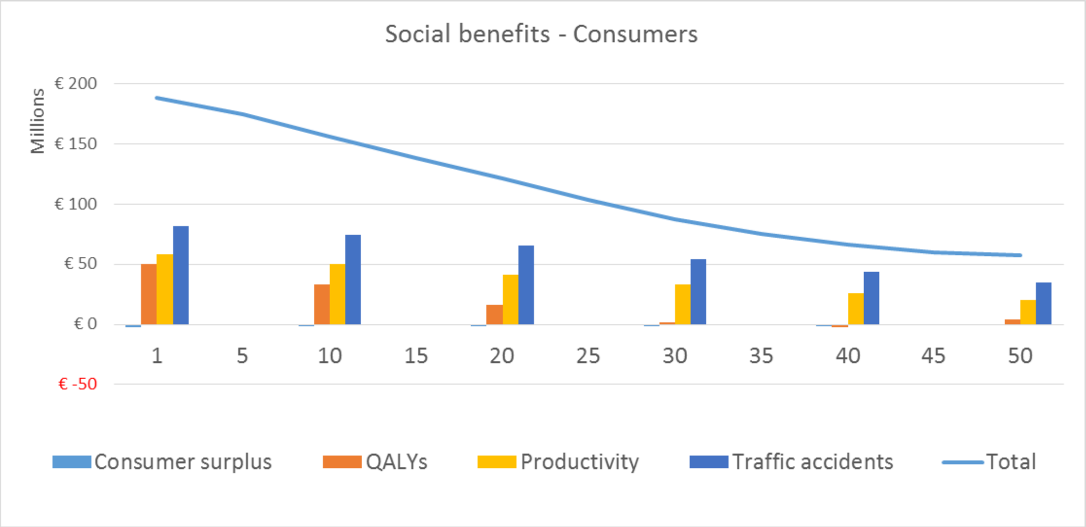


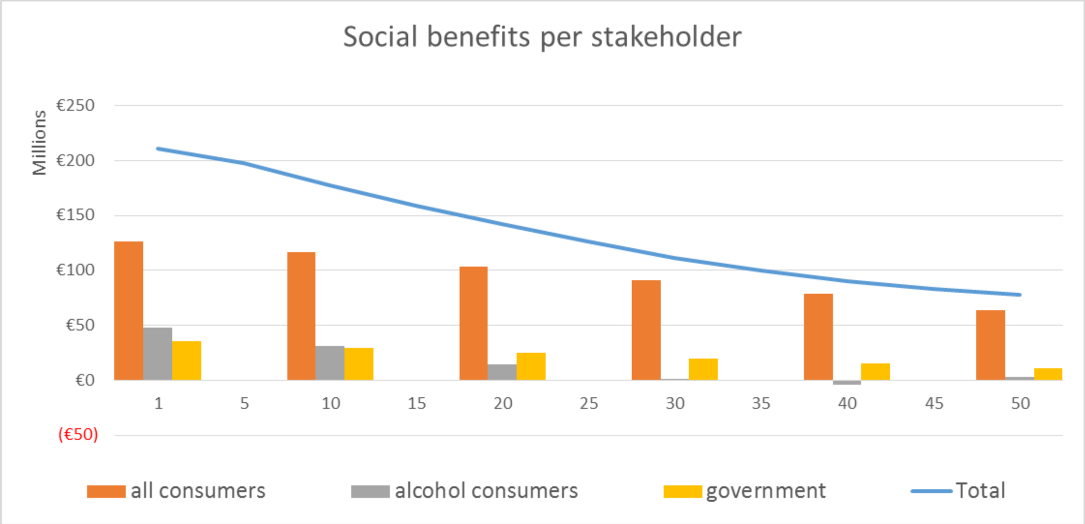
Figure 5.2 Social benefits of a 10% decrease in outlet density for the consumer domain (undiscounted figures)

The cumulative discounted value to society over a 50-year period amount to
€ 4 billion (95%CI: € 3 - € 5 billion), thus representing an expected benefit to society. Details regarding the development of cumulative and discounted social benefits are presented in table 5.2.The development of the different domains is similar to what was observed in the first policy scenario (increasing excise duties). The effects in the domains of education and police and justice are gradually decreasing over time. In this scenario, taxes and duties are gradually decreasing as well, as demand is returning to its pre-policy level. Compared to effects in the previous Chapter, effects in this domain are less prominent as there is only a demand effect, not a price effect.

Table 5.2 Cumulative (50 year), discounted social benefits of a 10% decrease in outlet density, in million €

	1	**10**	**20**	**30**	**50**
consumers	190	1.520	2.420	2.920	3.360
taxes and duties	-30	-280	-470	-600	-730
healthcare	40	350	610	810	1.060
education	10	40	50	60	70
police justice	20	160	270	340	410
government	-10	-70	-130	-170	-220
Total	210	1.720	2.760	3.370	3.950

The social benefits can also be attributed to the different stakeholders involved, distinguishing between alcohol consumers, all consumers (including those consuming alcohol) and the government (see Section 1.5 for information on redistribution of costs). Figure 5.3 depicts the development of the social benefits for each of these stakeholders.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

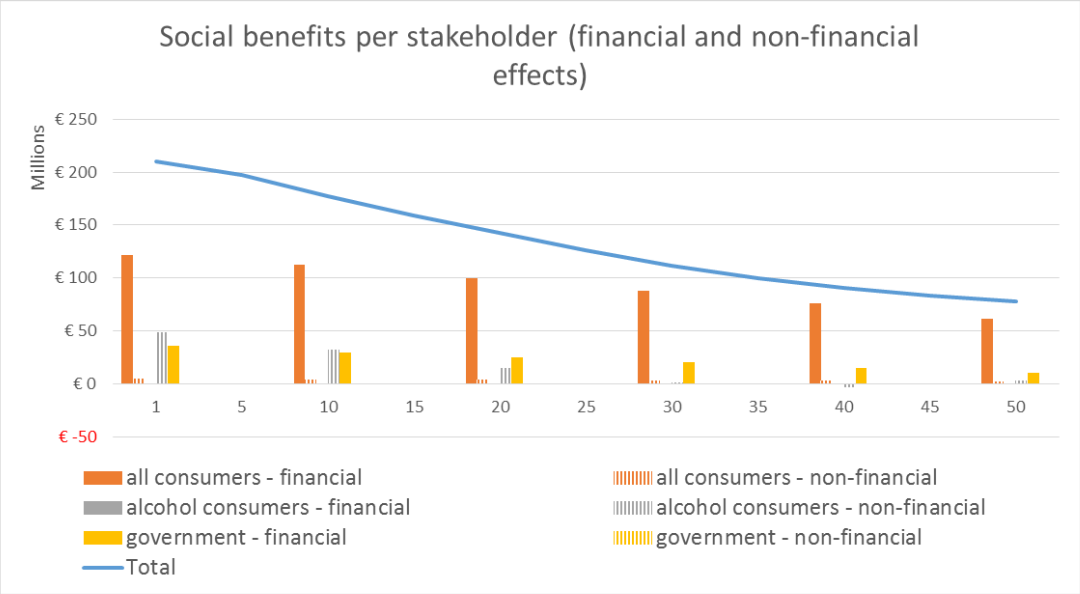
Figure 5.3 Social benefits per stakeholder (after redistribution) of a 10% decrease in outlet density (undiscounted figures)

As can be seen from figure 5.3, most of the benefits in this scenario are attributable to all consumers, as citizens in general will profit from reduced insurance premiums and higher wages because of improved productivity. Consumers of alcohol profit in terms of gain in QALYs. Despite government costs associated with the implementation of the policy measure, there is a net effect for the government domain from improvements in the domains of education and policy and justice.

Cumulated, discounted benefits per stakeholder are shown in table 5.3.

Table 5.3 Cumulative (50 year), discounted social benefits of a 10% decrease in outlet density, in million €

	1	**10**	**20**	**30**	**50**
all consumers	130	1.080	1.790	2.260	2.760
alcohol consumers	50	350	500	530	520
government	40	290	460	570	670
Total	210	1.720	2.760	3.370	3.950



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 5.4 Social benefits per stakeholder (after redistribution), specified into financial and non-financial effects (undiscounted figures)

Figure 5.4 shows the specification of the social benefits per stakeholder into financial and non-financial effects. The government experiences exclusively financial effects, while all consumers as well as alcohol consumers experience mainly financial effects and relatively small non-financial effects.

Figure 5.5 shows the total number of drinks in the reference scenario and in the scenario simulating a 10% decrease in outlet density. Compared to the reference scenario, consumption is decreased by 2.3% in the first year, and by 1.1% in year 50. The average reduction is 1,6%.

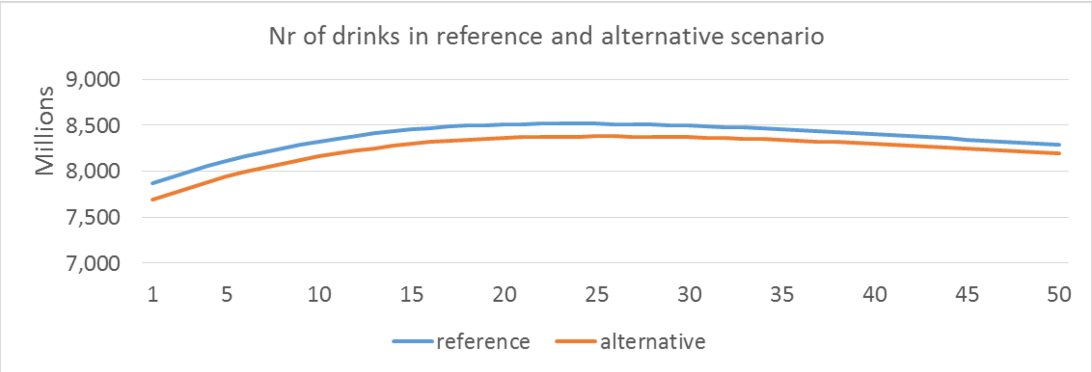


Figure 5.5 Total numbers of drinks in the reference scenario and in the alternative scenario of a 10% decrease in outlet density

Social benefits of a 25% decrease in outlet density
Social benefits in case of a 25% decrease in outlet density are similar to the scenario of 10% decrease in outlet density, but of a larger order of magnitude, see figure 5.6. The cumulative discounted value to society over a 50-year period amounts to € 10 billion (95%CI: € 8 - € 12 billion), thus representing an expected net benefit to society.

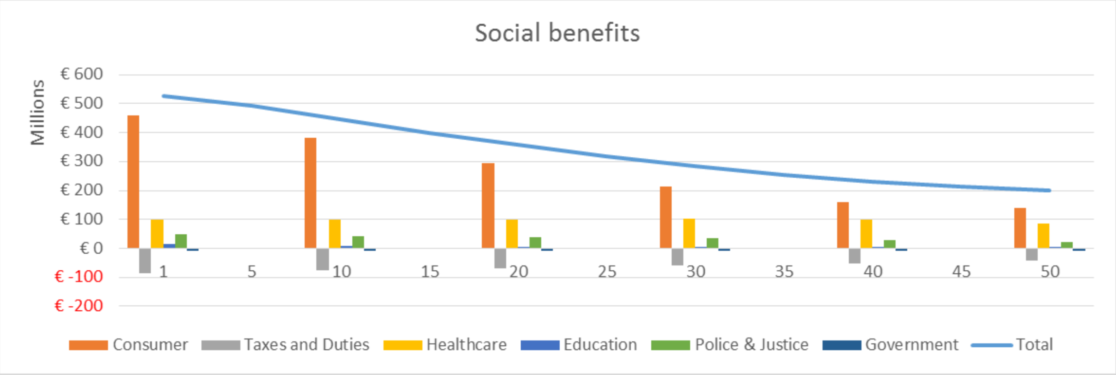


Figure 5.6 Social benefits of a 25% decrease in outlet density (undiscounted figures)

The development of benefits in the consumer domain is shown in more detail in figure 5.7. Patterns are similar to those observed in the 10% decrease in outlet density, although of a somewhat higher magnitude. As observed before, QALY effects fade out over time, following the increase in occurrence of coronary heart disease.

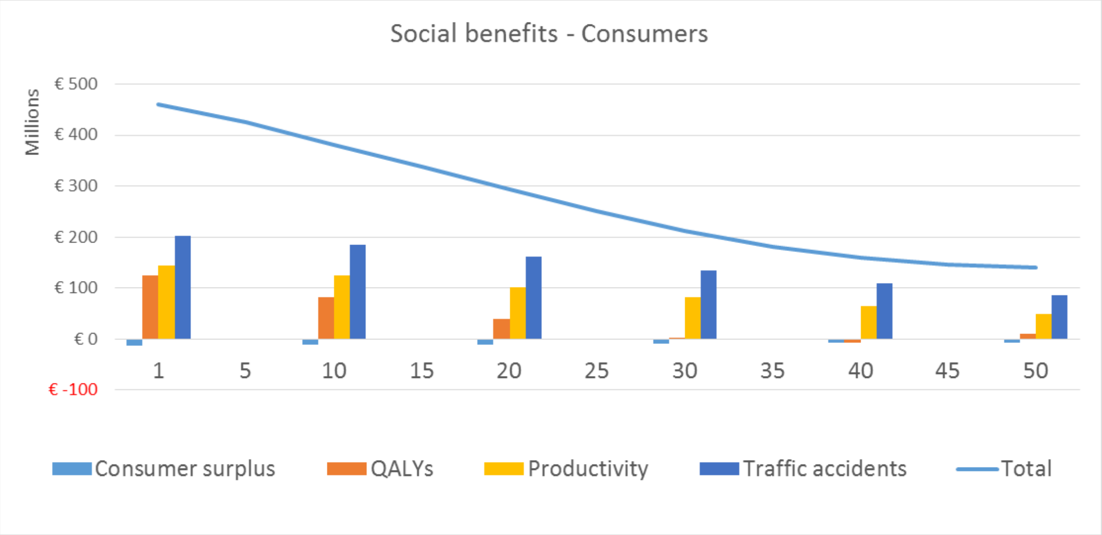
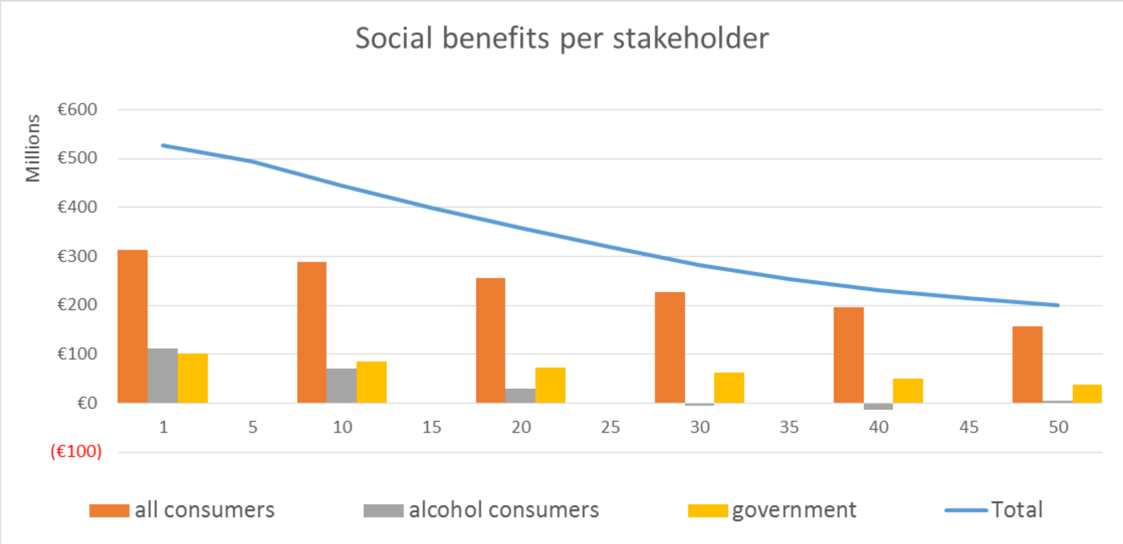


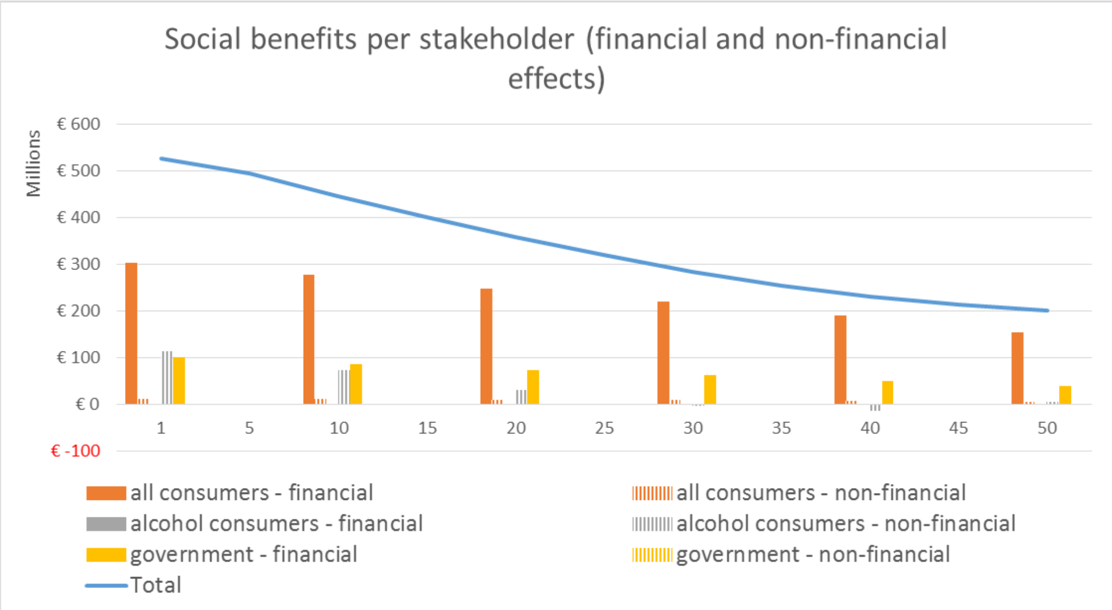
Figure 5.7 Social benefits of a 25% decrease in outlet density for the consumer domain (undiscounted figures)

The costs and benefits to the different stakeholders are also similar and larger in order of magnitude as compared to the scenario where outlet density decreases with 10%, see figure 5.8.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 5.8 Social benefits per stakeholder (after redistribution) of a 25% decrease in outlet density (undiscounted figures)



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 5.9 Social benefits per stakeholder (after redistribution), specified to financial and non-financial effects (undiscounted figures)

Figure 5.9 shows the specification into financial and non-financial effects of the social benefits per stakeholder. The government experiences exclusively financial effects, while all consumers as well as alcohol consumers experience mainly financial effects and relatively small non-financial effects.

Figure 5.10 shows the total number of drinks in the reference scenario and in the scenario simulating a 25% decrease in outlet density. In the first year, consumption is decreased by 5.8%, and in year 50 by 2.8% compared to the reference scenario. The average reduction is 4.1%.

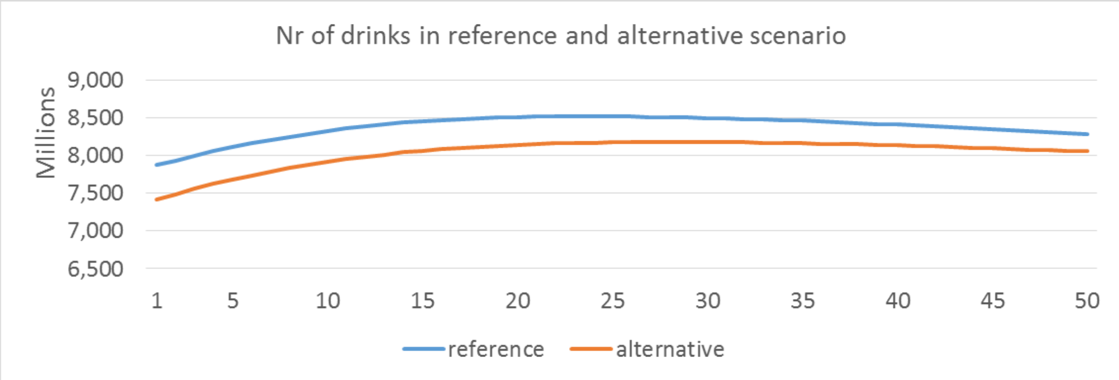


Figure 5.10 Total numbers of drinks in the reference scenario and in the alternative scenario of a 10% decrease in outlet density

5.5 Sensitivity analyses

A number of sensitivity analyses were performed to investigate the impact of uncertainty in the input parameters (see Section 1.7 for general description of sensitivity analyses and Appendix 3B for a detailed description). Results of the univariate sensitivity analyses are summarized in Table 5.4 below:

Table 5.4 Overview of sensitivity analyses for the scenarios that simulate a decrease in outlet density

	10% decrease in density		**25% decrease in density**	
	Cumulative discounted net monetary benefit (€ billion)	**Relative change compared to main analysis**	**Cumulative discounted net monetary benefit (€ billion)**	**Relative change compared to main analysis**
Main analysis	4	-	10	-
Discount rate 4%	3	-15%	8	-15%
Discount rate 1.5%	5	+33%	13	+33%
No productivity losses associated with alcohol	3	-16%	8	-16%
QALY valuation €100,000	5	+14%	11	+14%
Elasticity 0.03	0.3	-92%	1	-88%
Elasticity 0.37	6	+63%	16	+58%

Results of the sensitivity analyses show that the base-case analysis would render different outcomes if other choices had been made. Results appear very sensitive to the elasticity that was assumed in the base-case analysis. How consumers react in terms of consumption of units of alcohol is not sure, should their response be much lower (elasticity of 0.03), e.g. by buying higher quantities once they buy alcohol, then the social benefit of this policy scenario will turn out to be very modest, with 0.3-1 billion € over the 50 years considered. At the upside, results could also be more positive, with up to 63% more benefits in case of higher elasticities.

5.6 Conclusions

The cumulative discounted value to society of a 10% decrease in outlet density over a 50-year period amount to € 4 billion (range: € 3 - € 5 billion), thus representing an expected benefit to society. All stakeholders, i.e. consumers of alcohol, all consumers (including those who drink alcohol) and government profit from these social effects. In the 25% decrease in outline density scenario, these effects are stronger, with a cumulative discounted value to society over a 50-year period amounting to € 10 billion (range: € 8 - € 12 billion). However, results appear very sensitive to the elasticities that were assumed to reflect the consumers reaction in terms of consumption of alcohol following a decrease in outlet density. When consumers hardly change their alcohol drinking patterns, social benefits of a policy to reduce the number of outlets selling alcohol will be small to nil.

6 Social Cost-Benefit Analysis of a Ban on Advertisements

6.1 Evidence on the effectiveness of banning advertisements for alcohol

Commercial advertising

The industry spends large sums of money to advertise alcoholic beverages. In the year 2007, advertising of alcoholic drinks via television, radio, magazines and billboards amounted to € 84 million in the Netherlands, representing a € 5.15 per capita worth of advertising exposure (de Bruijn, 2013). The total expenditure on commercial marketing must be considerably larger when other types of marketing are also considered such as product placement in films and music videos, and advertising via social media. Alcohol advertising includes media advertising, sponsorships, internet advertising, product placements in movies and TV shows, direct mail, and price promotions.

Commercial advertising aims to increase market share (from competing brands) and increase market volume (attracting new drinkers and promoting increased drinking in people already drinking). The literature shows that commercial advertising is associated with increases in alcohol consumption, particularly in youth. From a review of thirteen longitudinal studies in a total of 38,000 young people, Anderson et al. (Anderson et al., 2009b) concluded that advertising is associated with an increased likelihood that non-drinking adolescents will start to drink alcohol and with increased drinking if they are already using alcohol.
Here we want to quantify the effect of advertising on nation-wide and longer-term alcohol consumption. It should be noted that this research field is riddled by methodological challenges, because effects of advertising cannot be established experimentally at population level. Therefore, no population-level trials on advertising were identified in a recent Cochrane review (Siegfried et al., 2014). Observational cross-sectional surveys are notoriously weak in assessing causal relationships and cannot contribute to the evidence-base for the impact of advertisement – or advertisement bans – on increasing or decreasing alcohol consumption. In our review of the evidence, we therefore have to rely on observational, population-based, longitudinal studies that quantify the effect of advertising while controlling for other contextual factors such as drinking culture, dispensable income and marketing variables such as pricing. We have a specific interest in econometric studies that quantify the relationship between advertising and consumption in elasticities, i.e. the per cent change in consumption as a result of a per cent change in advertising.

Impact of advertising on increased alcohol consumption

Saffer & Dave (Saffer & Dave, 2006) used data from two longitudinal studies: (1) Monitoring The Future (MTF) among 63,000 high-school students and (2) the National Longitudinal Survey of Youth 1997 (NLSY) of approximately 10,000 US adolescents. Their analysis of the

MTF data suggested an advertisement elasticity of 0.02 on annual participation in drinking, 0.02 for last month participation, and 0.01 for binge drinking. From the NLSY data, they obtained a slightly larger 0.03 for last month consumption and 0.04 for binge drinking. This suggests that a 1% increase in advertising is associated with about 0.01~0.04% increase of alcohol consumption among youth. These estimates might be underestimates, because econometrically more sophisticated models that were applied on the same NLSY data suggested an elasticity of 0.08 for past month drinking and 0.14 for binge drinking. Gallet (Gallet, 2007) conducted a meta-regression analysis of advertising elasticities on alcohol consumption. The 322 elasticities were derived from 132 econometric studies across 24 countries. In his study, it was shown that advertising elasticities for alcohol consumption average at 0.03 (i.e. 1% more advertising results in 0.03% more alcohol consumption). Saffer, Dave and Grossman (Saffer, 2012) based their econometric analysis on 8,000 young individuals and found advertising elasticities of 0.03 for moderate drinkers and 0.08 for the level of heavy drinking in individuals already drinking.

Impact of advertising bans on reduced alcohol consumption
The evidence for the effect of advertising on increased consumption cannot simply be reversed to conclude that a ban on advertising would reduce consumption in equal measure. Unfortunately, there is a paucity of studies that evaluate how a (partial or comprehensive) ban on commercial marketing would reduce consumption. On pooled time-series data over 26 years (1970-1995) across 20 countries (the Netherlands included), Saffer (Saffer, 2000; Saffer, 2002) estimated that an advertisement ban could decrease alcohol consumption by 5~8%. An econometric simulation study which was based on data from the NLSY (see above) suggested that a 28% reduction in advertising would reduce adolescent monthly alcohol consumption from 25% to 21~24%, and binge drinking from 12% to 8~11% (Saffer & Dave, 2006). In an earlier paper, Saffer and Dave (Saffer H., 2003) estimated from the NLSY data that a complete ban on commercial marketing of alcohol might reduce monthly alcohol use by about 24% and binge drinking by 42%.

In an OECD study with a focus on European countries, Sassi (Sassi, 2015) estimated that a 50% decrease in advertising would decrease consumption by 1.5% in moderate drinkers and by 4% in heavy drinkers, while a 25% decrease in advertising is expected to decrease alcohol demand by 0.8% overall. These estimates are derived from 322 estimates of advertising elasticities from Gallet (Gallet, 2007) and Saffer and Dave (2006), the two studies quoted above. The OECD estimates are more or less in line with those assumed by Chisholm (2004), namely a 2~4% reduction among hazardous drinkers following a comprehensive advertising ban. The OECD estimates are also in line (but smaller than) the 5% and 9% reductions in overall consumption that are used in the Sheffield Alcohol Policy Model (Meier, 2008).

In her cost-effectiveness analysis, Holm et al. (Holm, 2014b) used a 4% reduction after a comprehensive ban on all media channels. The

4% was adopted from Chisholm's 2~4% (Chisholm et al., 2004) range and the higher 4% was chosen because the drinking prevalence in Denmark is relatively high an ad ban is more likely to have a beneficial impact on people already drinking. Nelson and Young (Nelson, 2001) and Nelson (Nelson, 2003) questioned the causal relationship between advertising and (decreasing or increasing) consumption and warn that a ban on one type of media (e.g. television commercials) may cause substitution towards non-banned types of media (e.g. the social media). Also, the industry may restore to other ways to increase alcohol consumption, for example by increasing selling points or by offering more competitive prices for alcoholic beverages, which may lead to increased consumption when prices fall. Such counter-acting marketing strategies by the industry may offset the impact of a (partial) ban on advertising. Chisholm (Chisholm, 2004) and Anderson (Anderson & Baumberg, 2006), who recommend that a policy of marketing restrictions needs to be comprehensive and preferably accompanied by pricing policies, also follow this logic.

Conclusion

It has consistently been found that exposure to alcohol marketing increases the likelihood that young people start to drink alcohol and drink more alcohol when already drinking – especially among hazardous drinkers. In contrast, the evidence for the effectiveness of alcohol marketing bans is weak, primarily because only a few studies provided evidence and their estimates might have been inaccurate owing to unobserved or residual confounding. Moreover, a policy to restrict advertising may result in transferring promotional spending into alternative marketing channels, which may counter-act the intended impact of a ban. Such counter-acting strategies of the industry need to be considered when implementing a policy to restrict advertising. Still, the fact that alcohol advertising has an effect on consumption puts control on advertising high on the list of possible alcohol containment policies. Ideally, such policies require a firm evidence-base, which is now lacking in strength. In current context, and in line with Purshouse (Purshouse, 2009), we consider it very difficult to come up with a plausible estimate for the expected advertisement elasticity. Our scoping review suggests a reduction in consumption following a comprehensive ban in the range of 2~9% (see summary in Table 6.1).

Table 6.1 Reduction in alcohol consumption after a comprehensive advertisement ban

Reduction	Source
5-8%	Saffer, 2000; Saffer and Dave 2002
2-4%	Chisholm, 2004
5-9%	Meier 2008
4%	Holm 2010
3-8%*	Sassi 2015

* After linear extrapolation by the authors

We put the ‘average’ estimate tentatively at a 4% reduction in alcohol demand after a comprehensive ban on alcohol advertisements. Finally, it is important to note that our social cost-benefit analysis of advertisement restrictions now assumes the form of a speculative ‘what – if” analysis, which does merely indicate if such a policy might be worth the effort, provided that all key assumptions hold.

6.2 Policy scenario to ban advertisements

We assume a policy measure targeting at a complete ban of alcohol advertisements in line with the considerations set out in the previous paragraph. This would include no advertisements for alcohol containing products and no sponsoring activities for any type of alcohol. We tentatively assume that such a complete ban on advertisements (media ban) would decrease alcohol consumption on average with 4%.

6.3 Assessing the costs of the policy measures

The costs of the policy measure to implement a ban on advertisements for alcoholic beverages are difficult to assess, as there is no empirical evidence on the costs of such a measure. These costs include the costs of policy makers (i.e. time costs related to preparation and implementation of new national or local legislation to ban alcohol advertisements) and mainly consist of the costs of enforcement of the new regulation. The time involved in enforcement may be substantial and add up to several person-years. In the absence of Dutch evidence on the costs of introducing a total advertisements ban, we use an international figure as given by Anderson and Chisholm (Anderson, 2009a). They state that a total ban on advertisements is associated with annual costs of I$ 0.47 (2013€ 0.49) per capita, which amounts to € 8 million per year. This figure has been incorporated in the calculations.

6.4 Main appraisal of costs and benefits

The expected social benefits of a media ban are depicted in figure 6.1 (undiscounted effects). The scenario depicts the situation where consumption decreases with 4%, resulting in annual benefits to society varying between € 100 and € 400 million over the 50 years considered. The cumulative discounted value to society over a 50-year period amounts to € 7 billion.

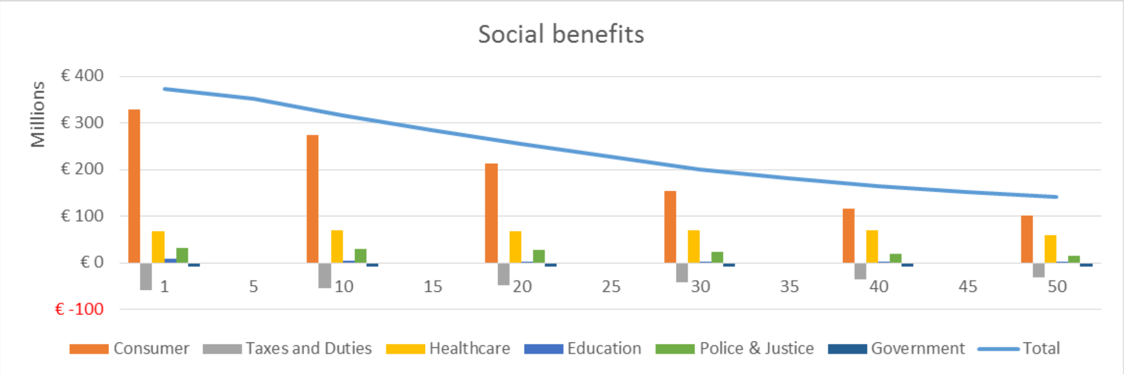


Figure 6.1 Social benefits of a media ban (undiscounted figures)

The main difference between this policy measure and the other policy measures, is that consumer surplus in this scenario is assumed to be unaffected. Exposure of consumers to different kinds of commercials results in an intrinsic change in the preferences of consumers, and thus a lower consumption of alcohol is not associated with a loss in consumer surplus (see section 1.4). The benefits to consumers are shown in more detail in figure 6.2.

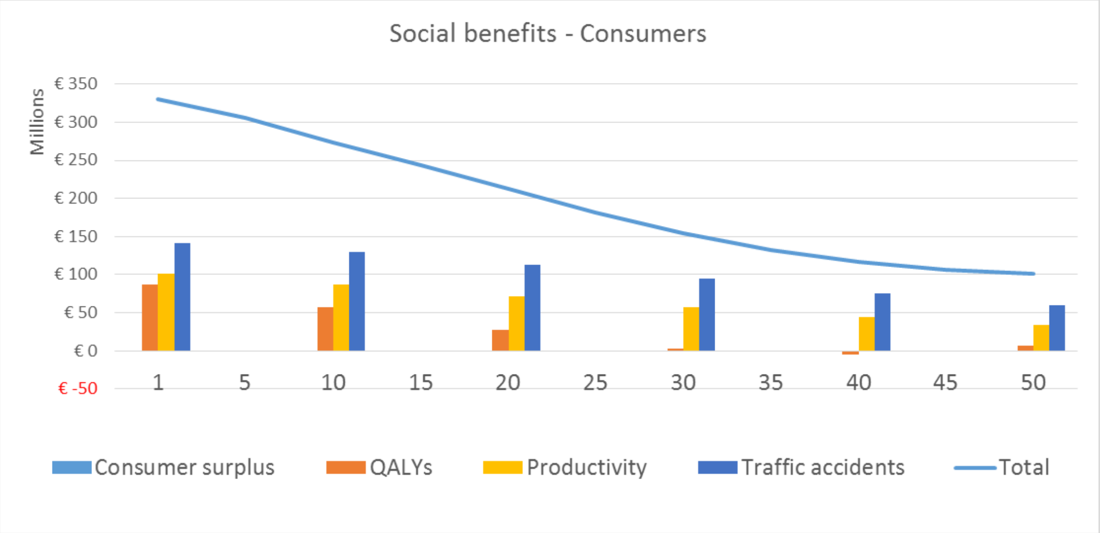


Figure 6.2 Social benefits for the consumer domain of a media ban (undiscounted figures)

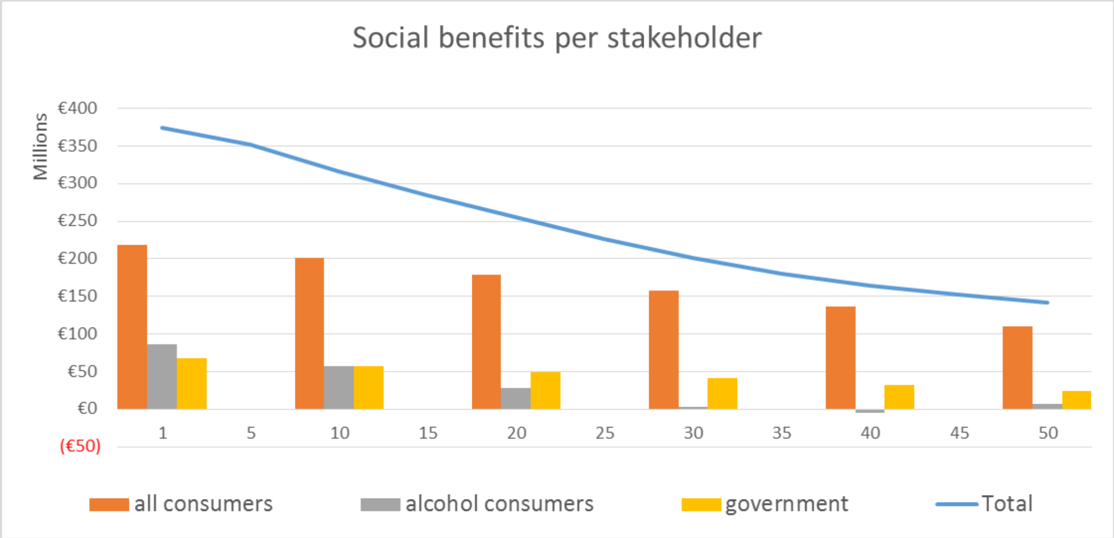
The same patterns as occurring after implementations of other policy measures (chapters 4 and 5) are observed: positive effects from improved productivity, gain in QALYs and less traffic accidents, with a decrease of these effects over time as a result of a gradual increase in consumption of alcohol over time.

Details regarding the development of cumulative, discounted social benefits over time are presented in table 6.1.

Table 6.1 Cumulative (50 year) and discounted social benefits of a media ban in million €

	1	**10**	**20**	**30**	**50**
consumers	330	2.670	4.250	5.130	5.900
taxes and duties	-60	-490	-820	-1.040	-1.270
healthcare	70	610	1.060	1.400	1.830
education	10	70	90	110	130
police justice	30	280	460	580	710
government	-10	-70	-130	-170	-220
Total	370	3.060	4.910	6.010	7.070

The social benefits can also be attributed to the different stakeholders involved, distinguishing between alcohol consumers, all consumers (including those consuming alcohol) and the government (see Section 1.5 for information on redistribution of costs). Figure 6.3 depicts the development of the social benefits for each of these stakeholders.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

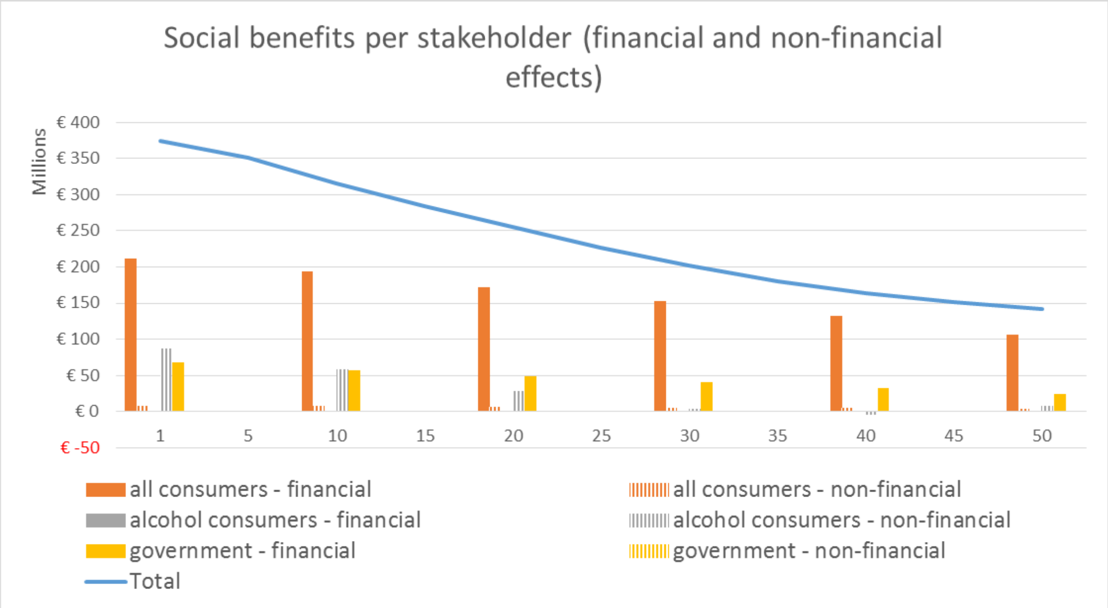
Figure 6.3 Social benefits of a media ban per stakeholder (undiscounted figures)

All stakeholders benefit from a media ban, with most benefits observed in all consumers. Cumulated, discounted benefits per stakeholder are shown in table 6.3.

Table 6.3 Cumulative, discounted social benefits of a media ban, in million €

	1	**10**	**20**	**30**	**50**
all consumers	220	1.870	3.100	3.920	4.780
alcohol consumers	90	640	910	980	970
government	70	560	900	1.110	1.320
Total	370	3.060	4.910	6.010	7.070

Figure 6.4 shows the specification into financial and non-financial effects of the social benefits per stakeholder. The government experiences exclusively financial effects, while all consumers as well as alcohol consumers experience mainly financial effects and relatively small non-financial effects.



* "alcohol consumers" and "all consumers" are mutually exclusive categories with regard to the types of costs and effects that are included, but not with regard to those who benefit, i.e. "all consumers" includes "alcohol consumers"

Figure 6.4 Social benefits per stakeholder (after redistribution), specified to financial and non-financial effects (undiscounted figures)

Figure 6.5 shows the total number of drinks in the reference scenario and in the scenario simulating a total media ban. In the first year, consumption is decreased by 4.0%, and in year 50 by 1.9% compared to the reference scenario. The average reduction is 2.8%.

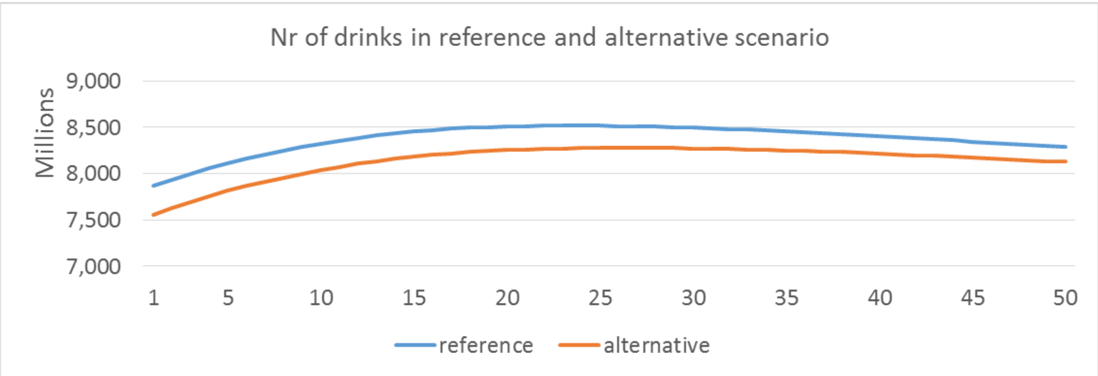


Figure 6.5 Total numbers of drinks in the reference scenario and in the alternative scenario of a media ban

6.5 Conclusions

The analyses presented above are highly explorative due to the uncertainty of the effect of a media ban on total alcohol consumption. Following a review of the available evidence, we used an estimate of a 4% reduction in alcohol consumption when a total media ban is implemented. As shown in Table 6.1, the range in available estimates is 2% to 9%. Our best guess, for the scenario that a media ban leads to a 4% reduction in alcohol consumption, shows that the yearly (undiscounted) benefits may fall roughly between € 100 and € 400 million over the 50 years considered, corresponding to a cumulative discounted value to society over a 50-year period of € 7 billion. Due to the exploratory nature of this analysis for the media ban policy measure, we have not performed a formal sensitivity analysis. When drinking is affected in a less pronounced way (i.e. 2% less consumption) or in a more profound way (i.e. 9% less consumption), the total social benefits will be either lower or higher than € 7 billion over the 50-year period.

7 Discussion of results

7.1 General discussion

This report discusses the social costs and benefits of alcohol in 2013 (cross-sectional analysis for 2013) and further describes the net monetary effects of different policies targeting at a reduction of alcohol consumption in the population over a period of 50 years. Current alcohol consumption is associated with annual costs of between € 2.3 and €2.9 billion annually. Out of three policy measures studied, an increase in excise duties is expected to counter these societal costs best.

Estimate of social costs and benefits of alcohol for the year 2013 (research question 1)

Alcohol consumption results in a substantial economic burden to society. Data as presented in Chapter 2 point at the fact that alcohol is associated with a net cost to society of about € 2.3 to € 2.9 billion in 2013. These costs are mainly incurred by consumers but were also visible in other domains, such as the domain of police and justice. The burden for consumers consists of costs associated with productivity losses, premature mortality and loss of quality of life from diseases associated with alcohol, and from traffic accidents. Alcohol, on the other hand, is associated with net benefits for the domain of taxes and duties and also represent a welfare gain for consumers, as many people experience pleasure from drinking alcohol as well, and for producers and retailers, who gain profits from production and distribution of alcohol. Besides the cost categories that were included in this estimate, several types of costs could not be expressed in monetary terms. These costs relate to impact of alcohol on productivity losses from voluntary work, to the life-time effects of school drop-out or leaving the school system at lower levels of education, from costs associated with fear for violence (in family members) and social insecurity (in society) and costs related to diseases that were not included in this analysis.

Discussion of results of estimate for 2013

The estimate of net societal costs attributable to alcohol of about € 2.3 to € 2.9 billion should be interpreted with caution, although we are confident that indeed alcohol represents a net cost to society. This finding is in line with findings of a review study carried out for the European Commission, that consistently found alcohol to be associated with both net financial and net non-financial costs (Anderson & Baumberg, 2006). To arrive at the estimate of € 2.3 to € 2.9 billion, we had to collect a large number of input data for all the different domains considered in the analysis. It was not always possible to use reliable, recent and Dutch figures. Hence, we often could only use estimates from other countries, had to combine several data sources to arrive at a parameter value, and sometimes we had to choose between conflicting sources of information. We have tried to be transparent about the choices that were made and, wherever available, to provide with minimum and maximum estimates. However, these minimum- and maximum estimates are in general in the same order of magnitude as the point estimate used, implying that the final confidence interval surrounding our point estimates of costs and effects is relatively small.

Alcohol is both negatively and positively related to diseases. In our estimate of costs of healthcare related to alcohol, we took account of both sides to arrive at an estimate of net heathcare costs of about € 400 to € 450 million in 2013. Large groups in the population consume modest amounts of alcohol, which at population level represent less cardiovascular disease, less diabetes mellitus and prevention of some types of stroke, compared to a situation without alcohol consumption (everyone in RIVM-CDM class 1). At the same time, alcohol is related to several types of cancers that occur frequently, to certain types of stroke, to addiction, to cognitive disorders and to Fetal Alcohol Syndrome Disorders (FASD). Evidence on especially the latter consequence is lacking at the moment, as different sources report prevalence figures ranging from 3/1000 to 60/1000. We have chosen to use a conservative figure here, with relatively limited occurrence and thus health care costs of FASD. In addition, estimates of health care costs associated with FASD are very different, ranging from annual costs of € 4,000 to € 60,000. However, in case we would have used the higher estimates both for prevalence and for costs, health care costs of FASD could easily sum up to several billions. In that case, our figure for health care cost would have been a larger net cost. As a result, our 2013 estimate of net social costs associated with alcohol would have been higher. More evidence on frequency and cost of FASD is needed to arrive at a better estimate of net health care costs associated with alcohol. Furthermore, many more diseases have been linked to alcohol than those incorporated in our estimate. Costs of these diseases have been included as a p.m.[+] in our estimate, implying that health care costs associated with alcohol are likely to be higher than our € 400 to € 2.3 450 million estimate. One further issue is that indirect costs within healthcare, the costs stemming from a longer life, e.g. because cancer cases are prevented when alcohol consumption is reduced, have not been consistently incorporated in our models. These costs are modeled within RIVM-CDM but not taken into account within the SCBA model. We therefore consider our estimate of healthcare costs of alcohol as an underestimate of the true costs.

Our approach to estimate healthcare costs associated with alcohol follows the evidence on associations between alcohol use and incidence and prevalence of diseases. At population level, positive benefits are expected from large groups in the population consuming only small amounts of alcohol. This translates into “savings” on health care costs, implying that prevalence of disease and associated health care costs would have been higher in a situation where the population would not consume any alcohol at all. Although we used the same evidence as used for the recent Health Council advise on nutrition, including alcohol (Gezondheidsraad, 2015b), our findings may seem contra-intuitive given the widely communicated advise of both the Health Council and the Netherlands Nutrition Center to preferably not drink any alcohol. However, following recent discussion on the strict character of this advice, the Health Council provided with the nuance that those who already consume alcohol should not drink more than one glass a day and those who do not at present should stay with this habit. Indeed, the positive health benefits (with regard to CHD and some strokes) in our analysis are found in the majority of the population who consume a small amount of alcohol, i.e. classes 1 and 2 of the RIVM-CDM.

One other estimate of social costs of alcohol is available and stems from 2000 (KPMG, 2001). This report arrives at an estimate of net social costs of € 2.5 billion (or an equivalent of € 3.2 billion in 2013 €). Hence, our estimate is somewhat lower. Looking at the details, it becomes clear that the KPMG study incorporated certain types of costs that we did not include in our estimates (i.e. costs of unemployment, disability and social security). These costs sum up to half of the total KPMG estimate and are therefore important components of their final estimate. We left out these costs following the reasoning that, at societal level and in a situation of structural unemployment, other workers would substitute alcohol related unemployment, disability and social security, resulting in equal societal costs. KPMG, on the other hand, did not include several types of costs in their estimate that we incorporated, i.e. consumer surplus, premature mortality, education, traffic accidents and quality of life losses. KPMG only included healthcare costs at a very crude level, through hospitalizations and primary care directly related to alcohol. Furthermore, no benefits of alcohol were included in their cost estimate at all. Overall, the two estimates are too different to compare directly.

SCBA of policy measures targeted at consumption of less alcohol (research question 2)

In response to the health and economic burden attributable to alcohol use, the Dutch Ministry of Health, Welfare and Sport (VWS) asked to explore the costs and effects of further strengthening alcohol policies by implementing and enforcing regulatory policies aimed at curbing alcohol use in the Netherlands. These potential policies are:

1. An increase in excise taxes of 50% and 200%.
2. A reduction of sales venues of alcohol with 10% and 25%.
3. A total ban on advertisements (media ban) for alcohol.

We explored social costs and benefits of these three policy measures, based on available evidence in the literature on the effectiveness of such policies. Putting a monetary value on each of the effects helps to make comparisons across interventions and to decide on whether or not to implement new policy measures, as those policy measures with net positive welfare effects are prime candidates for implementation, above those with net negative welfare effects.

None of the policy scenarios explored by us resulted in net negative welfare effects. An increase in excise taxes is expected to have a cumulative discounted net monetary benefit over a period of 50 years of € 17 billion (95%CI € 14-20 billion) in the 50% tax increase scenario and € 42 billion (95%CI 37 – 47 billion) in the 200% tax increase scenario, thus representing an overall benefit to society.

Yearly (undiscounted) benefits are expected to be roughly between €350 and €850 million in case of a 50% tax increase. In the 200% tax increase scenario, the annual benefits (undiscounted) are expected to be between €1,000 and €2,300 million. These monetary benefits are unequally spread over the different stakeholders involved, with consumers being largest net payers and all consumers (including those who consume alcohol) and the government sector (following higher tax incomes) being net benefactors. These results are fairly robust in sensitivity analyses with regards to discount rate, valuation of QALY losses, either or not including productivity losses and different price elasticities.

The policy measure aiming at a reduction of sales venues for alcohol overall has lower net social benefits than the excise tax policy measure, mainly because it is not associated with social benefits in terms of higher excise taxes. The cumulative discounted value to society of a 10% decrease in outlet density over a 50-year period amount to € 4 billion (95%CI: € 3 - € 5 billion), thus representing an expected benefit to society. In this scenario of less outlet density, all main groups of stakeholders (alcohol consumers, all consumers and government) profit from this policy measure. In the 25% decrease in outline density scenario, these effects are stronger, with a cumulative discounted value to society over a 50-year period amounting to €10 billion (95%CI: €8 - €12 billion).

The results of the third policy scenario, a total media ban for alcohol, are more explorative due to the uncertainty of the effect of a media ban on total alcohol consumption. Although most reports indicate a decrease in alcohol consumption following a media ban, some argue that consumption could increase as well, following a reaction of alcohol producers and retailers on such a media ban. Most estimates in the literature are in the range of a reduction of alcohol consumption between 2% and 9%. Our best guess, for the scenario that a media ban leads to a 4% reduction in alcohol consumption, shows that the yearly (undiscounted) benefits may fall roughly between € 0.1 and € 0.4 billion over the 50 years considered, corresponding to a cumulative discounted value to society over a 50-year period of € 7 billion.

Results of the three different policy scenarios are uniform in a sense that, after redistribution of effects and comparing the three main groups of stakeholders (alcohol consumers, all consumers and Government), all consumers profit most from the policy measures. Depending on the policy measure, alcohol consumers themselves pay for the cost (in case of increased excise taxes) or profit as well. Of course, as a large part of our society consumes alcohol, there is a large overlap between the two stakeholder groups alcohol consumers and all consumers. This implies that even if alcohol consumers pay for the cost of a policy measure, indirect benefits may be experienced as well. The government sector, despite having to pay for the cost of implementing the measures, gains net benefits from all three policy measures. Despite less traffic accidents, a gain in QALYs and improved productivity, consumers of alcohol experience net costs in the increase of excise taxes scenario, resulting from a decrease of consumer surplus that does not outweigh the benefits. In all policy scenarios, effects on other domains of society, i.e. education and police and justice, are relatively stable over time.

Strengths and limitations of this analysis

This study has several strengths. First, our study is a comprehensive study. We aimed at incorporating all domains in society that are affected by alcohol, which turned into a large number of effects that needed to be quantified. Alcohol is affecting many domains in society and our analysis clearly shows which domains bear the benefits and take the losses. This is the first SCBA that depicts the costs and benefits of three potentially effective policy measures for a large number of domains in Dutch society. We look into a larger level of detail at health care costs and zoom in on the different types of costs and benefits borne by consumers. Second, the study was performed by a consortium of four research institutes, bundling knowledge in different fields necessary to perform this complex study on the complex subject of social costs and benefits of alcohol use.

Although we performed the calculations to the best of our knowledge and with the best available data, the figures presented in the report need to be treated with caution. Underlying data are not uniform, derived from various sources and range from very detailed to very crude. The modelling exercise is associated with a number of limitations. While the RIVM-CDM provides detailed estimates of the development of the age- and gender-specific prevalence in risk classes, it is not exactly clear how the different risk classes are linked to the costs and benefits in the different domains. Therefore, we often made the conservative assumption that the costs and benefits in different sectors were only linked to the highest drinking classes. This assumption assures that the impact of alcohol policies is more likely to be underestimated than to be overestimated. This assumption was made for the social effects that can potentially accrue as a result of alcohol consumption, such as violence, traffic accidents, healthcare costs, etc. For the categories directly related to the number of glasses of alcohol consumed, such as consumer surplus and taxes and duties, such an assumption did not have to be made and the effects in these areas were directly related to total consumption. However, we assumed an ‘average’ effect of consumption on these domains, regardless of the underlying distribution of beer, wine and spirits. This is a limitation of the model, because policies resulting in a relatively large decrease in beer consumption can be expected to have a different impact on, for example, taxes and duties than policies resulting in a relatively large decrease in the consumption of spirits. The evidence as well as the structure of the RIVM-CDM did not allow us, however, to differentiate between the consumption of beer, wine and spirits.

We modelled the separate effects of three different policy measures, all assumed to be implemented in isolation. However, it is likely that implementation of different measures at the same time adds to the effects of individual measures. Anderson and Chisholm show that programs combining several policy measures are at least as cost-effective as individual policy measures (Anderson, 2009). This finding was confirmed in a recent OECD report (Sassi, 2015). A recent report on SCBA of tobacco control measures indeed also showed that a combination of different policy measures was expected to have highest effectiveness and result in highest net welfare gains (de Kinderen et al., 2016). As we had no information on the combined effect of increasing excises taxes, lowering the number of outlets and implementing a media ban, we could not model such a combined strategy. However, the total welfare effect of a combination of these measures is expected to be higher than the welfare effect of individual measures.

Another limitation of the present study relates to the translation of a change in prevalence in a risk class to the corresponding change in costs and benefits of the different domains. The correlations as estimated by Wagenaar et al. (2010) were used to moderate these relations, such that a certain percentage decrease in alcohol consumption resulted in a lower percentage decrease in costs and benefits. The resulting decrease in costs and benefits should intuitively indeed be lower than the decrease in alcohol consumption, as costs and benefits are not solely and directly caused by alcohol consumption (e.g. crime is affected by alcohol consumption but no alcohol consumption will not completely remove social costs of crime). The correlation as estimated by Wagenaar et al. (2010) was predominantly based on studies conducted in the United States. Preferably, correlations based on Dutch studies should be used, but these were not available.

We were unable to model the policy scenarios via a modification of the transition probabilities between the classes of alcohol consumption. That method would have been preferable compared to changing the initial prevalence of the alcohol consumption classes, as done now, because it would result in new stable prevalence of alcohol consumption classes rather than prevalence that slowly returns to the initial prevalence of the reference scenario. Changing the transition probabilities reflects a change in behaviour of the persons being modelled, in this case the total Dutch population. However, data needed to calculate modifications of the transition probabilities were unavailable. At the same time, the second best method to model the policy scenarios, i.e. changing the initial prevalence of the alcohol consumption classes, happens to fit better to the policies of increased excise taxes. In these scenarios, one would expect a relatively large effect in alcohol consumption patterns immediately after the implementation of the policy, and possibly a gradual return to the original level of alcohol consumption when consumers get accustomed to the new price of alcoholic drinks.

The available literature on alcohol consumption uses different definitions related to alcohol consumption. The lexicon used by WHO is different from the categories used in the DSM. Moreover, both categorizations cannot easily be translated to each other, thus needing additional assumptions. As we needed to combine evidence using different categorizations, we needed to make assumptions, adding to the uncertainty of our outcomes.

Due to an insufficient evidence-base, not every effect that was deemed relevant could be quantified. Example of these items are impact of alcohol consumption for non-consumers of alcohol, long term effects of school drop-out on employability and career, fines related to alcohol misbehavior and effects of alcohol consumption on a number of diseases associated with alcohol. Most of these cost items that could not be quantified further add to the annual societal costs of alcohol and, likewise, would increase our estimates of social benefits of policy measures. However, some other types of cost that were left out of the analysis could possibly decrease our estimates of social benefits of policy measures. Examples of such costs are the impact of reduced alcohol consumption on agricultural production (grapes, hops), lost revenues for sub-suppliers, e.g. of brewery equipment, and lost revenues for retailers from products that may be sold together with alcohol, such as savory snacks. Finally, a reduced alcohol consumption level, i.e. following an increase of excise taxes, might probably lead to more home breweries, purchases of alcohol in neighboring countries and smuggling. Such substitution effects could not be taken into account in our analysis. As the Netherlands is not an isolated country and neighboring countries are within easy reach for many inhabitants, some consumers will decide to travel to other countries with the purpose of buying alcohol. Policies to reduce alcohol consumption may be more viable if implemented on a cross-European level, or at least in agreement with neighboring countries.

Some methodological limitation should be mentioned as well. First, transition probabilities as used in the RIVM-CDM only depend on age and sex and are not influenced by either one of the policy options. However, it is plausible that transition between drinking classes would be influenced by policy options. Especially adolescents may change their drinking behavior and likewise their transition to higher intake classes when alcohol becomes more expensive. This could have lifetime positive effects on alcohol consumption, but could not be modelled in the present analysis. Furthermore, all alcohol policy scenarios are implemented in the RIVM-CDM as a change in the initial prevalence of the alcohol consumption classes with every drinking person experiencing a similar relative reduction in the amount of drinks consumed. This implies that, if each person was to drink 10% less alcohol, those in class 4 (average consumption for males and females respectively) would consume about 0.10*(8.18+5.64)/2=0.7 drinks per day less and those in class 2 only about 0.10*(1.59+1.21)/2=0.14 drinks per day less (Table 1.3). Consequently, more people in class 4 and fewer people in class 2 shift to a class of lower alcohol consumption. Because class 4 is the most detrimental class with respect to health, and class 2 is the most beneficial, a relative large part of class 4 drinkers shift to lower classes as a consequence of policy measures. Additionally, costs and benefits that we related directly to the prevalence of class 4, such as related to traffic accidents, might be larger. In reality, it will be impossible to realize such substantial changes in the core of the group of heavy drinkers, as this class likely contains at least partially of addicted consumers, who will not easily switch to lower consumption patterns. To realize such changes, more effort than simply implementing country-wide policy measures will be needed.

However, our analysis shows that it pays out to realize a shift to lower drinking patterns in these high-level consumers.

The dose-effect relations of alcohol consumption and total mortality were taken from a recent study by Ferrari (Ferrari, 2014) that was also used by the Health Council in a background report on evidence of associations between alcohol and different health effects. Although these effects are very small and only apply to males, a recent publication of Stockwell et al. (2016) disputes previous meta-analyses that showed a J-shaped relationship between alcohol consumption and all-cause mortality, with reduced risks for low-volume drinkers (Stockwell et al., 2016). Stockwell et al. argue that previous studies were contaminated by not splitting non-consumers of alcohol in those who never consumed alcohol during their lives, and those who previously consumed alcohol. Compared with life-time abstainers, no net mortality benefit of low-volume alcohol use was present in this study. Having used evidence from the Stockwell study would have made our estimates of QALYs gained from the policy measures somewhat less favourable, resulting in a possible overestimation of monetary benefits of policy mesures.

Although uncertainty analysis is seen as an important part of the SCBA method, our approach to uncertainty analysis was somewhat restricted by the fact that for many costs and effects, only one (fixed) estimate was available, without further evidence on a confidence interval surrounding this fixed effect or data on distribution of costs and effects. Fixed data on effects and costs, e.g. annual excise taxes, were linearly coupled to prevalence within RIVM-CDM drinking classes, although this may be different in reality. This source of uncertainty was not incorporated in our analyses.

7.2 Research agenda

This SCBA is based on best available data on costs and effects of alcohol consumption in the relevant domains of society. However, sometimes data was of moderate quality or was derived from evidence from alcohol consumption in a foreign country. Therefore, assumptions for the Dutch situation had to be made as described in this report. This study highlights the need to fill the gap of scarce data on social effects of alcohol consumption in the following fields:

- The effectiveness of increasing excise taxes on alcohol consumption expressed in price elasticities is well known. The impact of advertisement bans and reduction of outlet density however, is less well researched. One way of performing research to underpin any future policy intervention in this field would be to start with small-sized pilot studies. Furthermore, a systematic review of the literature on effects of a total media ban on alcohol consumption is needed.
- Future research should increase our understanding of how a change in the level of alcohol consumption corresponds with changes in the costs and benefits in the different domains. The available evidence-base offers some guidance in the causal relationship between alcohol consumption and the change in costs and benefits in different domains. Recent evidence based

on a Dutch setting is lacking for the relationship between alcohol consumption and alcohol-related social problems like crime, violence, traffic accidents and domestic violence. In general, there are insufficient data available about the alcohol-related proportion of damage in the different domains. The same applies to the related costs. Better evidence could be generated by improving current registrations with regard to the presence of alcohol once problems are occurring.

- Little is known about the decay of the effects of regulatory policies. Ideally, future research should monitor the effect of regulatory policies over time. Will initial effects sustain over time or is there a gradual fade-out after time? This is an important assumption in an SCBA but researchers have paid little attention to the long-term effects of policies. More knowledge with respect to perseverance of effects over time would greatly help in supporting decision-making, as it allows decision-makers to base their decisions on a better understanding of the benefits of regulatory policies.
- There are various trends in current society that can have a profound impact on alcohol consumption. These trends point in different directions, where on the one hand there is a trend towards less alcohol consumption in youth and in immigrants, while on the other hand there is an increase in alcohol consumption in the older population. As it is unclear which of these trends will dominate, no trend was modelled in the current SCBA, but future research aimed at better understanding such trends could help our understanding of the future impacts of regulatory policies.
- Little is known about the specific impact of alcohol consumption on others in society (non-consumers of alcohol), such as victims, families, neighbors, etc. Future research could help to quantify the impact that alcohol consumption has on others in society, such that the externalities of alcohol consumption can be taken into account to a greater extent when deciding upon regulatory policies. Specific attention could be given to measuring effects on wellbeing of relevant others, such as family members of persons consuming large quantities of alcohol or addicted to alcohol.
- Future research is warranted with respect to the causal effect of alcohol consumption on labor productivity, to improve our understanding of the economic effects of regulatory policies aimed at decreasing alcohol consumption through increases in productivity.
- An SCBA in the field of alcohol consumption is complicated by the use of different classification systems for the use of alcohol. For example, the classification used by WHO is different from the classification used by DSM, in a way in which these different classifications are not easily linked to each other. The result is that the available evidence-base cannot be combined in a straightforward manner. Future research should increase our understanding of the interconnectedness between the different prevailing classification systems.

- This SCBA provides with estimates of costs and benefits of regulatory policies aiming at lower alcohol intake in the population. The scope of this SCBA was not to provide guidance on the implementation and acceptability of the alcohol policy measures in the population and among stakeholders. For that reason, future research on these topics is necessary.

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Abbreviations

AWLD	Annual number of work-days lost
DSM	Diagnostic and Statistical Manual of Mental Disorders
fte	fulltime-equivalent
PM	Pro Memori
QALY	Quality Adjusted Life Year
RIVM-CDM	RIVM Chronic Disease Model
SCBA	social cost-benefit analysis
SEO	Stichting Economische Onderzoek
VOSL	Value of a Statistical Life
WHO	World Health Organization
WTP	Willingness to Pay

References

Anderson DM, Crost B, Rees DI. Wet laws, drinking establishments, and crime. : Princeton, Center for Health and Wellbeing, 2014.

Anderson P, Baumberg B. Alcohol in Europe A public health perspective. Luxemburg: Institute of Alcohol Studies, 2006.

Anderson P, Chisholm D, Fuhr DC. Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. Lancet, 2009a;373:2234-46.

Anderson P, de Bruijn A, Angus K, Gordon R, Hastings G. Impact of alcohol advertising and media exposure on adolescent alcohol use: a systematic review of longitudinal studies. Alcohol Alcohol, 2009b;44:229-43.

Anderson P, Moller L, Galea G. Alcohol in the European Union Consumption, harm and policy approaches. Copenhagen: WHO Regional Office for Europe, 2012.

Baal PHM, Feenstra TL, Hoogenveen RT, Wit GA. Cost-Efectiveness analysis with the RIVM Chronic Disease Model. 260706002. Bilthoven, Netherlands: Dutch National Institute for Public Health and the Environment, 2005.

Bermingham SL. The appropriate use of neuroimaging in the diagnostic work-up of dementia: an economic literature review and cost-effectiveness analysis. Ontario health technology assessment series, 2014;14:1-67.

Boonzajer Flaes S. Data addiction care alcohol (personal communication). Mental Health Care Netherlands; 2015.

Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. J Health Econ, 2002;21:271-92.

CBS. Aantal verkeersdoden gelijk gebleven in 2014. 2015 [cited 2016; Available from: http://www.cbs.nl/nl-NL/menu/themas/gezondheid-welzijn/publicaties/artikelen/archief/2015/aantal-verkeersdoden-gelijk-gebleven-in-2014.htm

CBS. Gezonde levensverwachting; vanaf 1981 2016a [cited 2016; Available from: http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=71950NED&D1=0-2,5,7&D2=a&D3=a&D4=a&D5=l&HD=121001-1214&HDR=G4,G3,T&STB=G1,G2

CBS. Werkzame beroepsbevolking; positie in de werkkring. 2016b [cited; Available from: http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=82646ned&D1=0&D2=0&D3=0&D4=0&D5=54&HDR=T,G4&STB=G1,G2,G3&VW=T

CDC. Fetal Alcohol Syndrome Among Children Aged 7-9 Years – Arizona, Colorado, and New York, 2010. MMWR Morb Mortal Wkly Rep, 2015;64:54-7.

Chikritzhs T, Catalonao P, Pascal R. Predicting alcohol-related harms from licensed outlet density: a feasibility study. : National Drug Law Enforcement Research Fund, 2007.

Chisholm D, Rehm J, Van Ommeren M, Monteiro M. Reducing the global burden of hazardous alcohol use: a comparative cost-effectiveness analysis. J stud. alcohol., 2004;65:782-93.

Corman., Hope., Mocan. N. Alcohol consumption, deterrence and crime in new york city. Journal of Labor Research, 2015;36.2:103-28.

de Bruijn A. Report on the volume of youth exposure to alcohol advertisement in European countries.: AMPHORA, 2013.

de Graaf R, Ten Have M, van Dorsselaer S. The Netherlands Mental Health Survey and Incidence Study-2 (NEMESIS-2): design and methods. International journal of methods in psychiatric research, 2010;19:125-41.

de Graaf R, Tuithof M, Van Dorsselaer S. Verzuim door psychische en somatische aandoeningen: Resultaten van Nemesis-2. Utrecht: Trimbos Instituut, 2011.

de Kinderen RJA, Wijnen BFM, Evers SMAA, Hiligsmann M, Paulus AGT, de Wit GA, van Gils PF, Over EAB, Suijkerbuijk AWM, Smit F. Social cost-benefit analysis of tobacco control policies in the Netherlands. Maastricht: Faculty of Health, Medicine and Life Sciences. CAPHRI, School for Public Health and Primary Care, 2016.

de Looze M, van Dorsselaer S, de Roos S, Verdurmen J, Stevens G, Gommans R, van Bon-Martens M, Ter Bogt T, Vollebergh W. Gezondheid, welzijn en opvoeding van jongeren in Nederland HBSC 2013. Utrecht: Universiteit Utrecht, 2014.

de Wit M, Methorst R. Kosten verkeersongevallen in Nederland Ontwikkelingen 2003 - 2009. Delft: Rijkswaterstaat Dienst Verkeer en Scheepvaart, 2012.

Detailhandel.info. Slijterijen. 2016 [cited; Available from: http://detailhandel.info/index.cfm/branches/foodspeciaalzaken/slijterijen/

Dijsselbloem JRVA. Waardering van risico's bij publieke inversteringsprojecten. In: Finance Mo, editor. The Hague: Tweede Kamer er Staten-Generaal (House of Representives); 2015.

Doran CM, Byrnes JM, Cobiac LJ, Vandenberg B, Vos T. Estimated impacts of alternative Australian alcohol taxation structures on consumption, public health and government revenues. Med J Aust, 2013;199:619-22.

Drost RMWA, Paulus ATG, Ruwaard D, Evers SMAA. Handleiding intersectorale kosten en baten van (preventieve) interventies Classificatie, identificatie en kostprijzen. Maastricht: Faculty of Health, Medicine and Life Sciences, 2014.

Feenstra TL, Hamberg-van Reenen HH, Hoogenveen RT, Rutten-van Molken MP. Cost-effectiveness of face-to-face smoking cessation interventions: a dynamic modeling study. Value Health, 2005;8:178-90.

Ferrari P, Licaj I, Muller DC, Kragh Andersen P, Johansson M, Boeing H, Weiderpass E, Dossus L, Dartois L, Fagherazzi G, Bradbury KE, Khaw KT, Wareham N, Duell EJ, Barricarte A, Molina-Montes E, Sanchez CN, Arriola L, Wallstrom P, Tjonneland A, Olsen A, Trichopoulou A, Benetou V, Trichopoulos D, Tumino R, Agnoli C, Sacerdote C, Palli D, Li K, Kaaks R, Peeters P, Beulens JW, Nunes L, Gunter M, Norat T, Overvad K, Brennan

P, Riboli E, Romieu I. Lifetime alcohol use and overall and cause-specific mortality in the European Prospective Investigation into Cancer and nutrition (EPIC) study. BMJ Open, 2014;4:e005245.
Gallet GA. The demand for alcohol: a meta-analysis of elasticities. . The Australian Journal of Agriculture and Resource Economics, 2007;51:121-35.
Gezondheidsraad. Alcohol-Achtergronddocument bij bij Richtlijnen goede voeding 2015. A15/05. Den Haag: Gezondheidsraad, 2015a.
Gezondheidsraad. Richtlijnen goede voeding 2015. 2015/24. ISBN 978-94-6281-089-1. Den Haag: Gezondheidsraad, 2015b.
Gourin CG, Dy SM, Herbert RJ, Blackford AL, Quon H, Forastiere AA, Eisele DW, Frick KD. Treatment, survival, and costs of laryngeal cancer care in the elderly. Laryngoscope, 2014;124:1827-35.
Hahn RA, Kuzara JL, Elder R, Brewer R, Chattopadhyay S, Fielding J, Naimi TS, Toomey T, Middleton JC, Lawrence B, Task Force on Community Preventive S. Effectiveness of policies restricting hours of alcohol sales in preventing excessive alcohol consumption and related harms. Am J Prev Med, 2010;39:590-604.
Hersenstichting. Korsakov. [cited 2015 24 november]; Available from: https://www.hersenstichting.nl/alles-over-hersenen/hersenaandoeningen/korsakov?gclid=CIPM5rDmqMkCFYGlGwoduQoGPg
Hollingworth W, Ebel BE, McCarty CA, Garrison MM, Christakis DA, Rivara FP. Prevention of deaths from harmful drinking in the United States: the potential effects of tax increases and advertising bans on young drinkers. J. stud. alcohol., 2006;67:300-8.
Holm AL, Veerman L, Cobiac L, Ekholm O, Diderichsen F. Cost-effectiveness of changes in alcohol taxation in Denmark: a modelling study. Cost Eff Resour Alloc, 2014a;12:1.
Holm AL, Veerman L, Cobiac L, Ekholm O, Diderichsen F. Cost-effectiveness of preventive interventions to reduce alcohol consumption in denmark. PloS one, 2014b;9:e88041.
Hoogenveen RT, van Baal PH, Boshuizen HC. Chronic disease projections in heterogeneous ageing populations: approximating multi-state models of joint distributions by modelling marginal distributions. Math Med Biol, 2010;27:1-19.
Hopkins RB, Paradis J, Roshankar T, Bowen J, Tarride JE, Blackhouse G, Lim M, O'Reilly D, Goeree R, Longo CJ. Universal or targeted screening for fetal alcohol exposure: a cost-effectiveness analysis. Journal of studies on alcohol, 2008;69:510-9.
Houwing S, Bijleveld FD, Commandeur JJF, Vissers L. Het werkelijk aandeel verkeersdoden als gevolg van alcohol Aanpassing schattingsmethodiek. R-2014-32. Den Haag: SWOV, 2014.
Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E. Consolidated Health Economic Evaluation Reporting Standards (CHEERS)--explanation and elaboration: a report of the ISPOR

Health Economic Evaluation Publication Guidelines Good Reporting Practices Task Force. Value Health, 2013;16:231-50.
IAS. UK alcohol-related crime statistics. [cited 2016; Available from: http://www.ias.org.uk/Alcohol-knowledge-centre/Crime-and-social-impacts/Factsheets/UK-alcohol-related-crime-statistics.aspx
Isalberti C, Van der Linden T, Legrand S-A, Verstraete A, Bernhoft IM, Hels T, Olesen MN, Houwing S, Houtenbos M, Mathijssen R. Prevalence of alcohol and other psychoactive substances in injured and killed drivers: University Gent, 2011.
IVZ. Alcoholhulpvraag in Nederland Belangrijkste ontwikkelingen van de hulpvraag voor alcoholproblematiek in de verslavingszorg 2005-2014. Houten: Stichting IVZ.: Stichting IVZ, 2015.
Jacobs-van der Bruggen MA, van Baal PH, Hoogenveen RT, Feenstra TL, Briggs AH, Lawson K, Feskens EJ, Baan CA. Cost-effectiveness of lifestyle modification in diabetes patients. Diabetes Care, 2009.
Jellinek. Hoeveel mensen overlijden er door alcohol, tabak en andere drugs? 2015 [cited 2016; Available from: https://www.jellinek.nl/vraag-antwoord/hoeveel-mensen-overlijden-er-door-alcohol-tabak-en-drugs/
Kamer_der_Staten-Generaal E. Voorstel van wet van de leden Voordewind, Van der Staaij, Bouwmeester en Bruins Slot houdende wijziging van de Drank- en Horecawet, teneinde enkele leeftijdsgrenzen te verhogen van 16 naar 18 jaar en de preventie en handhaving te verankeren, Memorie van Antwoord. Kamerstuk 33 341; 2013.
Kieran JA, Norris S, O'Leary A, Walsh C, Merriman R, Houlihan D, McCormick PA, McKiernan S, Bergin C, Barry M. Hepatitis C in the era of direct-acting antivirals: real-world costs of untreated chronic hepatitis C; a cross-sectional study. BMC infectious diseases, 2015;15:471.
Koopmans C, Heyma A, Hof B, Imandt M, Kok L, Pomp M. Werkwijzer voor kosten-batenanalyse in het sociale domein Literatuur en bijlagen. Amsterdam: SEO Economisch Onderzoek, 2016a.
Koopmans C, Heyma A, Hof B, Imandt M, Kok L, Pomp M. Werkwijzer voor MKBA's in het sociaal domein Hoofdrapport. Amsterdam: SEO Economisch Onderzoek, 2016b.
Korf D, Visscher T, Smit-Dopmeijer J. Overweight, unhealthy behaviours and study-delay: A cross-sectional study among university students in Zwolle, the Netherlands. Amsterdam: Vu University, 2012.
Korsakovkenniscentrum. Syndroom van Korsakov. 2015 [cited 2016; Available from: http://www.korsakovkenniscentrum.nl/syndroom-van-korsakov
KPMG. Kosten en baten van alcoholzorg en -preventie, 2001.
Krol M, Stolk E, Brouwer W. Predicting productivity based on the EQ-5D: an explorative study. Eur J Health Econ, 2014;15:465-75.
Lanting C, De Vroome E, Elias S, Bausch-Goldbohm S. De bijdrage van leefstijlfactoren aan de incidentie van en de sterfte aan

kanker in Nederland. TNO/LA 2014 R10733. Leiden: TNO, 2014a.
Lanting CI, de Vroome EM, Elias SG, van den Brandt PA, van Leeuwen FE, Kampman E, Kiemeney LA, Peeters PH, de Vries E, Bausch-Goldbohm RA. [Contribution of lifestyle factors to cancer: secondary analysis of Dutch data over 2010 and a projection for 2020]. Ned Tijdschr Geneeskd, 2014b;159:A8085.
Lemmers L. Alcohol en uitgaansgeweld. De stand van zaken. Utrecht: Trimbos Institute, 2014.
Lokkerbol J, Adema D, de Graaf R, ten Have M, Cuijpers P, Beekman A, Smit F. Non-fatal burden of disease due to mental disorders in the Netherlands. Social psychiatry and psychiatric epidemiology, 2013;48:1591-9.
Meier PM. Independent review of the effects of alcohol pricing and promotion – Part A: systematic review. : University of Sheffield, 2008.
Middleton JC, Hahn RA, Kuzara JL, Elder R, Brewer R, Chattopadhyay S, Fielding J, Naimi TS, Toomey T, Lawrence B, Task Force on Community Preventive S. Effectiveness of policies maintaining or restricting days of alcohol sales on excessive alcohol consumption and related harms. Am J Prev Med, 2010;39:575-89.
Miners AH, Martin NK, Ghosh A, Hickman M, Vickerman P. Assessing the cost-effectiveness of finding cases of hepatitis C infection in UK migrant populations and the value of further research. Journal of viral hepatitis, 2014;21:616-23.
Movisie. Huiselijk geweld: aard en omvang, gevolgen, hulverlening en aanpak. 2011 [cited 2016; Available from: http://www.huiselijkgeweld.nl/doc/feiten/factsheet_movisie_mei_2011_website.pdf
Movisie. Huiselijk geweld: Aard en omvang, gevolgen, hulpverlening en aanpak. 2013 [cited 2016; Available from: http://www.huiselijkgeweld.nl/doc/feiten/factsheet_huiselijk_geweld_november_2013.pdf
Nelson JP. . Advertising bans, monopoly and alcohol demand: testing for substitution effects using state panel data. Review of Industrial Organization 2003;22:1-25.
Nelson JP. Meta-analysis of alcohol price and income elasticities - with corrections for publication bias. Health Econ Rev, 2013;3:17.
Nelson JP, Young, D.J. Do advertising bans work? An international comparison. . Journal of Advertising 2001;20:273-96.
NovioConsult. Toezicht Drank- en Horecawet door gemeenten, bevindingen evaluatieonderzoek, 2010.
Pidd KJ, Berry JG, Roche AM, Harrison JE. Estimating the cost of alcohol-related absenteeism in the Australian workforce: the importance of consumption patterns. . Medical Journal of Australia 2006;185:637-41.
Pomp M, Schoemaker CG, Polder JJ. Op weg naar maatschappelijke kosten-batenanalyses voor preventie en zorg. 010003003/2014. Bilthoven: RIVM, 2014.
Popova S, Lange S, Rehm J. The Burden and Economic Impact of Fetal Alcohol Spectrum Disorder in Canada. Toronto: Centre for Addiction and Mental Health, 2015.

Post NAM, de Bekker-Grob EW, Mackenbach JP, Slobbe LCW. Kosten van preventie in Nederland in 2007. Bilthoven: RIVM, 2010.
Purshouse R, Brennan A, Latimer N, Meng Y, Rafia R, Jackson R, Meier P. 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 Report to the NICE Public Health Programme Development Group. Sheffield: University of Sheffield, 2009.
Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet, 2009;373:2223-33.
RIVM. Cijfertool Kosten van Ziekten. 2015 [cited 2016; Available from: https://kostenvanziektentool.volksgezondheidenzorg.info/tool/nederlands/
Roche AM, Pidd K, Berry JG, Harrison JE. Workers' drinking patterns: the impact on absenteeism in the Australian work-place. Addiction, 2008;103:738-48.
Romieu I, Scoccianti C, Chajes V, de Batlle J, Biessy C, Dossus L, Baglietto L, Clavel-Chapelon F, Overvad K, Olsen A, Tjonneland A, Kaaks R, Lukanova A, Boeing H, Trichopoulou A, Lagiou P, Trichopoulos D, Palli D, Sieri S, Tumino R, Vineis P, Panico S, Bueno-de-Mesquita HB, van Gils CH, Peeters PH, Lund E, Skeie G, Weiderpass E, Quiros Garcia JR, Chirlaque MD, Ardanaz E, Sanchez MJ, Duell EJ, Amiano P, Borgquist S, Wirfalt E, Hallmans G, Johansson I, Nilsson LM, Khaw KT, Wareham N, Key TJ, Travis RC, Murphy N, Wark PA, Ferrari P, Riboli E. Alcohol intake and breast cancer in the European prospective investigation into cancer and nutrition. Int J Cancer, 2015;137:1921-30.
Romijn G, Renes G. Algemene leidraad voor maatschappelijke kosten-baten analyse. Den Haag: CPB/PBL, 2013.
Ronksley PE, Brien SE, Turner BJ, Mukamal KJ, Ghali WA. Association of alcohol consumption with selected cardiovascular disease outcomes: a systematic review and meta-analysis. BMJ, 2011;342:d671.
Saffer H. Alcohol Consumption and Alcohol Advertising Bans. Cambridge, MA.: Cambridge, MA: National Bureau of Economic Research., 2000.
Saffer H, Dave D. Alcohol advertising and alcohol consumption by adolescents. Health Econ, 2006;15:617-37.
Saffer H, Dave, D. Alcohol Consumption and Alcohol Advertising Bans. . Applied Economics, 2002;34:1325-34.
Saffer H, Dave, D., Grossman, M. Behavioural economics and the demand for alcohol: results from the NLSY97. Cambridge, MA.: National Bureau of Economic Research., 2012.
Saffer H. D, D. Alcohol advertising and alcohol consumption by adolescents. . Cambridge, MA.: National Bureau of Economic Research, 2003.
Sampson PD, Streissguth AP, Bookstein FL, Little RE, Clarren SK, Dehaene P, Hanson JW, Graham JM, Jr. Incidence of fetal

alcohol syndrome and prevalence of alcohol-related neurodevelopmental disorder. Teratology, 1997;56:317-26.
Sassi F, Belloni A. Fiscal incentives, behavior change and health promotion: what place in the health-in-all-policies toolkit?.[Erratum appears in Health Promot Int. 2014 Dec;29(4):794]. Health Promot International, 2014;29 Suppl 1:i103-12.
Sassi FE. Tackling harmful alcohol use: economics and public health policy. : OECD Publishing., 2015.
Scheltes W, Pleijster F, Bangma K. Effecten accijnsverhoging gedistilleerde dranken. Zoetermeer: Panteia, 2013.
Siegfried N, Pienaar DC, Ataguba JE, Volmink J, Kredo T, Jere M, Parry CD. Restricting or banning alcohol advertising to reduce alcohol consumption in adults and adolescents. Cochrane Database Syst Rev, 2014;11:CD010704.
Stockwell T, Zhao J, Panwar S, Roemer A, Naimi T, Chikritzhs T. A systematic review and meta-analysis of alcohol consumption and all-cause mortality. Journal of studies on alcohol and drugs, 2016;77:185-98.
Stouthard MEA, Essink-Bot ML, Bonsel GJ. Disability weights for diseases: A modified protocol and results for a Western European region. European Journal of Public Health, 2000;10:24-30.
Suijkerbuijk AWM, van Gils PF, de Wit GA. De kosteneffectiviteit van interventies gericht op verslaving aan alcohol en middelen. Een review van de literatuur. 133499001/2014: RIVM, 2014.
SWOV. [cited; Available from: https://www.swov.nl/NL/Research/cijfers/Cijfers_Ongevallen.htm
ter Bogt T, van Lieshout M, Doornwaard S, Eijklemans Y. Middelengebruik en voortijdig schoolverlaten. Utrecht: Universiteit Utrecht
Trimbos-instituut, 2009.
Tiessen-Raaphorst A, Breedveld K. Een gele kaart vor de sport Een quick scan naar wenselijke en onwenselijke praktijken in de sport. The Hague: The Netherlands Institute for Social Research, 2007.
Van Baal PHM, Feenstra TL, Hoogenveen RT, de Wit GA. Cost effectiveness analysis with the RIVM Chronic Disease Model. 260706002. Bilthoven: RIVM, 2005.
van der Veen HCJ, Bogaerts S. Huiselijk geweld in Nederland. Den Haag: WODC, 2010.
Van Dorsselaer S, Goossens FX. Alcohol-, tabaks- en drugsgebruik door studenten. Utrecht: Trimbos Institute, 2015.
van Gils PF, Hamberg-van Reenen HH, van den Berg M, Tariq L, de Wit GA. The scope of costs in alcohol studies: Cost-of-illness studies differ from economic evaluations. Cost Eff Resour Alloc, 2010;8:15.
Van Laar MW, Van Ooyen-Houben MMJ, Cruts AAN, Meijer RF, Croes E, Ketelaars APM, P.M. vdP. Nationale Drug Monitor, jaarbericht 2015. utrecht: Trimbos Instituut, 2015.
Van Wieringen H, Letteboer TGW, Rodrigues Pereira R, De Ruiter S, Balemans WAF, Lindhout D. Diagnostiek van foetale

alcoholspectrumstoornissen. Ned Tijdschr Geneeskd., 2010;154.
Veiligheid.nl. beter zicht op alcohol- en drugsgerelateerde ongevallen. 2015 [cited 2016; Available from: https://www.veiligheid.nl/organisatie/actueel/nieuws/beter-zicht-op-alcohol--en-drugsgerelateerde-ongevallen
Versteegh M VK, Evers S, de Wit GA, Prenger R, Stolk E. Dutch Tariff for the 5-level version of the EQ-5D. Value Health, 2016;in press.
VTV. Volksgezondheid Toekomst Verkenning. 2014 [cited 2015 9 mei]; Available from:
Wagenaar AC, Salois MJ, Komro KA. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. Addiction, 2009;104:179-90.
Wagenaar AC, Tobler AL, Komro KA. Effects of alcohol tax and price policies on morbidity and mortality: a systematic review. Am J Public Health, 2010;100:2270-8.
Ware JE, Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Medical care, 1992;30:473-83.
WCRF/AICR. Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective Washington DC: World Cancer Research Fund / American Institute for Cancer Research., 2007.
Whyte S, Harnan S. Effectiveness and cost-effectiveness of an awareness campaign for colorectal cancer: a mathematical modeling study. Cancer Causes Control, 2014.
York_Health_Economics_Consortium. The societal cost of alcohol misuse in Scotland for 2007: University of York, 2010.
Zhang X, Hatcher B, Clarkson L, Holt J, Bagchi S, Kanny D, Brewer RD. Changes in density of on-premises alcohol outlets and impact on violent crime, Atlanta, Georgia, 1997-2007. Prev Chronic Dis, 2015;12:E84.
Zorginstituut_Nederland. Richtlijn voor het uitvoeren van economische evaluaties in de gezondheidszorg Bijlage 1: Kostenhandleiding: Methodologie van kostenonderzoek en referentieprijzen voor economische evaluaties in de gezondheidszorg. Diemen: Zorginstituut Nederland, 2015.

Appendix 1: Explanation of concepts used in this report

Consumer surplus
Consumer surplus is a measure of the economic welfare that people gain from purchasing and then consuming goods and services. Consumer surplus is the difference between the total amount that consumers are willing to pay for a good or service, e.g. alcohol, and the total amount that they actually do pay.

Price elasticity
Price elasticity is the concept used to express the relationship between price changes and changes in demand. Price elasticity measures the responsiveness of demand for a good or service after a change in price of that good or service. Price elasticity describes the percentage of change in quantity demanded in response to a 1% percent change in price (ceteris paribus, i.e. holding all the other determinants of demand, such as income, constant). For example, if the price increases by 10% and the quantity demanded decreases by 25%, the price elasticity at the initial price and quantity is -2.5. In this report, our point estimate for the price elasticity of demand for alcohol is -0.50. It implies that a 1% increase in the price of alcoholic beverages would result in a decrease in alcohol consumption of 0.5%, based on evidence discussed in section 2.2.1.

Producer surplus
Producer surplus is an economic measure of the difference between the amount that a producer receives from the sale of a good or service and the lowest amount that producer is willing to accept for that good or service. The difference, or surplus amount, is the benefit that the producer receives for selling the good or service.

Relative risk
Relative risk (RR) is the ratio of the probability of an event occurring in an exposed group to the probability of the event occurring in a non-exposed group. For instance, the RR for the occurrence of stroke in a group of heavy drinkers (6 or more glasses per day) is 1.62 (Ronksley et al., 2011).

Standard drink
In our calculations, alcohol consumption is defined in terms of standard drinks. For every type of alcohol consumed (beer, wine, spirits), 1 standard drink contains 10g of alcohol.

Appendix 2A: Relative risks used in the RIVM-CDM

Two recent Dutch reports were used to retrieve up-to-date relative risks of alcohol consumption on chronic diseases and mortality. The first was the 2015 Health Council report Good Nutrition Guidelines(Gezondheidsraad, 2015a), which provides an overview of published relative risks on several diseases. From these, we selected the relative risks that were reported in a dose-response fashion. The second report was the 2014 TNO report on lifestyle and cancer (Lanting, 2014a), which reports chances of cancer incidence as a function of daily alcohol consumption. We converted these chances to relative risks. See Tables 1, 2, 3 and 4 for the relative risks per half a drink per day. For the alcohol consumption classes in the RIVM-CDM we calculated average relative risks, with the reference class of 0.0-0.5 a drink per day being the mean of the columns 0-0 and 0-0.5 drinks per day in Tables 1 and 2. All relative risks were divided by this mean relative risk to ensure that the relative risk in the reference class was always 1.00.
The resulting RRs are reported in Tables 5 and 6.

Table A1. Relative risks for men, 2015 Health Council report (Gezondheidsraad, 2015a)

men		**drinks per day (1 standard drink contains 10 g of alcohol)**													
	From	**0**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**
Source	**To**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**	**+**
(Ferrari et al., 2014)	Total mortality	1.29	1	0.93	0.93	0.99	0.99	0.99	1.15	1.15	1.15	1.15	1.15	1.15	1.53
(Ronksley, 2011)	CHD	1	0.96	0.75	0.75	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67	0.67	0.76
(Ronksley, 2011)	CVA	1	0.81	0.8	0.8	0.92	0.92	0.92	1.15	1.15	1.15	1.15	1.15	1.15	1.62
(Romieu et al., 2015)	Breast cancer	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A2. Relative risks for women, 2015 Health Council report (Gezondheidsraad, 2015a)

women		**drinks per day (1 standard drink contains 10 g of alcohol)**									
	From	**0**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**
Source	**To**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**+**
(Ferrari, 2014)	Total mortality	1.26	1	1.02	1.02	1.06	1.06	1.06	1.27	1.27	1.27
(Ronksley, 2011)	CHD	1	0.96	0.75	0.75	0.66	0.66	0.66	0.67	0.67	0.67
(Ronksley, 2011)	CVA	1	0.81	0.8	0.8	0.92	0.92	0.92	1.15	1.15	1.15
(Romieu, 2015)	Breast cancer	1.04	1	1.06	1.06	1.12	1.12	1.12	1.25	1.25	1.25

Table A3. Relative risks for men, TNO report on lifestyle and cancer (Lanting, 2014a)

men		**drinks per day (1 standard drink contains 10 g of alcohol)**													
	From	**0**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**
Source	**To**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**	**+**
(WCRF/AICR, 2007)	Oesophagus cancer	1	2	2	3	3	3	3	3	3	7	7	7	7	7
(WCRF/AICR, 2007)	Larynx cancer	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	2.6	2.6	2.6	2.6	2.6
(WCRF/AICR, 2007)	Oral cavity cancer	1	1.4	1.4	2	2	2	2	2	2	5.8	5.8	5.8	5.8	5.8

Table A4. Relative risks for women, TNO report on lifestyle and cancer (Lanting, 2014a)

women		**drinks per day (1 standard drink contains 10 g of alcohol)**									
	From	**0**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**
Source	**To**	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**+**
(WCRF/AICR, 2007)	Oesophagus cancer	1	2	2	3	3	3	3	3	3	6
(WCRF/AICR, 2007)	Larynx cancer	1	1	1	2	2	2	2	2	2	3
(WCRF/AICR, 2007)	Oral cavity cancer	1	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	6

Table A5. Relative risks for men used in the RIVM-Chronic Diseases Model

men		**drinks per day (1 standard drink contains 10 g of alcohol)**												
	From	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**
Source	**To**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**	**+**
(Ferrari, 2014)	Total mortality	1.00	0.87	0.87	0.87	0.87	0.87	0.87	1.00	1.00	1.00	1.00	1.17	1.17
(Ronksley, 2011)	CHD	1.00	0.71	0.71	0.71	0.71	0.71	0.71	0.68	0.68	0.68	0.68	0.73	0.73
(Ronksley, 2011)	CVA	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.27	1.27	1.27	1.27	1.53	1.53
(Romieu, 2015)	Breast cancer	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
(WCRF/AICR, 2007)	Oesophagus cancer	1.00	1.89	1.89	1.89	1.89	1.89	1.89	4.00	4.00	4.00	4.00	4.67	4.67
(WCRF/AICR, 2007)	Larynx cancer	1.00	1.50	1.50	1.50	1.50	1.50	1.50	2.35	2.35	2.35	2.35	2.60	2.60
(WCRF/AICR, 2007)	Oral cavity cancer	1.00	1.58	1.58	1.58	1.58	1.58	1.58	4.04	4.04	4.04	4.04	4.83	4.83

Table A6. Relative risks for women used in the RIVM-Chronic Diseases Model

women		**drinks per day (1 standard drink contains 10 g of alcohol)**								
	From	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**
Source	**To**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**+**
(Ferrari, 2014)	Total mortality	1.00	0.92	0.92	0.92	0.92	1.03	1.03	1.12	1.12
(Ronksley, 2011)	CHD	1.00	0.72	0.72	0.72	0.72	0.68	0.68	0.68	0.68
(Ronksley, 2011)	CVA	1.00	0.95	0.95	0.95	0.95	1.14	1.14	1.27	1.27
(Romieu, 2015)	Breast cancer	1.00	1.07	1.07	1.07	1.07	1.16	1.16	1.23	1.23
(WCRF/AICR, 2007)	Oesophagus cancer	1.00	1.83	1.83	1.83	1.83	2.00	2.00	3.00	3.00
(WCRF/AICR, 2007)	Larynx cancer	1.00	1.75	1.75	1.75	1.75	2.00	2.00	2.50	2.50
(WCRF/AICR, 2007)	Oral cavity cancer	1.00	1.28	1.28	1.28	1.28	1.33	1.33	3.33	3.33

APPENDIX 2B: Background data on diseases related to alcohol

Table A7: Health consequences of alcohol consumption: incidence, prevalence, PAF, utility weight and costs (2013€)

Disease	**Incidence**	**Prevalence**	**Population attributable fraction (PAF)**	**Utility weight**	**Costs (million €)**
Net positive effect on health					
CHD	- 17,800 [1]	- 241,000 [1]	-0.38	0.712 [2]	-584 [1]
DM 2	- 11,100 [1]	- 179,000 [1]	-0.22	0.802 [2]	-288 [1]
Subtotal positive effects					***-872***
Positive health effect of moderate alcohol intake and negative health effect of high intake					
Stroke (moderate alcohol intake)	- 564 [1]	- 3,990 [1]	-0.02	0.391 [2]	-41 [1]
Stroke (high alcohol intake)	503 [1]	3,760 [1]	0.02	0.391 [2]	34 [1]
Subtotal mixed effects					**-7**
Net Negative effect on health					
Breast cancer	1,315 [3]	17,200 [3]	0.07	0.744 [2]	45 [4]
Oral cavity cancer	637 [3]	1,400 [3]	0.37	0.44 [2]	10 [4]
Larynx cancer	142 [3]	3,800 [3]	0.37	0.44 [2]	104 [5]
Esophagus cancer	228 [3]	3,700 [3]	0.48	0.407 [2]	105 [4]
Liver cancer	106 [3]	162 [3]		0.45 [6]	4 [7]
Colorectal cancer	1,419 [3]	12,500 [3]		0.7 [8]	74 [4]
Addiction	NA	29,247 [9]	1.00	0.855 [10]	293 [9]
Alcohol related brain damage(Wernicke/Korsakow)	900 [11]	9,000 [11]	1.00	0.37 [12]	546 [13]
FASD	51 [14]	5,100 [14]	1.00	0.47 [15]	20 [16]
Subtotal negative effects					**1,201**
Total net costs					**322**

[1] Calculated with RIVM-CDM, following a Population Attributable Risk (PAR) approach:
The contribution of alcohol consumption to the diseases CHD, DM2, and stroke was quantified using the population attributable risk (PAR). PAR is the proportional reduction in population disease or mortality that would occur if exposure to a risk factor was reduced to an alternative ideal exposure scenario (i.e. no alcohol consumption). We used the following two equations [1] and [2] to calculate PARs:

$$PAR_{g,a} = \frac{\sum_{i=1}^{4} P_{i,g,a} \times (RR_{i,g,a} - 1)}{\sum_{i=1}^{4} P_{i,g,a} \times RR_{i,g,a}} \qquad [1]$$

with g = gender; a = age; PAR = proportion of disease caused by alcohol consumption; i = alcohol consumption class; P_i = proportion in i; and RR_i = relative risk of disease incidence, and

$$SUMPAR = \frac{\sum_{g,a} PAR_{g,a} \times DIS_{g,a}}{\sum_{g,a} DIS_{g,a}} \qquad [2]$$

with SUMPAR = PAR for the total population; and DIS = absolute number of disease incidence/prevalence/cost. All parameters are age and sex dependent.
See Appendix 2A for explanation and accountability of the RRs used in the RIVM-CDM.

[2] Complement of Disability weight (= 1 - Disability weight) as elicited in the Dutch Burden of Disease study. Source: (Stouthard, 2000)

[3] See Appendix 2C for estimates of number of incident and prevalent cases in 2013. For the estimate of the 2013 welfare losses attributable to alcohol, we have taken the 10-years prevalence data as basis for our estimate. The Dutch Cancer Registry also reports 5-year and 20-year prevalence data by type of cancer. We have used the 10-year prevalence data as a “midpoint” estimate, implying that no quality of life losses are included in welfare estimates for cancers that occurred more than 10 years ago (i.e. quality of life is similar to the general population).

[4] RIVM-CDM disease cost data, adapted from earlier Dutch Cost of Illness Studies and indexed to 2013 price levels. Total costs are the multiplication of costs per patient from the RIVM-CDM and disease prevalence.

[5] Source: (Gourin et al., 2014). Average costs per patient indexed to 2013 and converted from USD to € (1 USD = 0.8944 €).

[6] Source: (Miners et al., 2014)

[7] Based on (Kieran, 2015)

[8] Source: (Whyte & Harnan, 2014)

[9] Data on number of patients and total costs of addiction care (alcohol only) from Mental Healthcare Netherlands (GGZ Nederland).

[10] Midpoint of adjusted disability weight for alcohol abuse (0.13) and alcohol dependenc (0.16). Source: (Lokkerbol et al., 2013)

[11] Source for prevalence: Korsakov kenniscentrum, 2015. Here, the number of Korsakov/Wernicke patients is estimated to be 8,000-10,000 in the Netherlands. The incidence is unknown. By assuming that patients living with Korsakov have an average life expectancy of 10 year after diagnosis, the number of incident patients is estimated to be 900 per year.

[12] assumed to be similar to utility of moderate dementia (nursing home)
Source: (Bermingham, 2014)

[13] Costs of nursing and care, including day time activities are € 166.33 per patient per day (Zorginstituut_Nederland, 2015), this equals annual costs of care of € 61,000 per patient.

[14] Sources on the incidence and prevalence of Fetal Alcohol Syndrome Disorder (FASD) vary widely with the amount of problems that is included in its definition. Some include cognitive limitations, ADHD and other disorders in the definition, while others stick to a more restricted definition. The prevalence of FASD may be as high as almost 1% (i.e. 0.009) of the total population (Sampson, 1997). We use a more limited definition of FASD, following a recent study by CDC (CDC., 2015). Using medical and other records, CDC studies have identified 0.2 to 1.5 infants with FAS for every 1,000 live births in certain areas of the United States. The most recent CDC study analyzed medical and other records and found FAS in 0.3 out of 1,000 children from 7 to 9 years of age. We use this figure of 0.3/1000 for both incidence and prevalence.

[15] Source: (Hopkins et al., 2008)

[16] Costs for the Dutch situation are unknown. As a proxy for costs of FASD, we use the cost data from a recent Canadian report (Popova, 2015), where average annual costs for FASD are estimated to be € 3,985 (after PPP correction).

APPENDIX 2C: Estimate of number of cancer cases related to alcohol (2013)

Table A8: Health consequences of alcohol consumption: incidence, prevalence, PAF, utility weight and costs (2013€)

	% alcohol related [2]	Total incidence in 2013 [3]	Incidence alcohol related: 2013 [4]	Total 5-years prevalence [5]: 2013 [3]	5-years prevalence alcohol related: 2013 [6]	Total 10-years prevalence [5]: 2013 [3]	10-years prevalence alcohol related: 2013 [6]
Breast cancer	7.7	17082	1315	70814	5452	120551	9282
Oral cavity cancer	36.4	1750	637	5494	2000	8242	3000
Larynx cancer	19.8	718	142	2738	542	4512	893
Esophagus cancer [1]	44.1	518	228	810	357	997	440
Liver cancer	17.2	619	106	778	134	944	162
Colorectal cancer	10.8	13136	1419	42364	4575	64717	6989

[1] Of the total number of esophagus cancer mentioned in the Lanting study, 24% is squamous cancer, a form caused by alcohol. Other forms of esophagus cancer are unrelated to alcohol. Therefore, the total number of esophagus cancer presented by IKNL (incidence and prevalence) was multiplied by 0.24.

[2] Source: (Lanting, 2014b)

[3] Nederlandse Kankerregistratie/Integraal Kankercentrum Nederland (IKNL)/ www.cijfersoverkanker.nl

[4] Total incidence of cancer multiplied by percentage that is alcohol related (column 2)

[5] The prevalence of cancer includes all persons who are still alive in a certain year (2013) and who had this type of cancer in the past 5 years (total 5-years prevalence) or the past 10 years (total 10-years prevalence) (http://www.cijfersoverkanker.nl/definities-31.html).

[6] Total prevalence of cancer (5-years or 10-years data) multiplied by percentage alcohol related (column 2)

APPENDIX 3A: Results of sensitivity analyses for the increase of excise taxes policy scenario

The following sensitivity analyses were performed for the two policy scenarios involving increase of excise taxes:

1. Discount rate:
   A. Discount rate of 4% for costs and effects: Net present value decreases from €17 billion to €14 billion over a period of 50 years in case of an increase in excise duties of 50% and from €42 billion to €36 billion over a period of 50 years in case of an increase in excise duties of 200%.
   B. Discount rate of 1.5% for costs and effects: Net present value increases from €17 billion to €23 billion over a period of 50 years in case of an increase in excise duties of 50% and from €42 billion to €57 billion over a period of 50 years in case of an increase in excise duties of 200%.

2. Productivity losses associated with alcohol. When we do not consider the decrease in productivity associated with alcohol consumption, the net present value decreases from €17 billion to €15 billion over a period of 50 years in case of an increase in excise duties of 50% and from €42 billion to €34 billion over a period of 50 years in case of an increase in excise duties of 200%.

3. When QALY differences are not valued at €50,000 per QALY but at €100,000 per QALY, the net present value increases from €17 billion to €19 billion over a period of 50 years in case of an increase in excise duties of 50% and from €42 billion to €44 billion over a period of 50 years in case of an increase in excise duties of 200%.

4. Finally, we varied the price elasticities used in the base-case analyses. Here, we specify scenario’s with lower and higher effectiveness of the policy measures. The lower and higher effects are related to the boundaries of the confidence interval for the price elasticity as described in the meta-analyses of Wagenaar et al (Wagenaar, 2009). The different sensitivity analyses for the policy measure in the field of increase of tax excises are described in table 3A.1.

Table 3A.1 Assumptions with regard to price elasticity

Number	**Scenario name**	**Price elasticity used / consumption change**
1	lower bound excise + 50%	price elasticity -0.414
2	lower bound excise + 200%	price elasticity -0.414
3	upper bound excise + 50%	price elasticity -0.625
4	upper bound excise + 200%	price elasticity -0.625

When the 50% increase in excise tax is assumed to have less impact (with a price elasticity of -0,414) the net present value decreases from €17 billion to €15 billion over a period of 50 years. Social benefits in this sensitivity analysis are depicted in figure 3A.1.

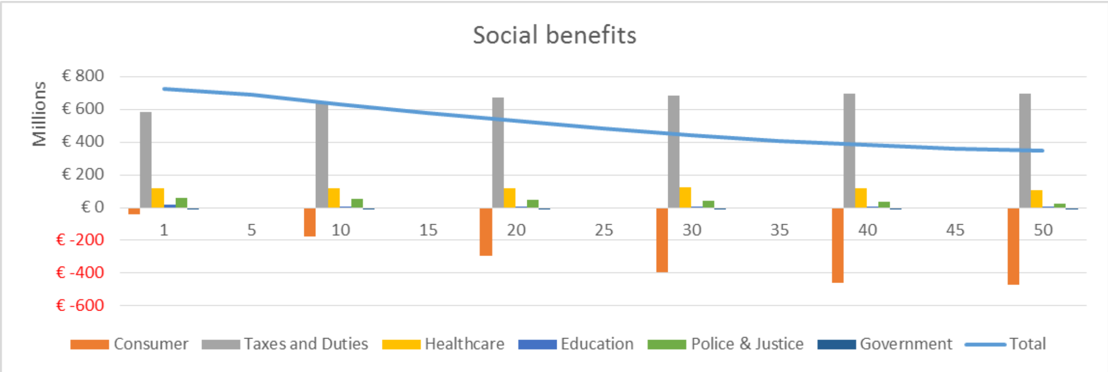

Figure 3A.1 Social benefits of a 50% increase in excise duties, with lower price elasticity

When the 50% increase in excise tax is assumed to have an overall larger impact on alcohol consumption (with a price elasticity of -0.625), the net present value increases from €17 billion to €20 billion over a period of 50 years. Social benefits are depicted in figure 3A.2.

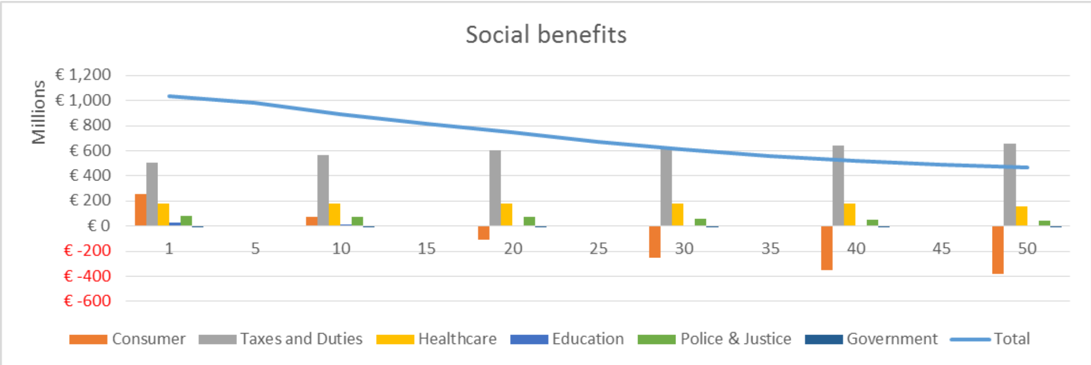

Figure 3A.2 Social benefits of a 50% increase in excise duties, with higher price elasticity

When the 200% increase in excise tax is assumed to have less impact, the net present value increases from €42 billion to €43 billion over a period of 50 years. Social benefits are depicted in figure 3A.3. These counterintuitive results are discussed in Chapter 4.

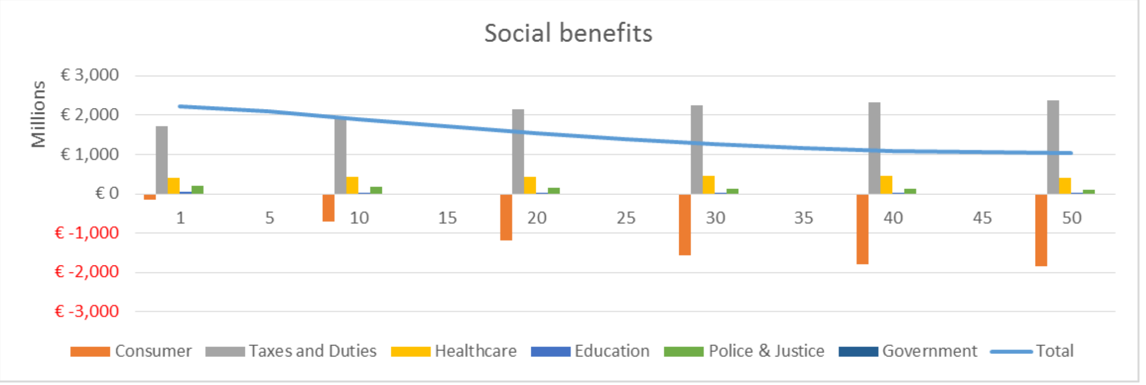

Figure 3A.3 Social benefits of a 200% increase in excise duties, with lower price elasticity

When the 200% increase in excise tax is assumed to have an overall larger impact on alcohol consumption, the net present value decreases from €42 billion to €37 billion over a period of 50 years. Social benefits are depicted in figure 3A.4. These counterintuitive results are discussed in Chapter 4.

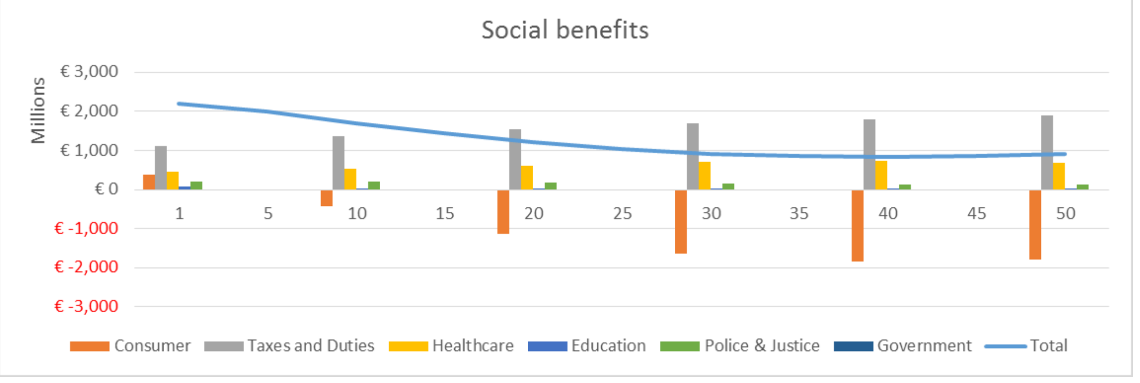

Figure 3A.4 Social benefits of a 200% increase in excise duties, with higher price elasticity

APPENDIX 3B: Results of sensitivity analyses for the reduction of alcohol sales venues policy scenario

The following sensitivity analyses were performed for the policy scenario involving a reduction of venues were alcohol is sold:

1. Discount rate: Discount rate of 4% for costs and effects: Net present value decreases from €4 billion to €3 billion over a period of 50 years in case of a decrease in outlet density of 10% and from €10 billion to €8 billion over a period of 50 years in case of a decrease in outlet density of 25%. Discount rate of 1.5% for costs and effects: Net present value increases from €4 billion to €5 billion over a period of 50 years in case of a decrease in outlet density of 10% and from €10 billion to €13 billion over a period of 50 years in case of a decrease in outlet density of 25%.
2. Not taking the productivity losses associated with alcohol into account: Net present value decreases from €4 billion to €3 billion over a period of 50 years in case of a decrease in outlet density of 10% and from €10 billion to €8 billion over a period of 50 years in case of a decrease in outlet density of 25%.
3. When QALY differences are not valued at €50,000 per QALY but €100,000 per QALY, the net present value increases from €4 billion to €5 billion over a period of 50 years in case of a decrease in outlet density of 10% and from €10 billion to €11 billion over a period of 50 years in case of a decrease in outlet density of 25%.
4. Finally, we varied the price elasticities used in the base-case analyses. Here, we specify scenario's with lower and higher effectiveness of the policy measures. The lower and higher effects are related to the boundaries of the confidence interval for the price elasticity as described in the meta-analyses of Wagenaar et al (Wagenaar, 2009). The different sensitivity analyses are described in table 3B.1.

Table 3B.1 Assumptions with regard to price elasticity

Number	Scenario name	Price elasticity used / consumption change
1	lower bound outlet density -10%	elasticity 0.03
2	lower bound outlet density -25%	elasticity 0.03
3	upper bound outlet density -10%	elasticity 0.37
4	upper bound outlet density -25%	elasticity 0.37

When the 10% decrease in outlet density is assumed to have less impact on drinking, the net present value decreases from €4 billion to €1 billion over a period of 50 years. The social benefits of this scenario are shown in figure 3B.1.

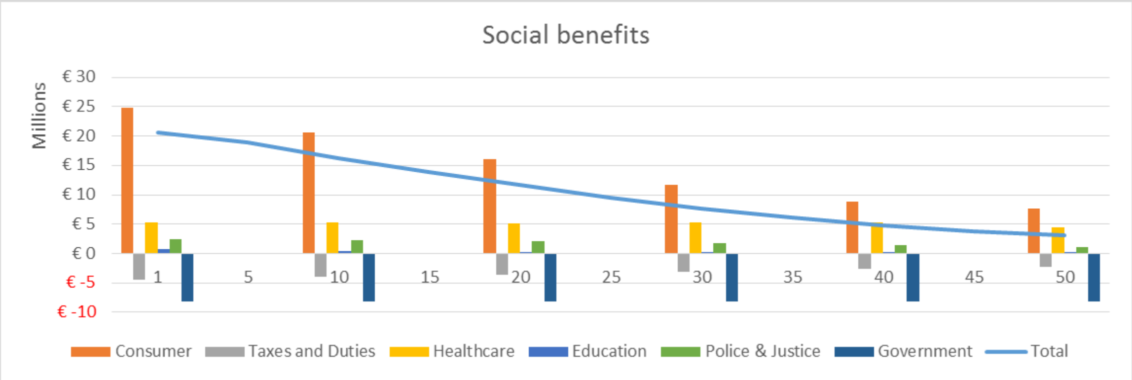

Figure 3B.1 Social benefits of a 10% decrease in outlet density with a lower impact on demand

When the 10% decrease in outlet density is assumed to have a larger impact on alcohol consumption, the net present value increases from €4 billion to €6 billion over a period of 50 years. Social benefits of this scenario are shown in figure 3B.2.

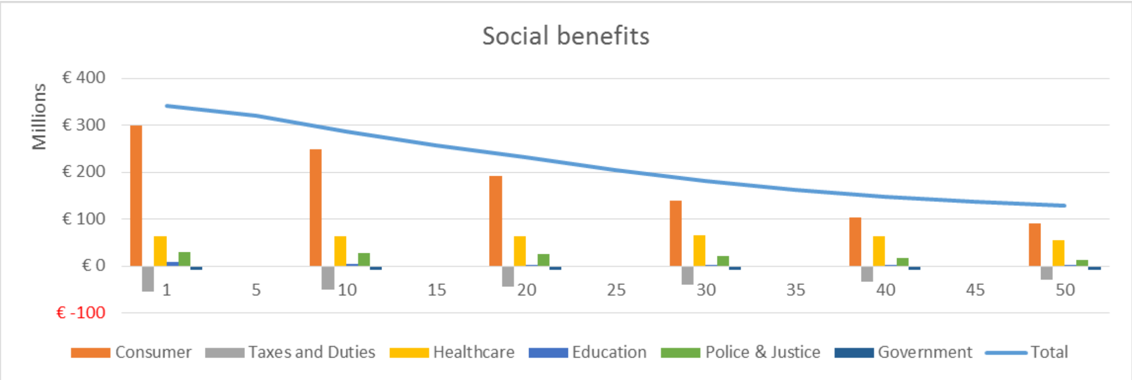

Figure 3B.2 Social benefits of a 10% decrease in outlet density with a higher impact on demand

When the 25% decrease in outlet density is assumed to have less impact on drinking, the net present value decreases from €10 billion to €1 billion over a period of 50 years. Social benefits of this scenario are shown in figure 3B.3.

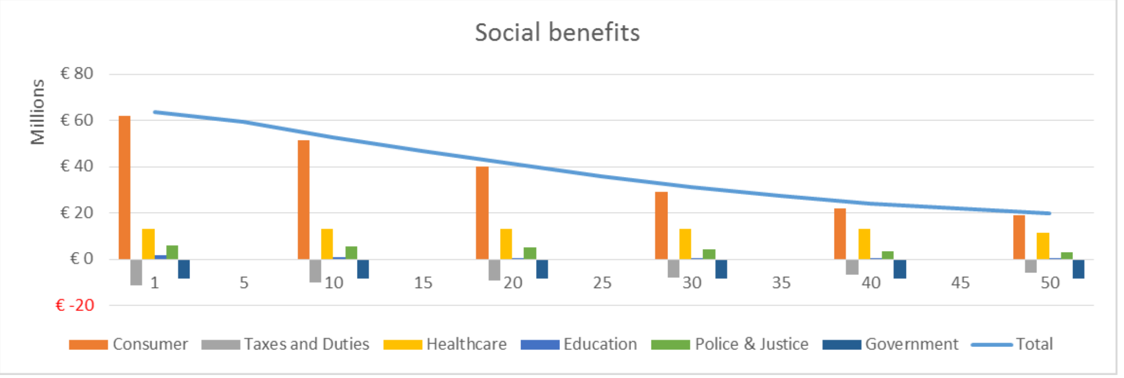

Figure 3B.3 Social benefits of a 25% decrease in outlet density with a lower impact on demand

When the 25% decrease in outlet density is assumed to have a larger impact on alcohol consumption, the net present value increases from €10 billion to €16 billion over a period of 50 years. Social benefits of this scenario are shown in figure 3B.4.

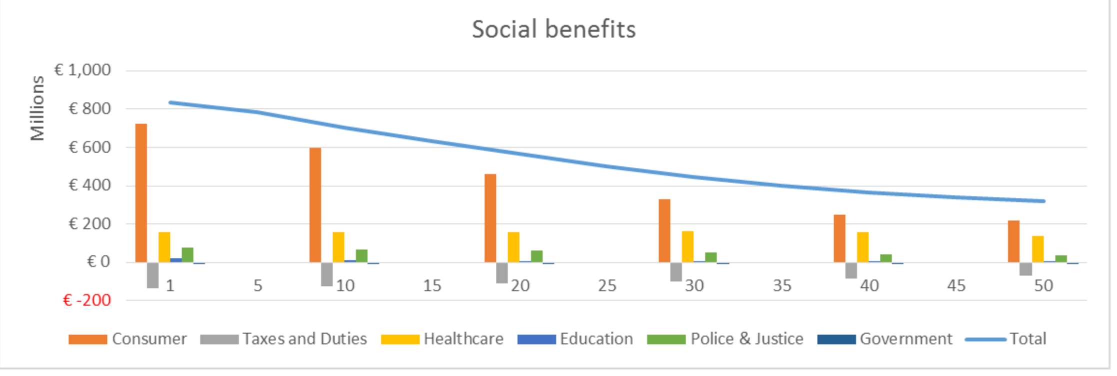

Figure 3B.4; social benefits of a 25% decrease in outlet density with a higher impact on demand

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