New modelling of alcohol pricing policies, alcohol consumption and harm in Scotland

An adaptation of the Sheffield Tobacco and Alcohol Policy Model

<u>Final Report</u>

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Glossary

SARG - Sheffield Alcohol Research Group

MUP - Minimum Unit Price

TAX-Sim - the Tobacco and Alcohol Tax and Price Intervention Simulation Model

STAPM - the Sheffield Tobacco and Alcohol Policy Model

YLLs - Years of Life Lost

SHeS - Scottish Health Survey

SIMD - Scottish Index of Multiple Deprivation

LCFS - Living Costs and Food Survey

RTDs - Ready-To-Drinks

ABV – Alcohol By Volume

CPIH – the Consumer Prices Index including owner occupiers' housing costs

CPI - the Consumer Prices Index excluding owner occupiers' housing costs

RPI – the Retail Prices Index

SAPM – the Sheffield Alcohol Policy Model

ONS - the Office for National Statistics

OBR – Office for Budget Responsibility

SA – Sensitivity Analysis

GLM – Generalised Logistical Model

RDHI – Real Disposable Household Income

Background

In July 2022 the Scottish Government commissioned the Sheffield Alcohol Research Group (SARG) to undertake new modelling work to inform a review of the 50p per unit threshold for the Minimum Unit Price (MUP) policy currently in place in Scotland for alcohol and to contribute to wider discussions around alcohol policy.

SARG have previously produced a series of policy appraisals for Scottish Government which contributed to the development and implementation of the 50p MUP in Scotland (1–4). These previous reports used the Sheffield Alcohol Policy Model (SAPM), an established alcohol policy appraisal tool that has also been used to explore the potential impact of a wide range of alcohol policies across numerous countries including all other UK nations (5–7), the Republic of Ireland (8), Canada (9) and Italy (10).

In recent years SARG have developed a new model, the Tobacco and Alcohol Tax and Price Intervention Simulation Model (TAX-sim), using a new modelling platform, the Sheffield Tobacco and Alcohol Policy Model (STAPM) (11,12). TAX-sim is largely similar to SAPM in functionality, overall structure and methodological approach, however it differs in two key respects. Firstly, it has the capacity to include data and appraise policies related to both alcohol and tobacco, and to explore the interacting behavioural and epidemiological effects of both substances. Secondly, TAX-sim has a 'dynamic' rather than 'static' population, which means the characteristics and behaviours of individuals in the model can change over time to reflect underlying trends, such as trends in alcohol consumption, that are unrelated to any modelled policy. This simulation-based approach addresses some of the limitations of SAPM, which used a cohort-based approach that could not reflect underlying trends, however it has some important implications for the way that the model results are interpreted. These implications are highlighted in the results section of this document.

The new modelling work commissioned by Scottish Government involved the development of a Scottish version of TAX-sim, which had previously been developed for England, and the use of this new model adaptation to answer the following research questions:

1. What is the estimated impact of changing the current 50p/unit MUP threshold in Scotland to a range of alternative thresholds: 40p, 45p, 55p, 60p, 65p, 70p, 75p and 80p/unit, or removing the MUP entirely?
2. What changes in alcohol duties would be required to achieve the same number of:
    a. Total alcohol-attributable deaths averted
    b. Total alcohol-attributable deaths averted in hazardous and harmful drinkers[1]
    c. Total alcohol-attributable deaths averted in harmful drinkers

[1] In line with previous modelling studies we categorise drinkers into three groups: Moderate drinkers who consume no more than 14 units per week, Hazardous drinkers who consume between 14 and 35 units per week for women and 14-50 units for men, and Harmful drinkers who are women drinking more than 35 units and men drinking more than 50 units per week.

d. Total alcohol-attributable deaths averted in hazardous and harmful drinkers in the lowest quintile of the Scottish Index of Multiple Deprivation (SIMD)

e. Total alcohol-attributable deaths averted in harmful drinkers in the lowest SIMD quintile

In the 20th year after policy implementation as each of the modelled MUP thresholds from research question 1?

3. What is the estimated impact of the UK Government's proposed reforms to the alcohol duty system and how might this affect the required duty rate increases estimated in research question 2?
4. What is the estimated impact of COVID-era changes in alcohol consumption on longer-term alcohol-related harm outcomes?
5. What is the estimated impact of alternative approaches to uprating (or not) MUP thresholds - for example indexing to inflation?

We have grouped these research questions into four distinct chapters, combining questions 2 and 3 into a single chapter. Within each chapter we highlight the specific methods used to answer that research question and present the modelled results for the impact on alcohol consumption, consumer spending on alcohol, revenue to the exchequer from alcohol taxation, revenue to retailers from alcohol sales, alcohol-related hospital admissions, alcohol-related mortality and alcohol-related healthcare costs. Where appropriate these outcomes are further disaggregated by drinker group (moderate, hazardous and harmful) and SIMD quintiles, to illustrate the potential distributional impacts of the modelled policies.

For all analyses, we use 2019 as the baseline year for the modelling. There are two key reasons for this decision: Firstly, the fact that 2019 is the most recent year for which much of the necessary data for the modelling is available in a format that is consistent with previous data. The COVID-19 pandemic has had a significant impact on data collection across many different data sources and the data available from 2020 onwards is not always directly comparable than the data from previous years. Secondly, the pandemic itself has had a huge impact on many aspects of alcohol consumption and drinking behaviour and it is not yet clear to what extent these changes will persist in the longer-term. We explore these issues in chapter 3 of the report, but throughout the rest of the report all modelled results do not attempt to capture these pandemic effects on alcohol consumption or health. The more recent high levels of inflation and the so-called 'cost-of-living crisis' are also not captured in the modelling presented in this report, except for chapter 4 which explores issues around inflation and the MUP threshold.

While this decision is necessary given the nature of the available data, it means that the results presented in this report reflect the impact of policy decisions being taken in 2019, not 2023. Results should therefore be interpreted accordingly, with due consideration given to the circumstances that may have changed in the intervening years.

Methods

TAX-sim is a joint tobacco and alcohol policy model built on the STAPM modelling platform (https://stapm.gitlab.io/index.html). TAX-sim uses components from the Sheffield Alcohol Policy Model - R implementation (SAPM-R) and the Sheffield Tobacco Policy Model (STPM). The TAX-sim model then adds a bespoke pricing policy module that can be used to model the effects of tax and price changes on alcohol and tobacco products, and investigate the interactive and cross-substance effects. TAX-sim also adds bespoke economic outcomes including changes in government and retailer revenues. The STAPM platform, including TAX-sim, SAPM-R and STPM are built in R statistical software (13) and full methodological details of all three models can be found in the relevant technical reports (12,14,15). TAX-sim has been constructed to allow us to estimate the potential health and economic impacts of alcohol and tobacco pricing policies. Although TAX-sim can investigate the impact of alcohol price changes on tobacco-related outcomes, we do not use that functionality in the present work.

Key outcomes estimated by the model include (i) consumption outcomes, including the mean weekly number of units of alcohol consumed, and weekly spending on alcohol products (ii) economic outcomes including mean prices, price distributions, total annual consumer spending, total annual tax revenues to government, and total annual revenue to retailers/industry (iii) health outcomes including total deaths from alcohol-related conditions, hospitalisations, NHS costs of hospitalisations, and years of life lost (YLLs) due to death.

The model is a dynamic micro-simulation which constructs a synthetic population from Scottish Health Survey (SHeS) data, a survey of alcohol and tobacco consumption with a sample that is representative of the Scottish population. It incorporates ongoing trends in the consumption of alcohol and prevalence of smoking in different population subgroups, and incorporates demographic trends based on projected changes in the population. The model iterates in steps of one year until a specified time horizon is reached, and in each year of the simulation new individuals are added at the youngest age in the model (age 18), some individuals die, and others are removed from the model at the maximum age (age 89).

The effects of tax and price policies are modelled by estimating a “treatment” or “intervention” arm in which a policy intervention occurs in a specified “policy effect year”. One arm is modelled for each intervention of interest. Each intervention arm is compared to a “business-as-usual” or “control” arm in which the tax and price policy regime in place the year prior to the policy effect year is maintained indefinitely (including an ongoing escalator of 2% annual real terms increases in tobacco duties).

Tax policy effects on price are modelled by a sequence of calculations performed on price distributions for 10 beverage types that describe the proportion of total sales for each beverage type at different price points. We use separate price distributions for individuals in each of 800 possible population subgroups defined by age category, sex, Scottish Index of Multiple Deprivation (SIMD) quintile[2], smoking status, and drinking status. The first step calculates the “expected” price change due to a tax change – the change in price which would occur if tax changes are passed directly and in full onto the retail price of each product while maintaining the same net revenue to the retailer per unit of product (defined as UK standard units of alcohol). The expected price is then adjusted for tax pass-through using findings from our previous analyses of supermarket and on-trade venue pricing trends (16,17). This captures real-world industry responses to tax changes – some products may over-shift (result in a higher price than the expected price) or under-shift (a lower price than the expected

[2] SIMD quintiles are defined in relation to the total population, not the total *adult* population. Due to differences in the age distribution between quintiles this means that the SIMD quintile groups in the model are not identically sized.

price). Having applied tax pass-through, the new mean price and change in mean price are calculated for all individuals in the model. Price elasticities of demand calculated from British household spending data are then used to estimate the percentage change in consumption of each product in the model from the percentage changes in price (18).

From these changes in consumption, changes in mortality and morbidity are calculated to obtain the health impacts using an epidemiological model drawing on risk functions relating consumption to level of risk from 45 categories of alcohol-related diseases (19), and 52 categories of tobacco-related diseases . Individuals are assigned a relative risk of each alcohol or tobacco related disease according to their current alcohol consumption. The effect of past alcohol consumption on the assigned relative risk is considered in terms of a time-lagged effect past amounts of alcohol consumed (20). The Potential Impact Fraction methodology (21) is then applied to update rates of mortality and morbidity for changes in alcohol consumption between years. First, average relative risks for each disease are computed. Second, the average relative risks are compared between years to compute a ratio - this ratio is an 'impact fraction'. The impact fraction is then multiplied by the rates of mortality and morbidity to give new rates of mortality and morbidity for each alcohol related disease. From the new rates of mortality, individual specific probabilities of death from each alcohol and/or tobacco related cause, and all other causes, are calculated. Based on these individual specific probabilities of death, the model simulates who dies in each year and removes them from the synthetic population.

For each tobacco and/or alcohol related health conditions, hospital admission rates, stratified by age, sex, and SIMD were calculated from individual patient records taken from SMR01 admitted patient care data for Scotland. The model uses unit costs of hospitalisations by condition, age group, sex and SIMD. These costs are derived from the hospital episode-level Healthcare Resource Group reference costs associated with the length of stay in hospital and the procedures applied. We calculate these costs using a single year (2016/17) of English hospital episode statistics data; these English unit costs are assumed to apply to Scotland. Unit costs are inflated to 2019/20 prices using the NHS cost inflation index (22).

From the changes in consumption, TAX-sim also calculates estimates of changes in economic outcomes. The model produces estimates of total annual consumer spending in each year of the simulation by multiplying average weekly consumption units and average price paid per unit in each population subgroup, annualising the resulting weekly spending, and then scaling the synthetic population to the total population using ONS population projection figures. Annual total revenue to government from VAT and duties payable on alcohol is also calculated. As consumption is routinely under-reported in the survey data from which the synthetic population is constructed, this leads to underestimates of the total spending and revenue figures. To account for this, the model applies a scaling factor to the consumption data to calculate the total spending/revenue figures. The scaling factor is constructed by comparing the total duty receipts estimated by the model on the basis of self-reported consumption figures with duty receipts reported by HMRC in the first year of the model simulation.

Key model assumptions and differences from previous reports

Full details of the modelling of alcohol consumption and health outcomes can be found in the SAPM-R technical report (14) and details of the modelling of pricing policies and economic outcomes can be found in the TAX-sim technical report (12). The key assumptions underlying the model and the important differences between this and previous reports are summarised below.

Firstly, there is significant evidence that the COVID-19 pandemic has had a substantial impact on alcohol consumption and alcohol-related harm, with age-standardised alcohol-specific deaths rising by 15.6% in Scotland in 2020 compared to 2019, followed by a further 4.2% increase in 2021 (23). The mechanisms underlying this increase may be complex and are not yet fully understood (24), but may include contributions from both changes in alcohol consumption and changes in the accessibility, nature or performance of NHS and specialist alcohol treatment services. In light of this complexity, although this report uses 2019 as the baseline year for all modelling, we do not attempt to model the impacts of the pandemic on alcohol consumption or health and alcohol consumption is assumed to continue on pre-pandemic trends in the absence of policy intervention. The exception to this is in chapter 3, where we examine changes in alcohol consumption during the pandemic and the implications of these changes for future alcohol-related health.

As stated above, our baseline setting is the year 2019, with a 50p MUP already in place, and levels of alcohol consumption and harm that reflect the initial impacts of MUP having been introduced in 2018. The control arm of our model (i.e. our counterfactual scenario) is that this 50p MUP remains in place, with the 50p threshold being uprated each year in line with inflation (the Consumer Price Index (CPIH)[3]). When modelling changes to the MUP threshold we assume these changes are introduced at the start of 2019 and that any new threshold is also uprated in line with CPIH.

There have been notable changes in alcohol consumption patterns in Scotland in recent years, with large reductions in the drinking of younger adults which have been offset, to some extent, by increases in drinking among older age groups (25). Although TAX-sim has the capacity to incorporate assumptions about how these trends may continue into the future, the magnitude of recent trends makes such forecasting subject to large uncertainty (26). As a result, we make the conservative assumption that the age-patterns in alcohol consumption will remain at 2019 levels (e.g. the consumption distribution of 40-year old men from the most deprived areas in future years will be the same as the consumption distribution of 40-year old men from the most deprived areas in 2019), in the absence of any policy impacts, across future modelled years. As a consequence of this decision, changes in alcohol consumption in the control arm in the model are possible, but these are driven only by changes in the age distribution of the population, rather than changes over time in the alcohol consumption of any given age group.

TAX-sim also explicitly models individuals switching between being drinkers and non-drinkers, whereas our previous modelling reports using SAPM did not account for changes in abstention rates over time. This switching is modelled by having separate sets of price elasticities governing whether individuals are drinkers or not (i.e. whether an increase in price leads them to stop drinking a beverage type entirely) and the extent to which consumption changes among drinkers (18). However, note that when price policy effects are applied, they

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[3] Note that although the MUP threshold is estimated to increase in line with CPIH, we assume alcohol prices increase each year in line with RPI – to ensure consistency with UK government assumptions in relation to alcohol duty. This difference has only a small impact on overall model results, as examined in the Sensitivity Analyses at the end of Chapter 1.

act separately to switch people between consumption and non-consumption of each the ten alcoholic beverage products modelled. Thus, in order for someone to give up drinking entirely (i.e. become an abstainer) due to a pricing policy effect, they would have to stop consuming each of the products that they currently consume due to the effects of changes in product price.

Another key difference between SAPM and TAX-sim is the incorporation of smoking into the STAPM framework, as discussed above. Although TAX-sim has been developed with the capacity to appraise cross-substance policy impacts (e.g. the impact of tobacco policies on alcohol consumption and vice versa), for the present project we have removed these effects from the model. As a result, the estimated impacts of the modelled alcohol policies are only their direct impacts on health through changes in alcohol consumption and do not include indirect health impacts through changes in smoking rates. However, TAX-sim does still model smoking dynamics, including underlying trends in smoking rates, which have been falling in Scotland for many years. As a result, the model will still capture the resulting improvements in overall population health resulting from reduced smoking rates over time, which will in turn impact the estimated future population demographics in the model (e.g. more people living to older ages as reduced prevalence of smoking reduces the number of premature smoking-attributable deaths).

Additionally, the epidemiological component of TAX-Sim which models the health and economic impacts of changes in alcohol consumption, operates on a more individualised basis than the cohort-based approach used in previous modelling work with SAPM. The most important consequence of this is to address a limitation inherent in cohort-based approaches known as 'mortality selection' (27). Briefly, this arises when modelling a cohort in which there is significant variation in risk between individuals, driven by differences such as heterogeneous alcohol consumption. In an individual model, such as TAX-Sim, the individuals with the greatest risk (e.g. the heaviest drinkers) are at greatest risk of dying, whereas in a cohort-based model, such as SAPM, risk is pooled and shared equally across the entire cohort group. This means that, all else being equal, an individual-level model will correctly reflect the fact that alcohol consumption and therefore associated risks of harm will *fall* over time, as the heaviest drinkers are more likely to die earlier, while a cohort model will estimate that risks of harm will remain constant, on average, as all drinkers in the group are equally likely to die within any given time frame. The magnitude of this limitation depends on the degree of heterogeneity within cohort groups. This was limited in SAPM by separating cohorts by age, sex, deprivation and drinking level, but some variation in alcohol consumption within groups still remained.

Finally, due to the different structures of STAPM and TAX-sim, there are some important differences in the way that some model results should be interpreted in the present report compared to previous reports based on SAPM analyses (e.g. (4). These differences are highlighted where they arise throughout the text of this report, however three of the most important differences are as follows:

Firstly, the dynamic simulation approach used within TAX-sim means that the model captures the extent to which policy changes lead to drinkers moving between drinker groups (e.g. hazardous drinkers who reduce their consumption below 14 units/week and therefore are reclassified as moderate drinkers). In contrast, individuals did not move between drinker groups in SAPM and their drinker groups remained fixed irrespective of any future changes in their alcohol consumption. Readers should therefore not compare drinker group-specific results between the two models. In contrast, socioeconomic position, defined using SIMD quintiles, is determined on the basis of place of residence. As we do not model internal (or international) migration within the model, individuals do not transition between SIMD quintiles and therefore this distinction does not apply.

Secondly, the health outcomes reported in SAPM represented changes in the number of *alcohol-attributable* deaths or hospital admissions (i.e. those outcomes that would not have occurred in the absence of alcohol). These deaths and admissions were sometimes separated into health outcomes that were acute (i.e. associated with intoxication) or chronic (i.e. associated with alcohol consumption over a sustained period of time), and either wholly alcohol-attributable (i.e. from conditions caused solely by alcohol) or partially alcohol-attributable (i.e. from conditions for which alcohol is one of several risk factors). Under this approach a policy which reduces alcohol consumption might avert deaths from, for example, liver disease, but some of those same individuals who no longer die from liver disease may subsequently die from other causes within the time horizon of the model. A focus on only alcohol-attributable health outcomes would mean that there is a distinction between whether this future, delayed, death occurs from a cause linked to alcohol, or not. If it is, then an alcohol-attributable lens would consider this to be a death postponed, but not averted, while if it is from an unrelated cause it would be viewed as a death averted. Ultimately the aim of effective public health policy is to improve population health, in which case all deaths postponed are regarded as equally valuable, irrespective of the precise nature of the eventual cause of death. We have chosen to take a new approach in TAX-sim and focus on changes in *all-cause* mortality and additionally present estimated changes in Years of Life Lost (YLLs) to premature death, which capture the benefits of extending lifespan within the time horizon of the model. For selected analyses we also present estimates of changes in alcohol-specific mortality, in order to enable more direct comparison with other published evidence, such as Public Health Scotland's evaluation of the impact of MUP (28).

Finally, whereas in previous reports the key comparison for health outcomes is between pre- and post-intervention scenarios (i.e. comparing alcohol consumption and harm before and after a policy is implemented), in the present report we instead compare outcomes between a simulated control arm (where a 50p/unit MUP is maintained in perpetuity) and each modelled policy. This ensures that the results presented here reflect the dynamic nature of TAX-sim, and represent the best estimate of the marginal impact of each policy compared to a scenario where the policy is not enacted.

Notes on data

The data used in TAX-sim is consistent with data used in SAPM, updated to the latest available years, with a few notable exceptions. Most significantly, individual-level hospital admissions data has been obtained directly from Public Health Scotland, allowing us to undertake more detailed analysis of these figures than has previously been possible. As a result of this the baseline analysis uses hospital admissions as defined by the 'narrow measure' whereby an admission is allocated to an alcohol-related condition only on the basis of the primary diagnosis or any external causes (29). This is in contrast with previous SAPM analysis which have used the 'broad measure' which uses alcohol-related diagnosis codes in any diagnostic position. In general the 'narrow measure' *underestimates* the total number of hospital admissions which are attributable to alcohol, however using it in the present analyses means that we can have high confidence that all admissions attributed to alcohol consumption are genuinely alcohol-attributable, rather than alcohol playing an incidental role in the admission. See (29) for full details and a discussion of the relative merits of both approaches.

Linked to this change in the measure of hospital admissions, TAX-sim also takes a different approach to hospital costs from SAPM. In SAPM costs were estimated for the impact of policies on healthcare costs across the whole of the health service, including inpatient admissions, A&E care, ambulance callouts and primary care (1). In TAX-sim, we have used more recent data from 2016/17, inflated to 2019 prices, to estimate the mean costs associated with each modelled health condition by age group, sex and SIMD, however this is only available for inpatient hospital admissions. As such, the estimates of NHS costs associated with particular scenarios in this report will be smaller than equivalent cost estimates from SAPM, as they are capturing a smaller proportion of the overall healthcare cost burden of alcohol, albeit using more recent NHS data.

Chapter 1 - Modelling changes to the current MUP threshold

Introduction

Scotland introduced a Minimum Unit Price of 50p/unit of alcohol in May 2018. The MUP threshold has remained at this level since its introduction. In this chapter we appraise the potential impact of the following options for changing the threshold: i) Removing it entirely; ii) Reducing it to 40p or 45p/unit, or iii) increasing it to 55p, 60p, 65p, 70p, 75p or 80p/unit. In each case the change would take effect from 2019 as this is the baseline year in the model, being the most recent year for which data unaffected by the COVID-19 pandemic is available. For each change in the MUP threshold, we present modelled estimates of the resulting changes in alcohol consumption, consumer spending on alcohol, revenue to the exchequer and retailers, hospital admissions for alcohol-related health conditions, all-cause mortality and Years of Life Lost (YLLs) to premature death as well as costs to the NHS associated with hospital admissions. Results are presented at the population level as well as, where appropriate, split by drinker group (moderate, hazardous and harmful drinkers) and by SIMD quintiles.

Methods

MUP Modelling methods

The baseline (i.e. 2019) distribution of prices paid for alcohol in Scotland is derived from data from the Living Cost and Food Survey (LCFS), an individual-level diary survey in which respondents report all food and drink purchased over a 2-week period, including details on what was purchased, where, in what quantities and at what price. In line with previous modelling studies (4), the prices reported in the LCFS are calibrated to align with observed sales price distributions, in this case using data reflecting sales in Scotland in 2019 published by Public Health Scotland (30). In order to allow for the possibility of the MUP level reducing over time, we also construct a second, 'equilibrium' price distribution. This distribution is constructed similarly, but using data from prior to the introduction of MUP in May 2018, inflated to 2019 prices. This equilibrium distribution therefore represents the price distribution we would expect in any given year *in the absence of MUP* and at all price levels above the MUP threshold the two distributions are identical. The equilibrium distribution, along with all current prices in the model are expressed in real terms using the Retail Price Index (RPI) measure of inflation. We use RPI for this purpose as this is the measure used by the UK government to set inflation-indexed duty rates for alcohol. This is also consistent with the fact that RPI is used in the estimation of price elasticities and tax pass-through coefficients which are used in the modelling. All prices in the model across all time points are presented in 2019 RPI terms.

The MUP for a given year in the model is also input in 2019 real-terms prices according to RPI. Data on all inflation indices used up to 2022 are obtained from historic data from the Office for National Statistics (31). Inflation indices from 2023-2030 are taken from Office for Budget Responsibility (OBR) forecasts and/or align with assumptions about future inflation used by the OBR in their forecasts of long term economic determinants (32). As OBR only publish forecasts of CPI and not CPIH, we assume that future CPIH will align with CPI. These estimates have not been published beyond 2030, therefore from that point onwards we assume that RPI and CPIH inflation converge at 2% per year.

Within each year of the model, if the real-terms value of the MUP threshold rises, then all prices in the observed price distribution which fall below the new threshold are increased to the level of the new threshold. This may occur either due to an explicit increase in the threshold, or if inflation leads the MUP threshold to rise faster than alcohol prices in real terms.

If the MUP threshold falls year-on-year, or is removed entirely then the equilibrium price distribution is used in order to estimate the proportion of products sold at the previous threshold which will reduce further in price towards the new, lower, threshold. For example, if the MUP threshold falls from 50p/unit to 45p and the observed price distribution shows that 30% of alcohol was being sold at exactly 50p/unit prior to this fall then information on the proportion of alcohol being sold in the equilibrium price distribution for no more than 45p/unit, between 45 and 50p/unit and for 50p/unit is used to apportion the 30% between these levels in the updated observed distribution. In the case where MUP is removed entirely the observed distribution will become equal to the equilibrium distribution. As with an increase, the MUP may fall for one of two reasons. Firstly, there could be a deliberate policy decision to either reduce or remove the MUP entirely. Secondly, if the MUP is allowed to fall in real terms over time, rather than adjusting it to account for inflation.

For each subgroup in the model, the average price paid for each product is calculated for the current and previous year's observed price distributions, and the percentage change in mean price calculated. The price elasticity matrix is then applied to the percentage changes in price to obtain proportionate changes to drinker vs. non-drinker status and conditional consumption among drinkers for each beverage type. These effects are in turn used to adjust whether or not an individual in the simulation is a drinker or an abstainer (i.e. a non-drinker for all 10 beverage type), and then for those that are drinkers, the amount consumed.

Scenarios

The approach of TAX-sim is to estimate the control (or "business as usual") arm against which each intervention is compared. All models are initialised in 2017, prior to the introduction of the 50p MUP in 2018, and the simulation runs until 2040. For the additional scenarios modelled here, 2019 is the "policy effect year" - the year in which policy interventions are applied, and therefore the first year in which the intervention arms deviate from the control arm. All modelled arms also maintain the current tax system from the policy effect year onwards, i.e. the duty structure and rates remain unchanged in real terms from their 2018 values for the duration of the model.

As all alcohol prices in the model are assumed to rise in line with RPI the fact that we assume the MUP threshold will rise in line with CPIH means that we are typically assuming the real-terms MUP level is decreasing over time as RPI inflation is typically higher than CPIH.

We have modelled nine intervention scenarios. Each scenario represents a hypothetical change to the cash-terms value of the MUP threshold in 2019. In each scenario the same CPIH uprating is applied to the new MUP level from 2020 onwards as in the control arm. The comparisons between the intervention scenarios and the control arm therefore represent the marginal impact of the change in MUP in 2019 compared to retaining a 50p MUP.

Sensitivity analyses

In order to establish the extent to which alternative assumptions or model inputs might influence our results we have undertaken three sensitivity analyses (SAs). In Sensitivity Analysis 1 (SA1) we assume that MUP is uprated each year in line with RPI instead of CPIH. In SA2 we replace the price elasticities estlimated by Pryce et al. (18) with those estimated by Meng et al. (33), which were used in previous modelling freports for the Scottish Government (4). In the SA3 we account for the fact that surveys usually underestimate alcohol consumption when compared to data on the volume of alcohol sold (34,35). We do this by 'upshifting' the baseline alcohol consumption data in the model so that it covers 80% of total alcohol sales, in line with the approach used by the Global Burden of Disease study (36). This approach is comparable with that used in a sensitivity analysis in the previous Scottish modelling report (4). For all sensitivity analyses we use an increase in the MUP threshold from 50p to 60p/unit as an illustrative policy scenario.

Main findings

Baseline (2019) data

At baseline, there are 3.6million drinkers in Scotland, consuming an average of 12 units of alcohol per week (roughly equivalent to 6 pints of standard beer, or one and a quarter bottles of wine) at a cost of £28. Across all adults, including those who do not drink alcohol, this equates to an average consumption of 9.9 units per week, costing £23 . These figures (for drinkers only) are presented, separated by drinker group in Table 1, showing that 71% of drinkers in Scotland are moderate drinkers, meaning that they consume within the UK Chief Medical Officers' low risk drinker guidelines of 14 units per week. 25% of drinkers are hazardous drinkers, meaning men who exceed the guidelines, but drinker fewer than 50 units/week and women who drink fewer than 35 units, while 4% of drinkers drink at harmful levels exceeding these thresholds.

	Population	Moderate	Hazardous	Harmful
Number of drinkers	3,568,079	2,546,719	877,934	143,426
Proportion of all drinkers	100.0%	71.4%	24.6%	4.0%
Mean consumption (units/drinker/week)	12.0	4.8	24.5	63.8
Mean spending on alcohol (£/drinker/week)	£27.92	£17.03	£48.87	£92.97

Table 1: Baseline alcohol consumption and spending by drinker group

Table 2 presents the same figures broken down by SIMD quintile, showing that the rate of abstention among adults (aged 18+) in Scotland is twice as high in the most deprived, compared to the least deprived quintile – 24% vs. 12%. Drinkers in the least deprived quintile also drink more, on average – consuming over 13.6 units per week compared to an average of 11.5 in the most deprived quintile.

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Number of drinkers	804,085	770,877	713,598	665,259	614,260
Proportion of all drinkers	22.5%	21.6%	20.0%	18.6%	17.2%
Abstention Rate	12.1%	14.2%	17.5%	20.2%	23.9%
Mean consumption (units/drinker/week)	13.6	11.4	12.1	11.2	11.5
Mean spending on alcohol (£/drinker/week)	£31.53	£28.07	£27.42	£25.88	£25.80

Table 2: Baseline alcohol consumption and spending by SIMD quintile

The implications of these figures are illustrated in Figure 1. People drinking above the guidelines make up less than a quarter (23.6%) of the adult population of Scotland, but consume over two thirds of all of the alcohol drunk (71.4%) and account for over half (56.5%) of all spending on alcohol. More starkly, the heaviest-drinking 3.3% of the population drink 21.3% of all alcohol and spend 13.4% of all of the money spent on alcohol in the country.

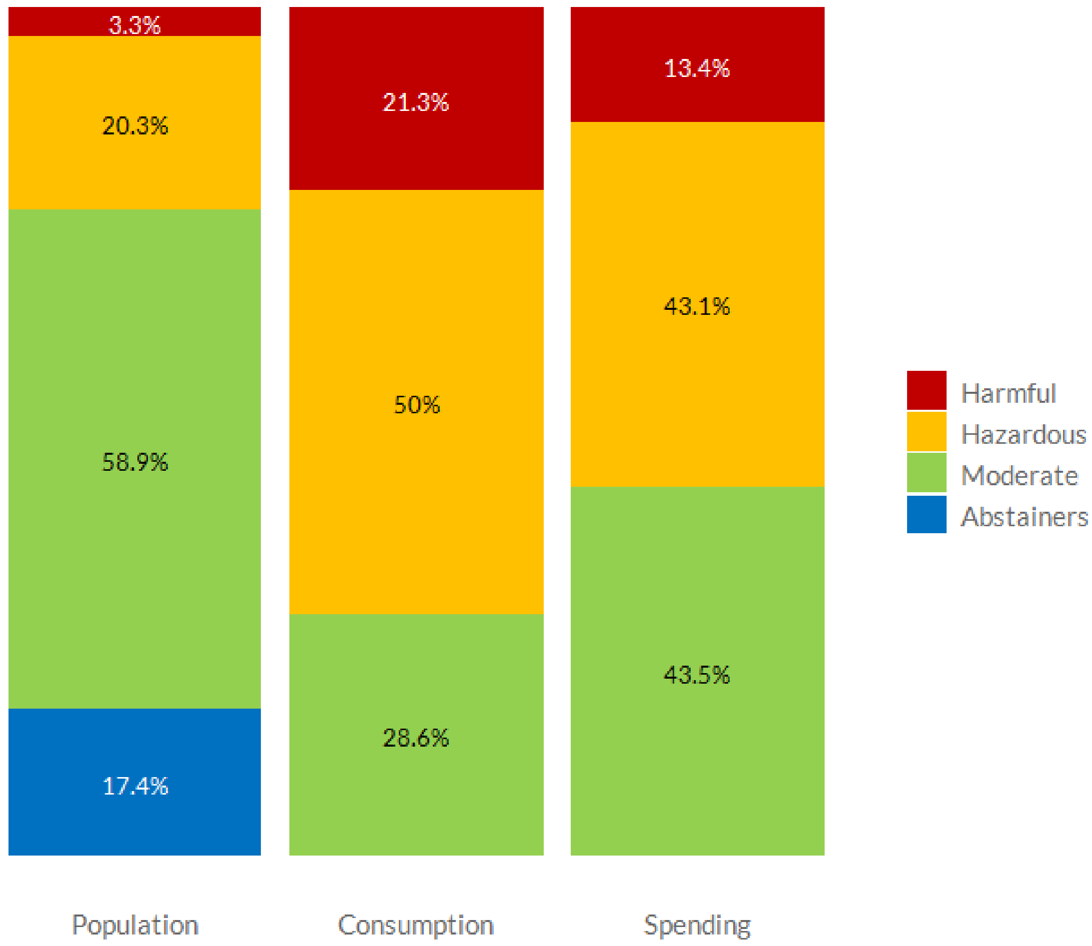

Figure 1: Distribution of the population, total alcohol consumption and total spending on alcohol between drinker groups at baseline

The equivalent graph for SIMD quintiles is shown in Figure 2, highlighting that not only are there fewer drinkers in the most deprived group, but that they consume and spend proportionately less than drinkers in less deprived areas. Note that the population proportions differ between quintiles as we are considering only adults and the proportion of under 18s in each SIMD quintile varies.

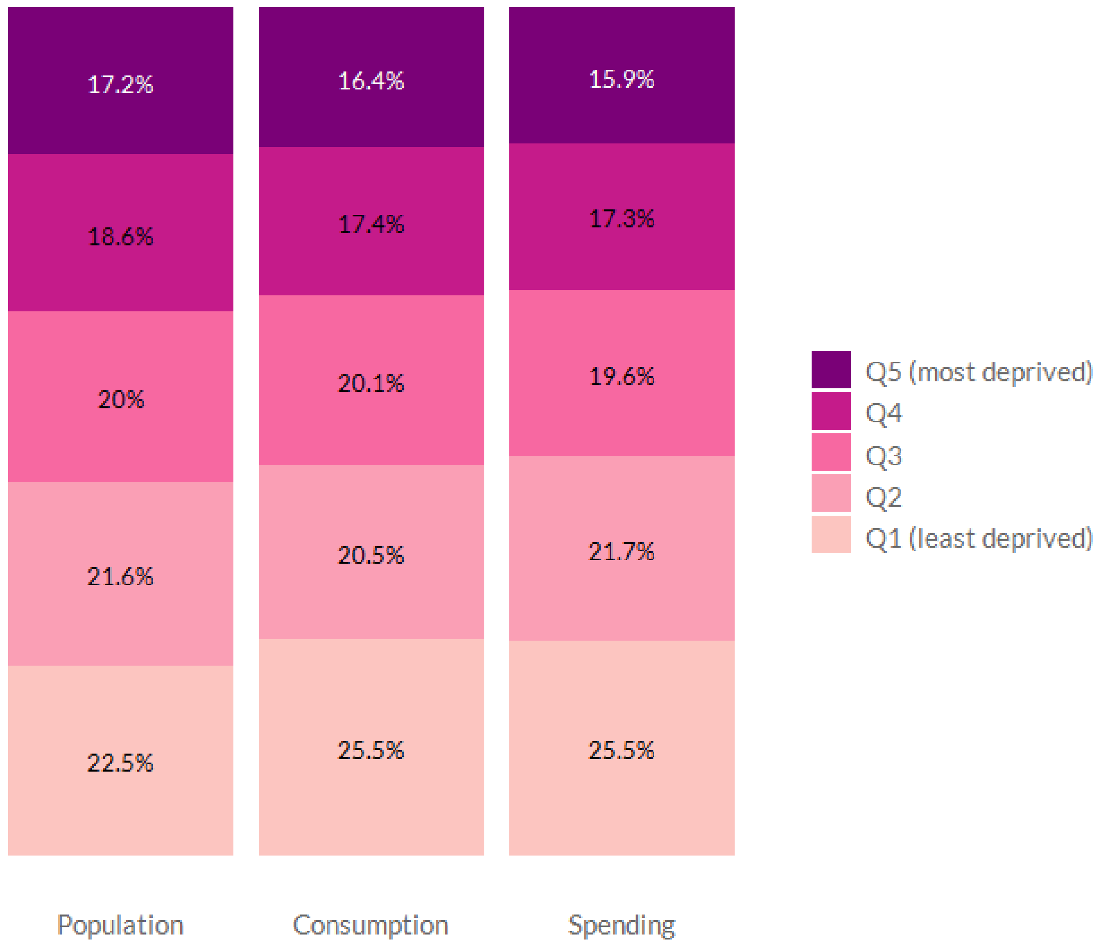

Figure 2: Distribution of the population, total alcohol consumption and total spending on alcohol between SIMD quintiles at baseline

Underlying these different patterns in alcohol consumption, and crucial to the impact of any potential future alcohol policy changes, are differences between population groups in terms of the type of alcohol that they consume (beer, cider, wine, spirits or Ready-To-Drinks (RTDs: pre-mixed alcoholic drinks such as cans of spirits with mixer or alcopops)) and where they purchase/consume that alcohol (either in the on-trade (pubs/bars/nightclubs/restaurants) or the off-trade (shops where alcohol is bought for consumption elsewhere)). Figure 3 shows the differences between drinker groups in beverage preferences, illustrating that hazardous and harmful drinkers consume more beer and cider and less spirits than moderate drinkers (as a proportion of their total consumption, heavier drinkers still consume far more spirits on average in absolute terms).

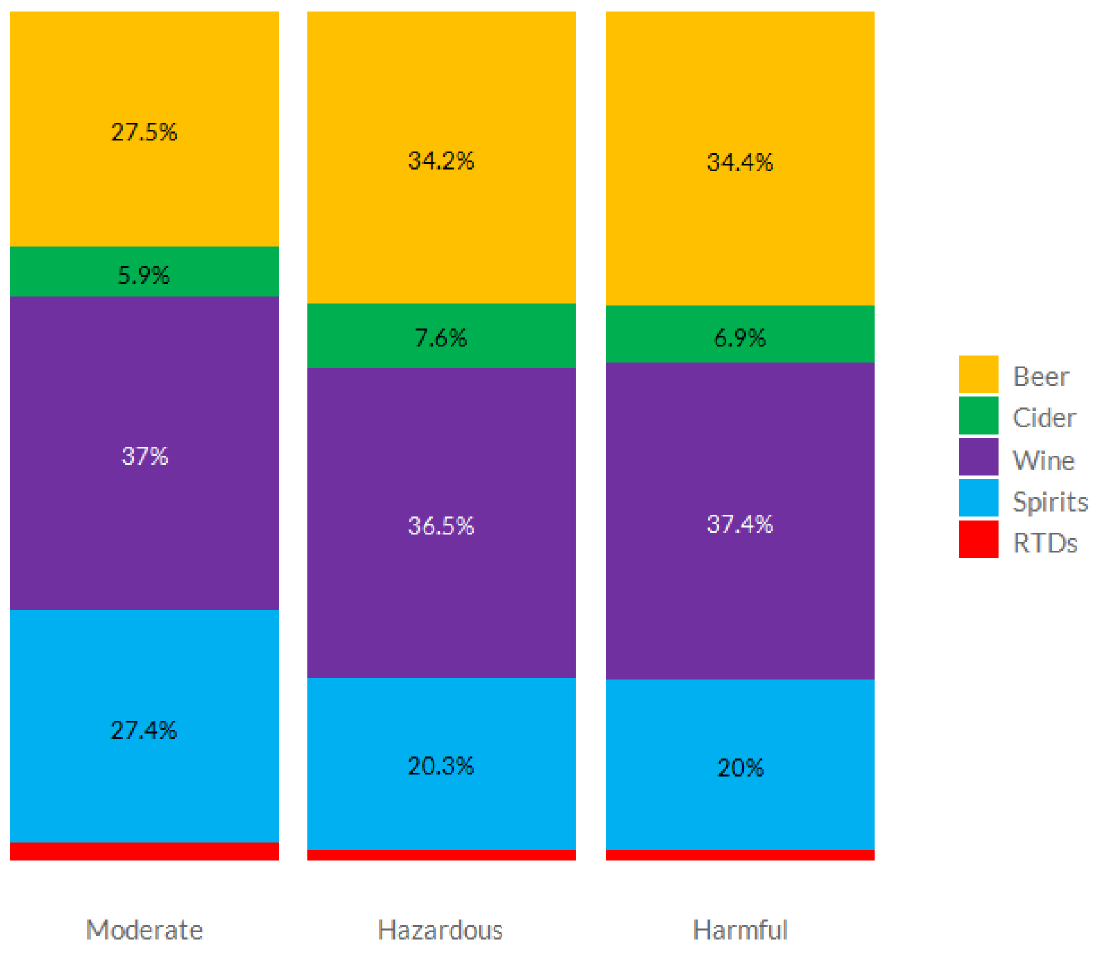

Figure 3: Baseline alcohol consumption by beverage type and drinker group

The equivalent data for SIMD quintiles is shown in Figure 4, demonstrating that the most deprived quintile consume a substantially higher proportion of their alcohol as beer, cider and spirits and lower proportions as wine compared to the least deprived quintile.

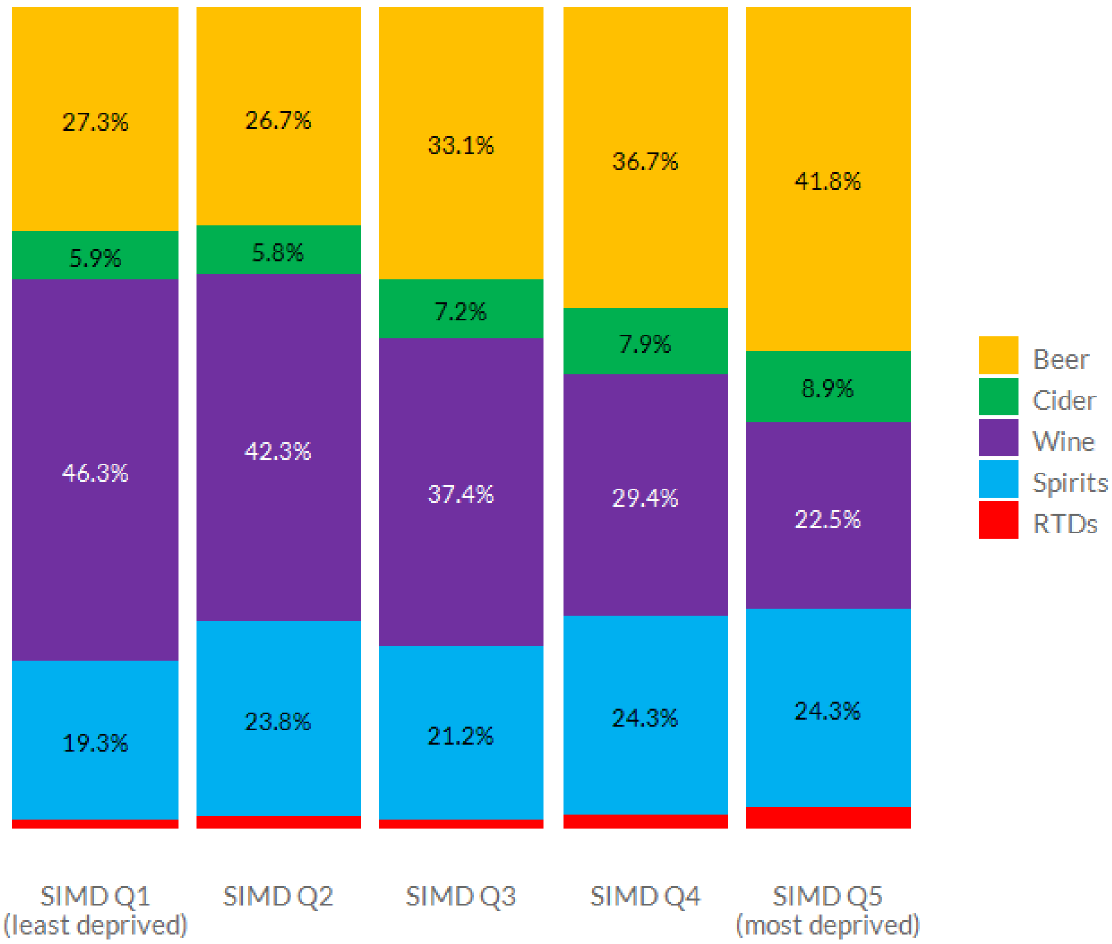

Figure 4: Baseline alcohol consumption by beverage type and IMD quintile

A breakdown of alcohol consumption by channel (on- and off-trade) and drinker group is shown in Figure 5, and by SIMD quintile in Figure 6. These figures illustrate a large difference in where alcohol is purchased between drinker groups, with moderate drinkers splitting their alcohol consumption almost equally between the on- and off-trades, while harmful drinkers purchase only one sixth of their alcohol in the on-trade. This difference is critical to the impact of alcohol pricing policies, particularly MUP, as off-trade alcohol tends to be considerably cheaper than alcohol bought in the on-trade. In contrast, there is very little difference in the proportion of alcohol bought in the on- and off-trades between SIMD quintiles, with all quintiles buying around two-thirds of their alcohol in the off-trade.

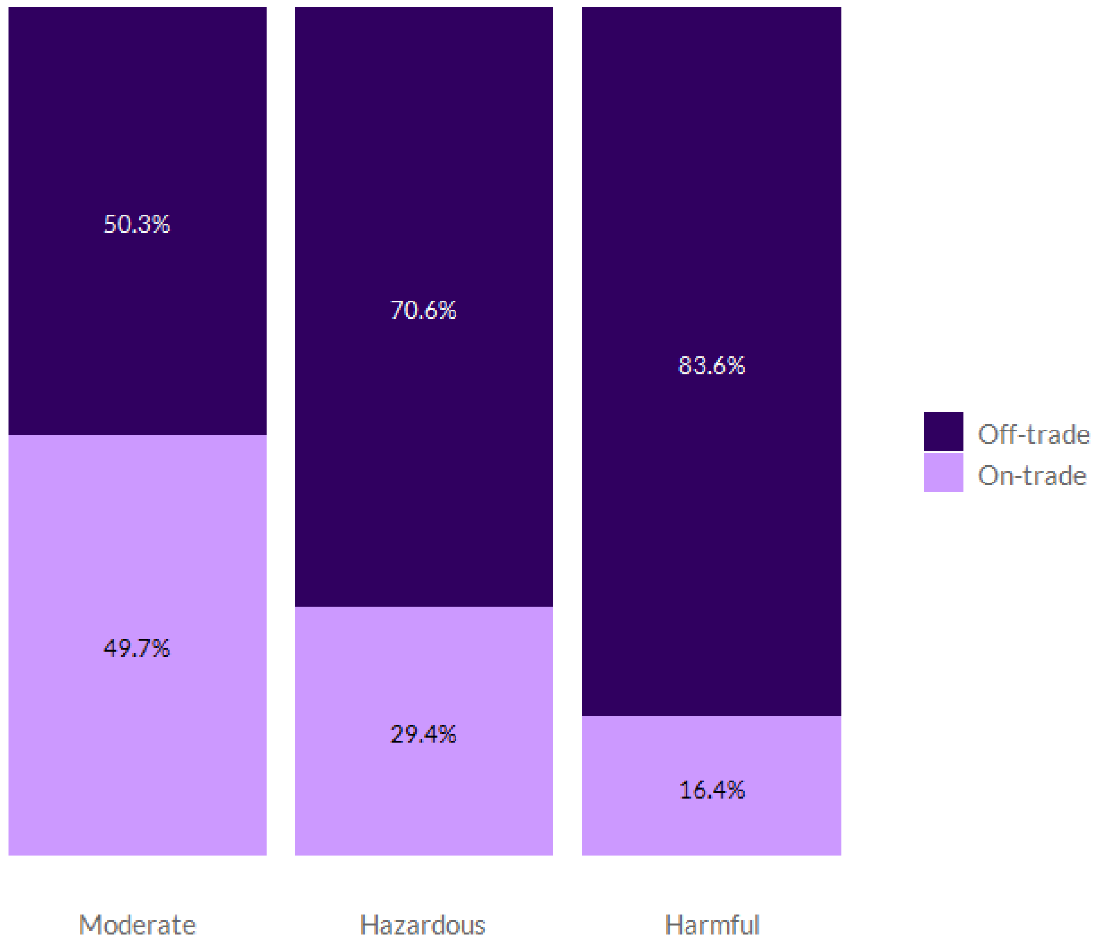

Figure 5: Baseline alcohol consumption by channel and drinker group

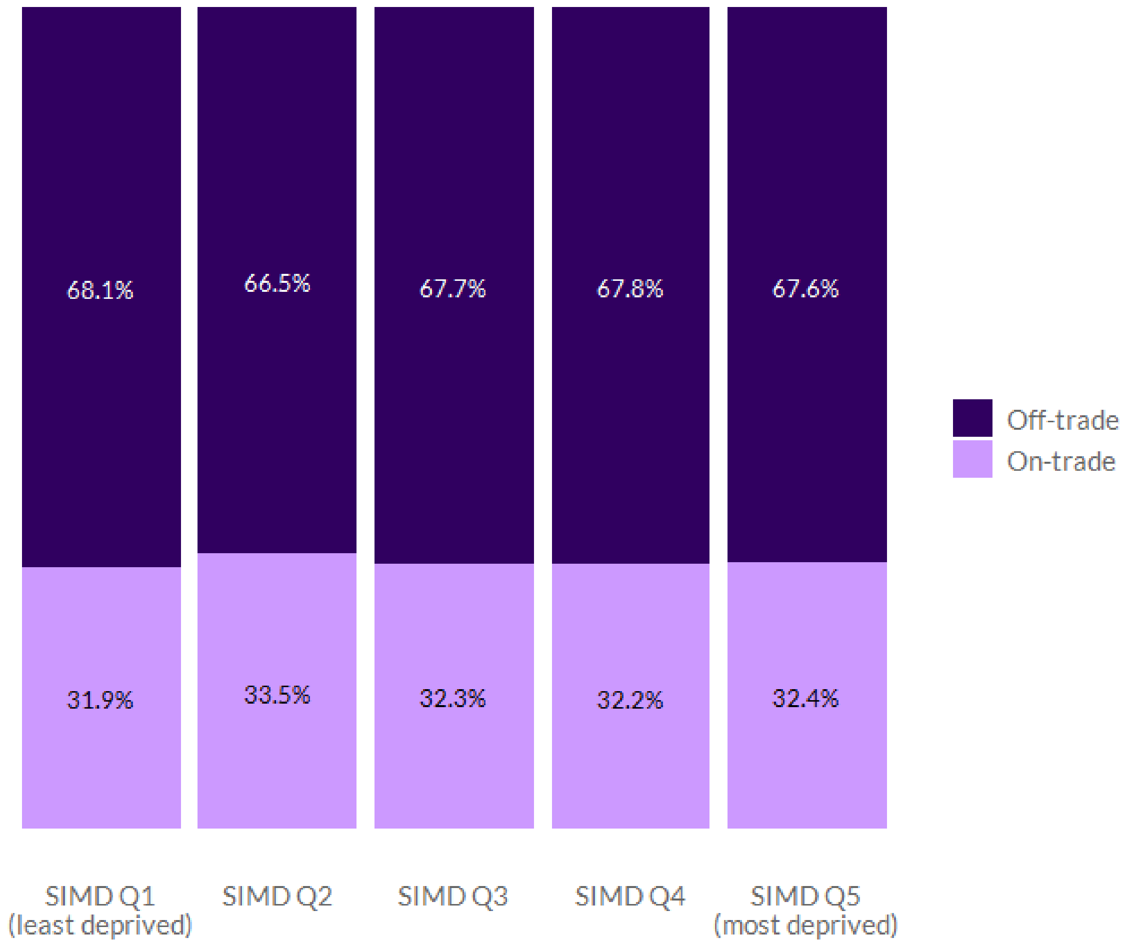

Figure 6: Baseline breakdown of alcohol consumption by price band across drinker groups and SIMD quintile

The consequences of these differences in purchasing preferences for the average prices paid, and the underlying price distributions, between different drinker and deprivation groups are presented in Table 3 and Table 4 respectively. These tables demonstrate that hazardous and harmful drinkers buy cheaper alcohol, as do drinkers from more deprived groups, but that the price gradient across drinker groups is substantially steeper than across SIMD quintiles. This is despite the effect of MUP, which has reduced but not eliminated differences in prices paid between moderate and harmful drinkers.

	Population	Moderate	Hazardous	Harmful
All alcohol	£1.30	£1.91	£1.14	£0.83
On-trade alcohol	£2.71	£3.09	£2.41	£2.12
Off-trade alcohol	£0.63	£0.66	£0.63	£0.60
Beer	£1.13	£1.35	£1.11	£0.92
Cider	£0.92	£1.05	£0.91	£0.77
Wine	£1.05	£1.29	£1.01	£0.79
Spirits	£1.75	£2.86	£1.31	£0.75
RTDs	£1.69	£1.88	£1.60	£1.46

Table 3: Baseline average prices paid for alcohol

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
All alcohol	£1.31	£1.35	£1.28	£1.29	£1.26
On-trade alcohol	£2.72	£2.77	£2.67	£2.71	£2.65
Off-trade alcohol	£0.65	£0.64	£0.63	£0.62	£0.62
Beer	£1.15	£1.19	£1.13	£1.10	£1.09
Cider	£0.93	£0.96	£0.92	£0.89	£0.88
Wine	£1.08	£1.09	£1.02	£1.00	£0.96
Spirits	£1.82	£1.79	£1.75	£1.71	£1.65
RTDs	£1.75	£1.73	£1.75	£1.69	£1.57

Table 4: Baseline average prices paid for alcohol by SIMD quintile

Further detail on the difference in prices paid between different population groups is given in Table 5 and illustrated in Figure 7. This shows that 42% of alcohol sold in Scotland is sold for less than 60p/unit, but only 28% of moderate drinkers' purchases fall below this threshold compared to 58% of harmful drinkers'. As with the mean price data in Table 4, the differences between SIMD quintiles are less pronounced, but those in more deprived groups do buy more alcohol below 60p and 70p/unit than those in less deprived groups.

	Proportion of alcohol purchased for less than:		
	60p/unit	70p/unit	80p/unit
Population	42.4%	51.9%	58.1%
Moderate	27.8%	35.1%	40.5%
Hazardous	44.0%	54.0%	60.6%
Harmful	58.2%	69.6%	75.9%
SIMD Q1 (least deprived)	40.1%	50.2%	57.2%
SIMD Q2	39.8%	49.4%	56.1%
SIMD Q3	42.7%	52.4%	58.7%
SIMD Q4	44.6%	53.7%	59.5%
SIMD Q5 (most deprived)	46.3%	54.9%	60.1%

Table 5: Baseline proportions of alcohol purchased below selected price thresholds

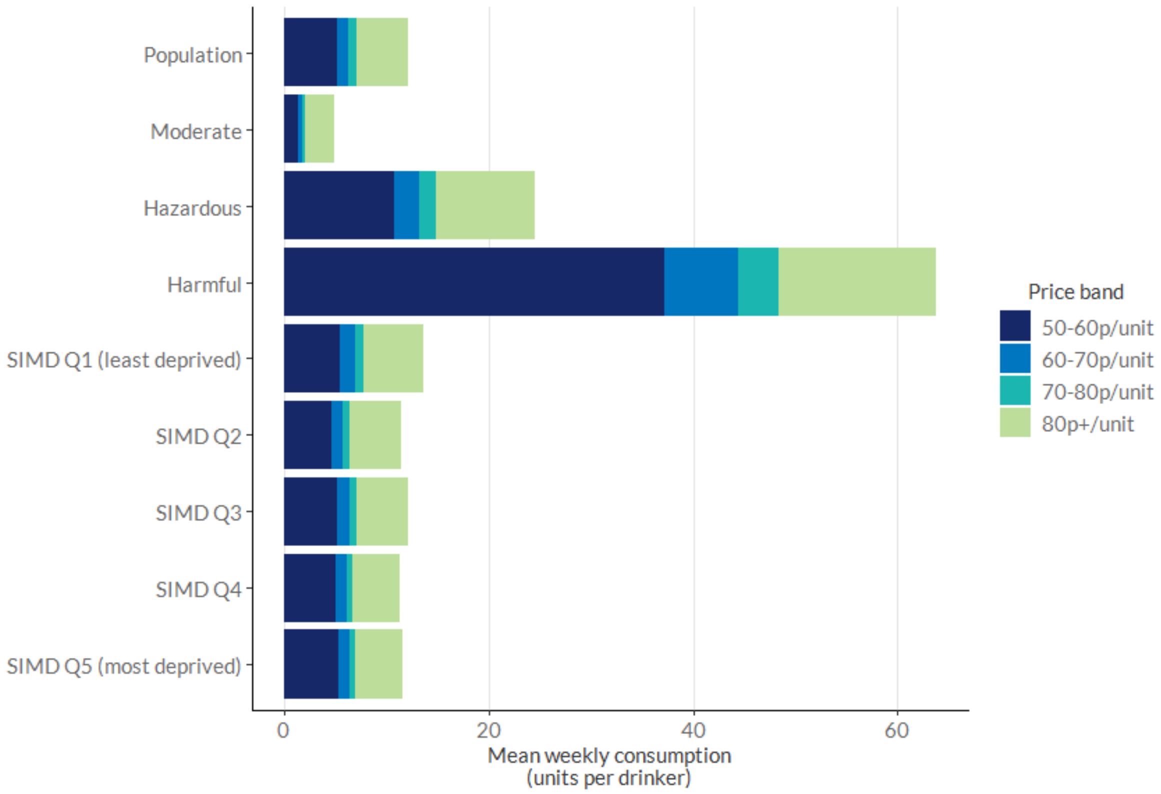

Figure 7: Baseline alcohol consumption by channel and SIMD quintile

Moving onto the impact of this alcohol consumption on population health - Table 6 gives the estimated total number of deaths, hospital admissions and Years of Life Lost (YLLs) which are attributable to alcohol in 2019. The table also includes the number of 'alcohol-specific' deaths - those from conditions which are wholly-attributable to alcohol. Note that the alcohol-specific figures here differ slightly from the alcohol-specific mortality figures published by National Records of Scotland for 2019 (37). This is as a result of the baseline health data in the model making use of data pooled across multiple years to reduce statistical noise when disaggregating by age, sex, deprivation quintile and cause of death. These figures highlight the substantial burden that alcohol continues to place on the population and healthcare services in Scotland, with over 1,200 deaths, 21,700 hospital admissions and almost 42,300 years of life lost to premature mortality each year as a result of alcohol consumption.

When we break these figures out by drinker group, we can see that alcohol is estimated to *reduce* the number of deaths overall in moderate drinkers. This is as a result of the putative protective effects of drinking for some health outcomes, most notably cardiovascular disease (see (19) for full details). Whether these protective effects represent genuine biological impacts of moderate alcohol consumption, or are methodological artefacts that arise due to limitations in the epidemiological studies that identify them remains a disputed topic in alcohol epidemiology (see for example (38–40)). Whilst we make the conservative assumption that these effects are genuine, significant caution should be exercised in interpreting these numbers. Note that these protective effects also mean that it is inappropriate to take the number of YLLs and divide this by the number of deaths to estimate the mean number of YLLs per death due to alcohol, as the net number of deaths conceals the fact that more deaths may have been caused by drinking, while some may also have been averted.

As may be expected, alcohol-attributable harms are much greater in heavier drinking groups, particularly when we account for their relatively smaller sizes by calculating rates per 100,000 drinkers.

	Population	Moderate	Hazardous	Harmful
Annual alcohol-attributable deaths	1,220	-165	795	590
Annual alcohol-attributable deaths per 100,000 drinkers	34	-6	91	411
Annual alcohol-specific deaths	911	27	574	311
Annual alcohol-specific deaths per 100,000 drinkers	26	1	65	216
Annual alcohol-attributable hospital admissions	20,700	2,876	11,276	6,549
Annual alcohol-attributable hospital admissions per 100,000 drinkers	580	113	1,284	4,566
Annual YLLs to alcohol	42,295	-863	25,116	18,042
Annual YLLs to alcohol per 100,000 drinkers	1,185	-34	2,861	12,579

Table 6: Baseline alcohol-attributable health harms by drinker group

The equivalent baseline alcohol-attributable harms across SIMD quintiles are presented in Table 7. This shows that, although more deprived groups are less likely to drink and consumer less alcohol on average than more deprived groups if the do so, rates of alcohol-attributable harm are much higher in more deprived groups. This phenomenon is widely referred to as the 'alcohol harm paradox' (41,42). Overall, the alcohol-attributable mortality rate and the rate of YLLs to alcohol in the most deprived quintile is more than times higher than the least deprived quintile.

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Annual alcohol-attributable deaths	135	149	221	279	436
Annual alcohol-attributable deaths per 100,000 drinkers	17	19	31	42	71
Annual alcohol-attributable hospital admissions	3,216	3,048	3,739	4,415	6,282
Annual alcohol-attributable hospital admissions per 100,000 drinkers	400	395	524	664	1,023
Annual YLLs to alcohol	4,365	5,129	7,775	9,906	15,119
Annual YLLs to alcohol per 100,000 drinkers	543	665	1,090	1,489	2,461

Table 7: Baseline alcohol-attributable health harms by SIMD quintile

These differences are illustrated in Figure 8, which shows the joint gradients in the alcohol-attributable mortality rate across both drinker groups and SIMD quintiles.

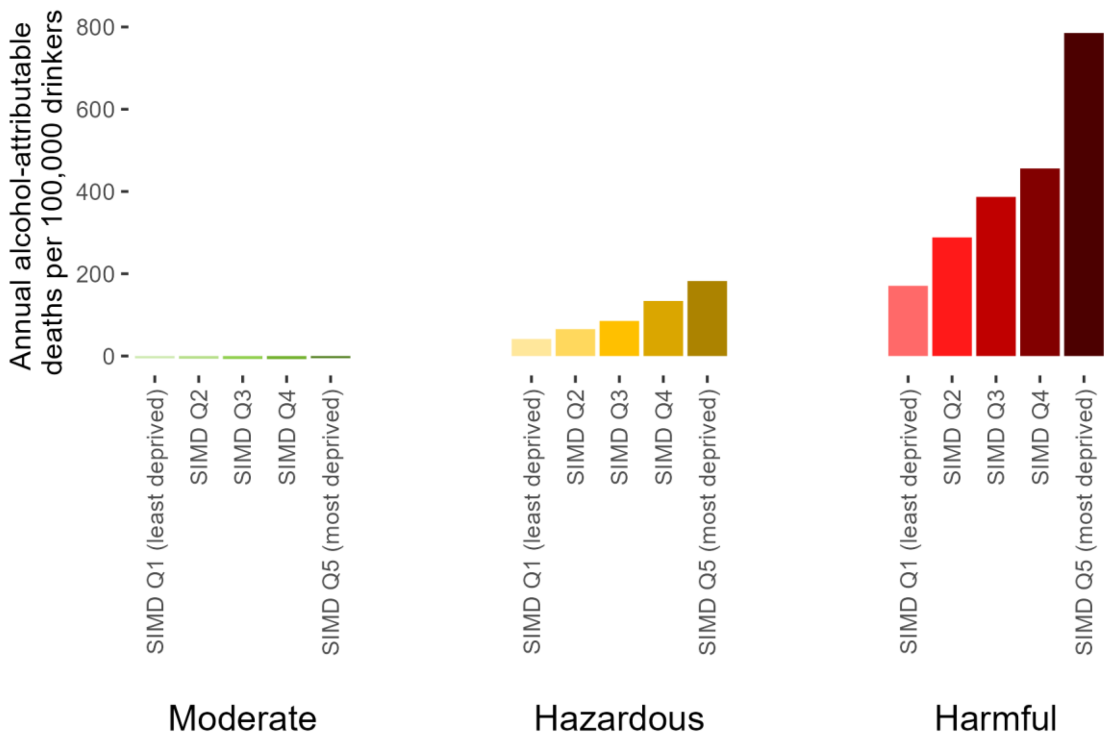

Figure 8: Baseline alcohol-attributable mortality by drinker group and SIMD quintile

Finally, Figure 9 shows how the baseline alcohol-attributable deaths and YLLs are distributed between health conditions. Liver disease is the largest single contributor to both alcohol-attributable deaths and YLLs, where it makes up 40.3% and 42.8% of the total respectively, excluding conditions with a net protective effect. Cancer is the second largest contributor to deaths and YLLS attributable to alcohol consumption. Overall, conditions wholly attributable to alcohol make up 60.5% of alcohol-attributable deaths and 67% of YLLs to alcohol. Chronic conditions which are partially attributable to alcohol represent 31.8% of deaths and 24% of Years of Life lost to alcohol, with partially alcohol-attributable acute conditions making up the remaining 7.7% of deaths and 9% of YLLs.

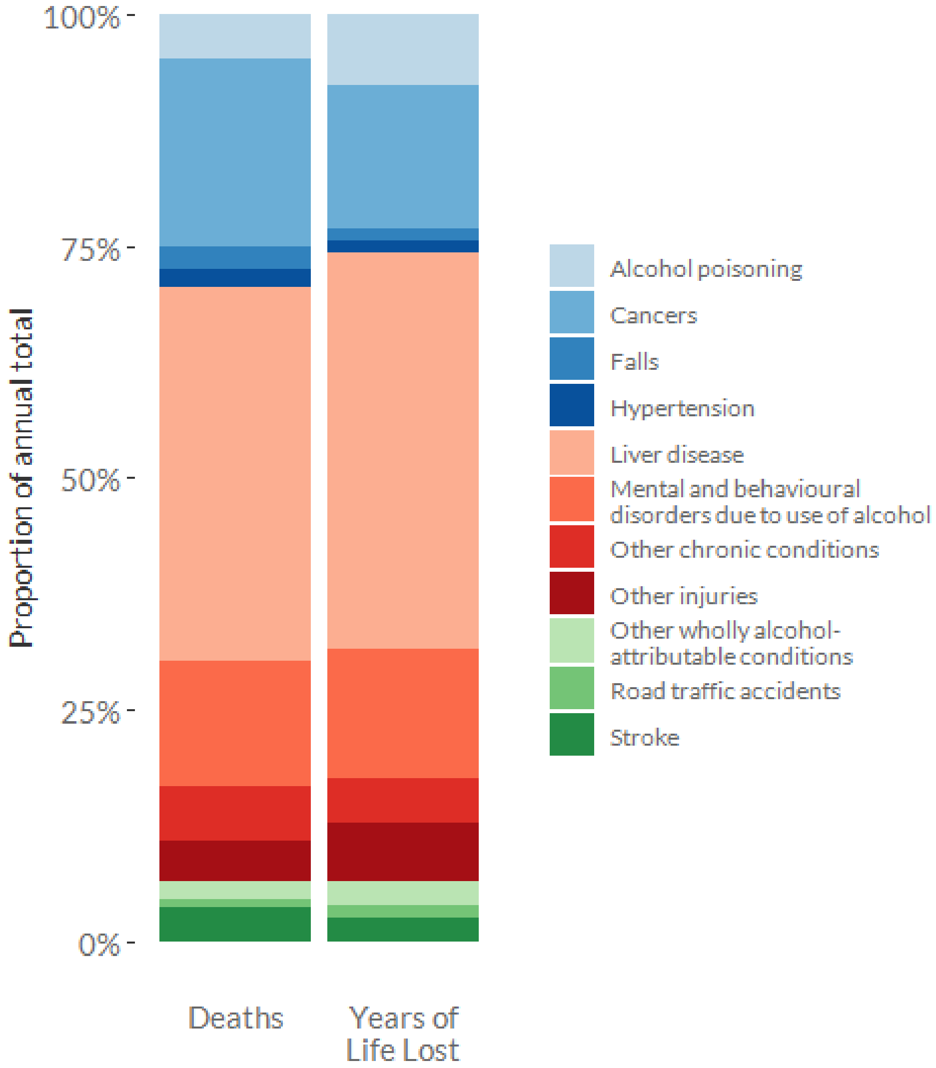

Figure 9: Breakdown of baseline alcohol-attributable harms by health condition (excluding protective conditions)

Modelled impacts of MUP policies on alcohol consumption and spending

The estimated effects of each of the modelled MUP policies on population alcohol consumption is shown in Table 8, with the impact on SIMD quintiles in Table 9 and illustrated in Figure 10 and Figure 11 respectively. Here we are comparing alcohol consumption in 2019 following the changing of the MUP threshold to the counterfactual scenario in 2019 where the MUP threshold remained at 50p (in real terms).

These estimates show that removing MUP entirely, or lowering the MUP threshold from 50p to 40p or 45p is estimated to increase alcohol consumption compared to retaining the threshold at 50p (the control arm). These increases are greatest among those in the most deprived quintile. In contrast, raising the MUP threshold above 50p is estimated to reduce alcohol consumption, with the largest reductions coming from those in the most deprived group.

	All drinkers	
	Absolute change	Relative change
Drinker population	3,568,079	
Mean consumption per drinker per week (control)	12.0	
Change in weekly consumption vs. control		
Remove MUP	0.65	5.4%
40p MUP	0.41	3.4%
45p MUP	0.26	2.2%
50p MUP (control)	0.00	0.0%
55p MUP	-0.33	-2.7%
60p MUP	-0.80	-6.7%
65p MUP	-1.29	-10.7%
70p MUP	-1.84	-15.3%
75p MUP	-2.39	-19.9%
80p MUP	-2.96	-24.6%

Table 8: Modelled impacts of removing or changing the MUP threshold on alcohol consumption in year 1

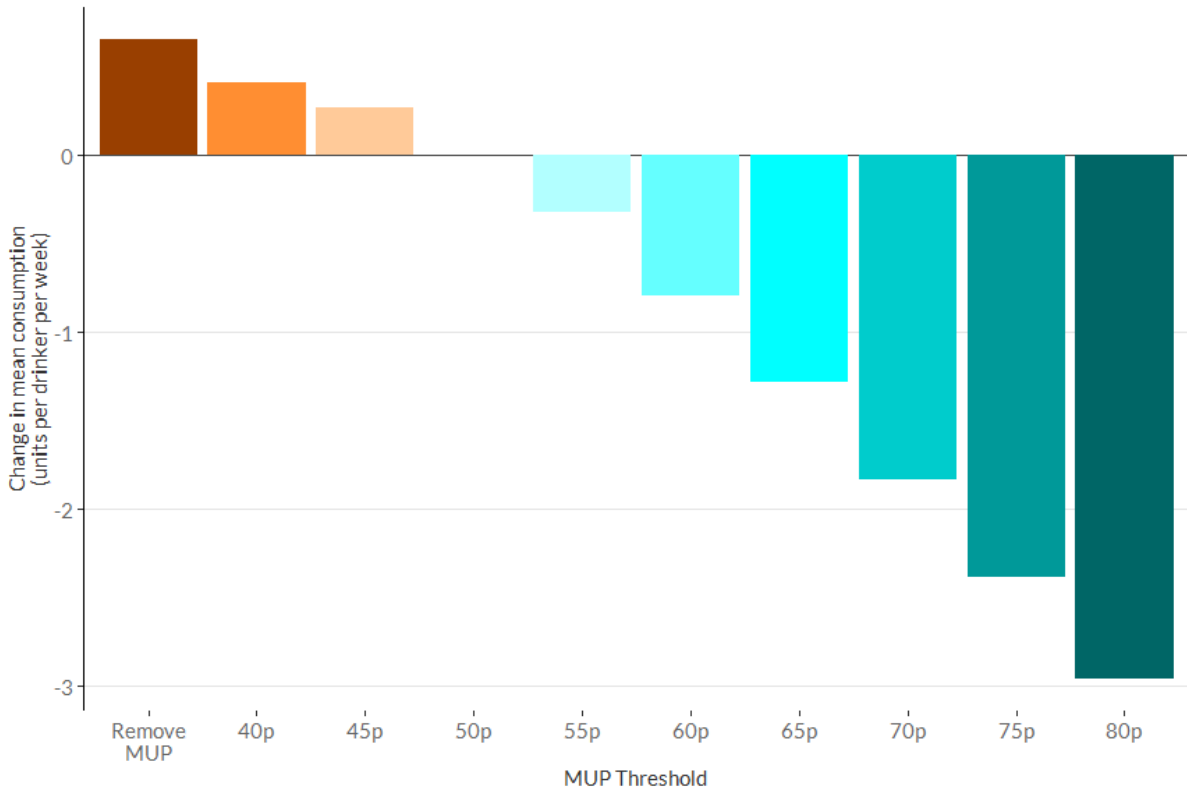

Figure 10: Modelled impacts of removing or changing the MUP threshold on alcohol consumption in year 1

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Drinker population	804,085	770,877	713,598	665,259	614,260
Mean consumption per drinker per week (control)	13.6	11.4	12.1	11.2	11.5
Absolute change in consumption vs. control					
Remove MUP	0.64	0.52	0.66	0.68	0.79
40p MUP	0.40	0.33	0.41	0.42	0.49
45p MUP	0.25	0.21	0.26	0.27	0.31
50p MUP (control)	0.00	0.00	0.00	0.00	0.00
55p MUP	-0.33	-0.26	-0.33	-0.35	-0.39
60p MUP	-0.81	-0.66	-0.81	-0.82	-0.93
65p MUP	-1.32	-1.06	-1.32	-1.32	-1.48
70p MUP	-1.89	-1.53	-1.87	-1.87	-2.08
75p MUP	-2.47	-2.01	-2.44	-2.43	-2.67
80p MUP	-3.07	-2.50	-3.01	-3.00	-3.30
Relative change vs. control					
Remove MUP	4.7%	4.6%	5.4%	6.0%	6.9%
40p MUP	2.9%	2.9%	3.4%	3.7%	4.3%
45p MUP	1.9%	1.9%	2.2%	2.4%	2.7%
50p MUP (control)	0.0%	0.0%	0.0%	0.0%	0.0%
55p MUP	-2.4%	-2.3%	-2.7%	-3.1%	-3.4%
60p MUP	-5.9%	-5.8%	-6.7%	-7.3%	-8.1%
65p MUP	-9.7%	-9.3%	-10.9%	-11.7%	-12.8%
70p MUP	-13.9%	-13.4%	-15.5%	-16.6%	-18.2%
75p MUP	-18.1%	-17.5%	-20.2%	-21.6%	-23.2%
80p MUP	-22.6%	-21.9%	-24.9%	-26.7%	-28.8%

Table 9: Modelled impacts of removing or changing the MUP threshold on alcohol consumption by SIMD quintile

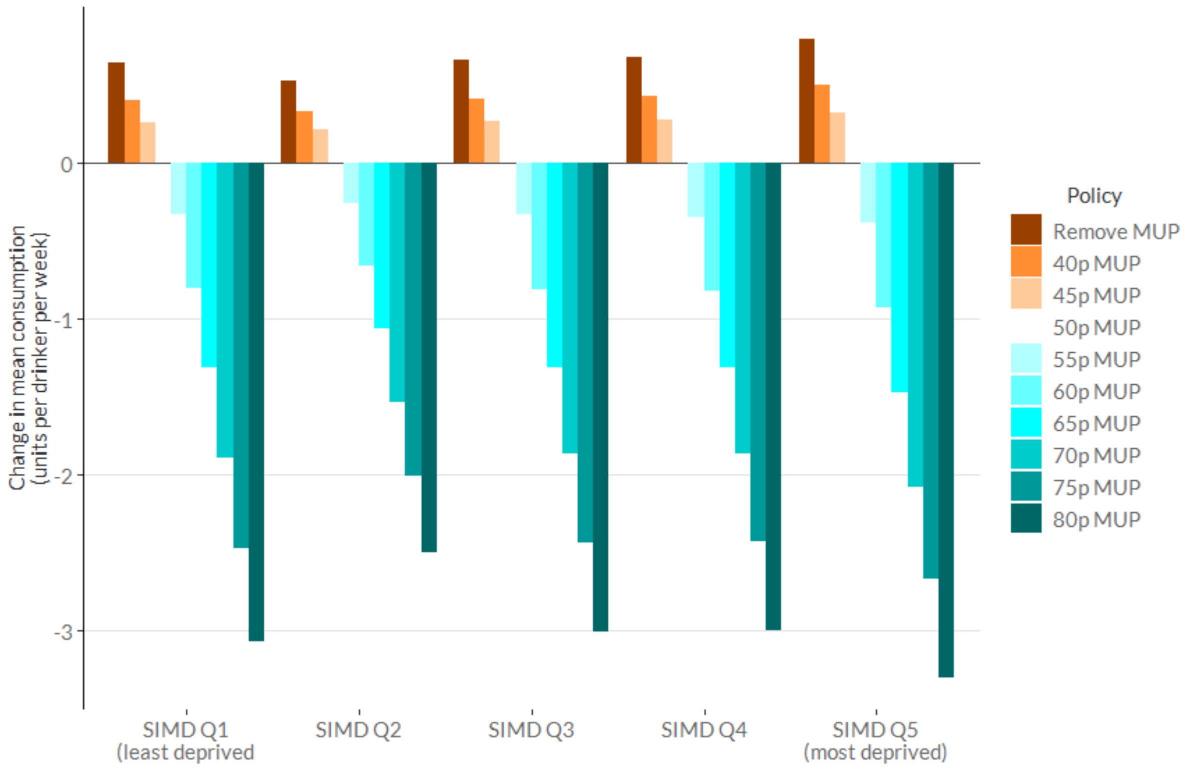

Figure 11: Modelled impacts of removing or changing the MUP threshold on alcohol consumption by SIMD quintile

When considering these changes in consumption, and the other modelled results throughout this report, it is important to understand a key difference between the TAX-sim model used for this report and the SAPM model used in previous reports. In SAPM, individuals were assigned to drinker groups based on their alcohol consumption at baseline and remained in these groups throughout the modelling process. We then reported the average change in consumption and other outcomes within each group, which reflected changes in consumption experienced for individual drinkers who began in each group at baseline. The structure of TAX-sim allows a different approach where we track changes in individual drinkers' alcohol consumption over time and allow drinkers to move between drinker groups in line with these changes. This means that a drinker consuming 16 units per week at baseline will be classified as a hazardous drinker, but if the introduction of a policy leads them to reduce their drinking to 12 units per week, they will be reclassified as a moderate drinker from that point onwards. It is therefore possible that the number of harmful drinkers in each arm will be different as more individuals may have transitioned between drinker groups in one scenario than the other. As a result, the difference in mean consumption for each drinker group between the intervention and control arms reflects changes in consumption among drinkers who remain in the group and the effect of drinkers moving into and out of the group.

Figure 12 illustrates the implications of this change in model structure by showing the modelled impact of increasing the MUP threshold to 60p on the number of drinkers in each group and the mean consumption within each group. Overall at the population level a 60p MUP is estimated to reduce alcohol consumption by 0.8 units per week, a relative reduction of 6.7%. Yet the consumption reductions with each of the three drinker groups are markedly smaller than this (-0.3% for moderate drinkers, -1.1% for hazardous drinkers and -2.6% for harmful drinkers). This is because the changes in consumption resulting from the increase in the MUP threshold from 50p to 60p lead some harmful drinkers to reduce their consumption sufficiently that they are reclassified as hazardous drinkers, and some hazardous drinkers to similarly reduce their drinking to the point where they become moderate drinkers. These flows are highlighted in Figure 12, with 26644 drinkers moving from the harmful to hazardous groups and 68050 moving from hazardous to moderate. These figures represent a reduction of -18.6% in the number of harmful drinkers, a -4.7% reduction in the number of hazardous drinkers and a corresponding 2.7% increase in the number of moderate drinkers.

As those moving into lower consuming groups are likely to be among the heaviest drinkers in those groups, this means the average in each group is pushed upwards. So even though the consumption of all individuals, and the overall population has fallen, this effect drags the mean consumption in both hazardous and moderate groups up. This drag offsets the fall in consumption among the individuals who remain within the group and is what leads to the lower within-group changes that we see in Figure 12 compared to the overall population. This effect is a version of what is sometimes referred to as 'Simpson's paradox', whereby splitting a population into subgroups leads to subgroup-level patterns that do not reflect the overall population pattern. It is also worth noting that the number of abstainers does not change. This is because, although STAPM incorporates participation elasticities which mean that some drinkers will stop drinking at all when prices become too high, these are applied at a beverage-specific level. That is to say, that some drinkers will have stopped drinking *some specific types of alcohol* when prices increase, but nobody has given up all beverage types simultaneously.

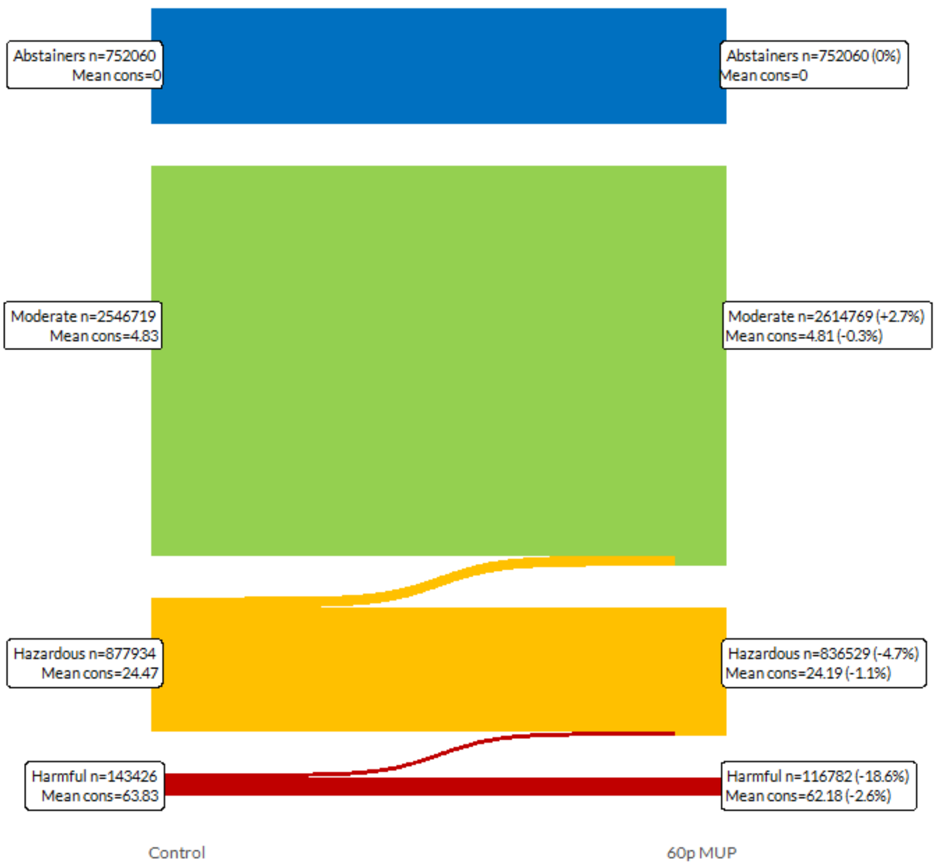

Figure 12: Illustrative diagram of shifts between drinker groups under a 60p MUP policy

In light of the fact that mean consumption changes at drinker group level represent a fundamentally different concept from similar numbers in previous modelling reports using SAPM and the potential for these numbers to be misinterpreted as a result when not considered alongside changes in the number of drinkers in each group, we do not present these results in the main text of the report. Drinker group level changes in mean consumption, along with drinker group level changes in consumer spending and health outcomes, are available in an appendix to this report. Instead, we focus on changes in the number of drinkers in each group arising from changes in the MUP level, something we have not previously been able to report.

The modelled impacts of removing or changing the MUP threshold on the number of drinkers in each group is shown in Table 10.

	Moderate	Hazardous	Harmful
Absolute change vs. control			
Remove MUP	-37,525	10,684	26,841
40p MUP	-24,311	8,067	16,244
45p MUP	-15,045	5,233	9,812
50p MUP	0	0	0
55p MUP	27,146	-15,742	-11,403
60p MUP	68,050	-41,406	-26,644
65p MUP	112,159	-70,012	-42,147
70p MUP	163,246	-108,235	-55,011
75p MUP	218,868	-148,943	-69,925
80p MUP	279,570	-196,540	-83,051
Relative change vs. control			
Remove MUP	-1.5%	1.2%	18.7%
40p MUP	-1.0%	0.9%	11.3%
45p MUP	-0.6%	0.6%	6.8%
50p MUP	0.0%	0.0%	0.0%
55p MUP	1.1%	-1.8%	-8.0%
60p MUP	2.7%	-4.7%	-18.6%
65p MUP	4.4%	-8.0%	-29.4%
70p MUP	6.4%	-12.3%	-38.4%
75p MUP	8.6%	-17.0%	-48.8%
80p MUP	11.0%	-22.4%	-57.9%

Table 10: Modelled impacts of removing or changing the MUP threshold on the number of drinkers in each group

Figure 13 shows how these shifts between drinker groups play out across all modelled MUP policies. This demonstrates, as might be expected, that higher MUP increases lead to bigger shifts away from hazardous and harmful drinking and a corresponding increase in the number of moderate drinkers. Lowering the MUP threshold from 50p to 40p or 45p, or removing it entirely, has the opposite effect, leading some drinkers to shift up from moderate to hazardous drinking and others to shift from hazardous to harmful.

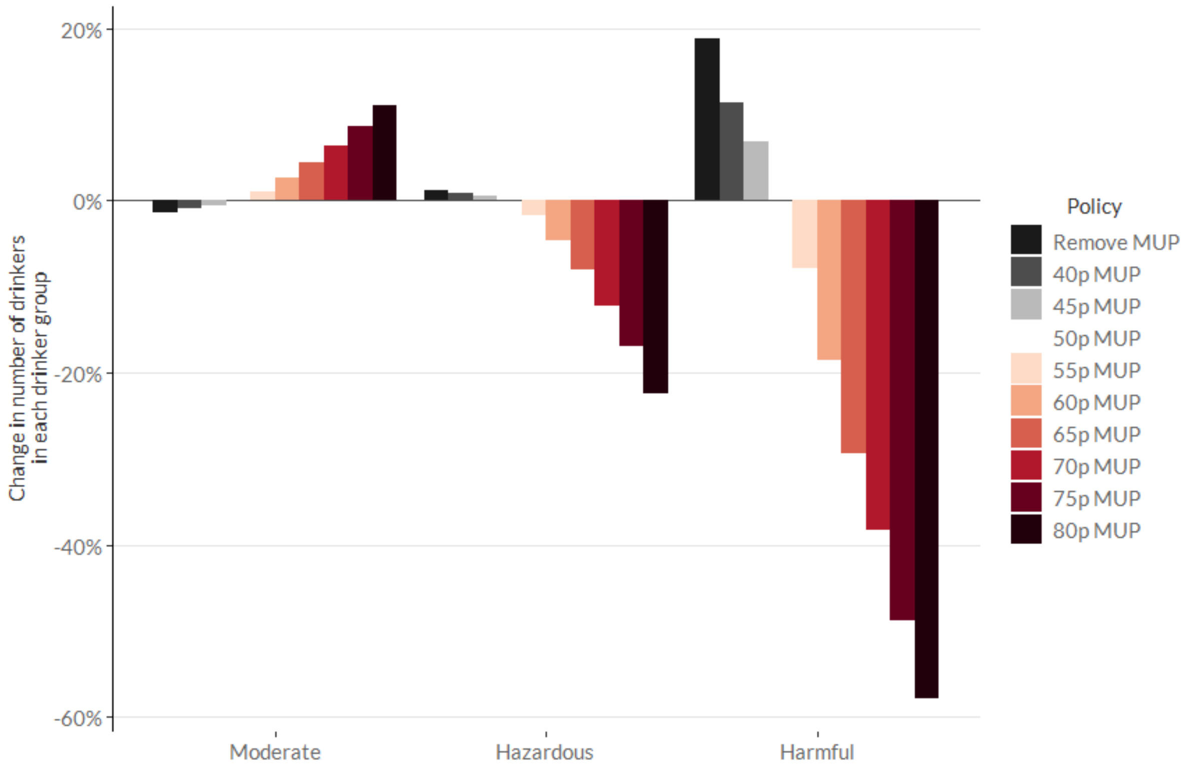

Figure 13: Modelled impacts of removing or changing the MUP threshold on the number of drinkers in each group

The extent to which changes in prices and resulting shifts in consumption combine to produce changes in overall consumer spending is shown in Table 11 by SIMD quintile in Table 12, with these results illustrated in Figure 14 and Figure 15 respectively. Across all drinkers, reducing or removing the MUP threshold is estimated to increase spending, while raising it reduces spending. This is true across all SIMD quintiles.

	All drinkers	
	Absolute change	Relative change
Drinker population	3,568,079	
Mean spending per drinker per week (control)	£27.92	
Change in weekly spending vs. control		
Remove MUP	£0.16	0.6%
40p MUP	£0.11	0.4%
45p MUP	£0.06	0.2%
50p MUP (control)	£0.00	0.0%
55p MUP	-£0.12	-0.4%
60p MUP	-£0.32	-1.1%
65p MUP	-£0.57	-2.0%
70p MUP	-£0.90	-3.2%
75p MUP	-£1.29	-4.6%
80p MUP	-£1.76	-6.3%

Table 11: Modelled impacts of removing or changing the MUP threshold on consumer spending on alcohol

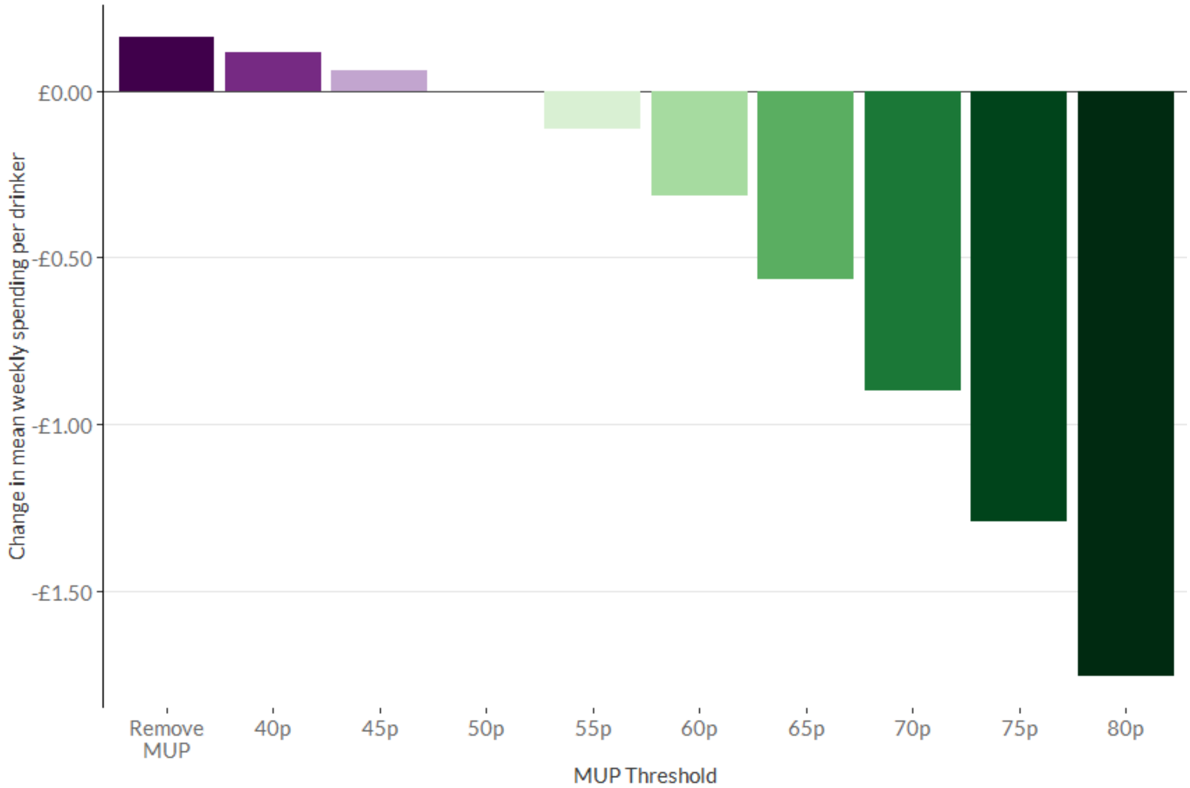

Figure 14: Modelled impacts of removing or changing the MUP threshold on consumer spending on alcohol

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Drinker population	804,085	770,877	713,598	665,259	614,260
Mean spending per drinker per week (control)	£31.53	£28.07	£27.42	£25.88	£25.80
Absolute change in spending vs. control					
Remove MUP	£0.14	£0.11	£0.16	£0.18	£0.23
40p MUP	£0.10	£0.08	£0.12	£0.13	£0.15
45p MUP	£0.04	£0.04	£0.06	£0.07	£0.09
50p MUP (control)	£0.00	£0.00	£0.00	£0.00	£0.00
55p MUP	-£0.11	-£0.08	-£0.11	-£0.13	-£0.14
60p MUP	-£0.30	-£0.24	-£0.32	-£0.34	-£0.40
65p MUP	-£0.55	-£0.42	-£0.58	-£0.62	-£0.71
70p MUP	-£0.87	-£0.70	-£0.91	-£0.97	-£1.12
75p MUP	-£1.25	-£1.02	-£1.32	-£1.39	-£1.56
80p MUP	-£1.69	-£1.40	-£1.77	-£1.88	-£2.15
Relative change vs. control					
Remove MUP	0.5%	0.4%	0.6%	0.7%	0.9%
40p MUP	0.3%	0.3%	0.4%	0.5%	0.6%
45p MUP	0.1%	0.2%	0.2%	0.3%	0.3%
50p MUP (control)	0.0%	0.0%	0.0%	0.0%	0.0%
55p MUP	-0.4%	-0.3%	-0.4%	-0.5%	-0.6%
60p MUP	-1.0%	-0.9%	-1.2%	-1.3%	-1.6%
65p MUP	-1.7%	-1.5%	-2.1%	-2.4%	-2.7%
70p MUP	-2.8%	-2.5%	-3.3%	-3.7%	-4.3%
75p MUP	-4.0%	-3.6%	-4.8%	-5.4%	-6.1%
80p MUP	-5.4%	-5.0%	-6.4%	-7.3%	-8.3%

Table 12: Modelled impacts of removing or changing the MUP threshold on consumer spending by SIMD quintile

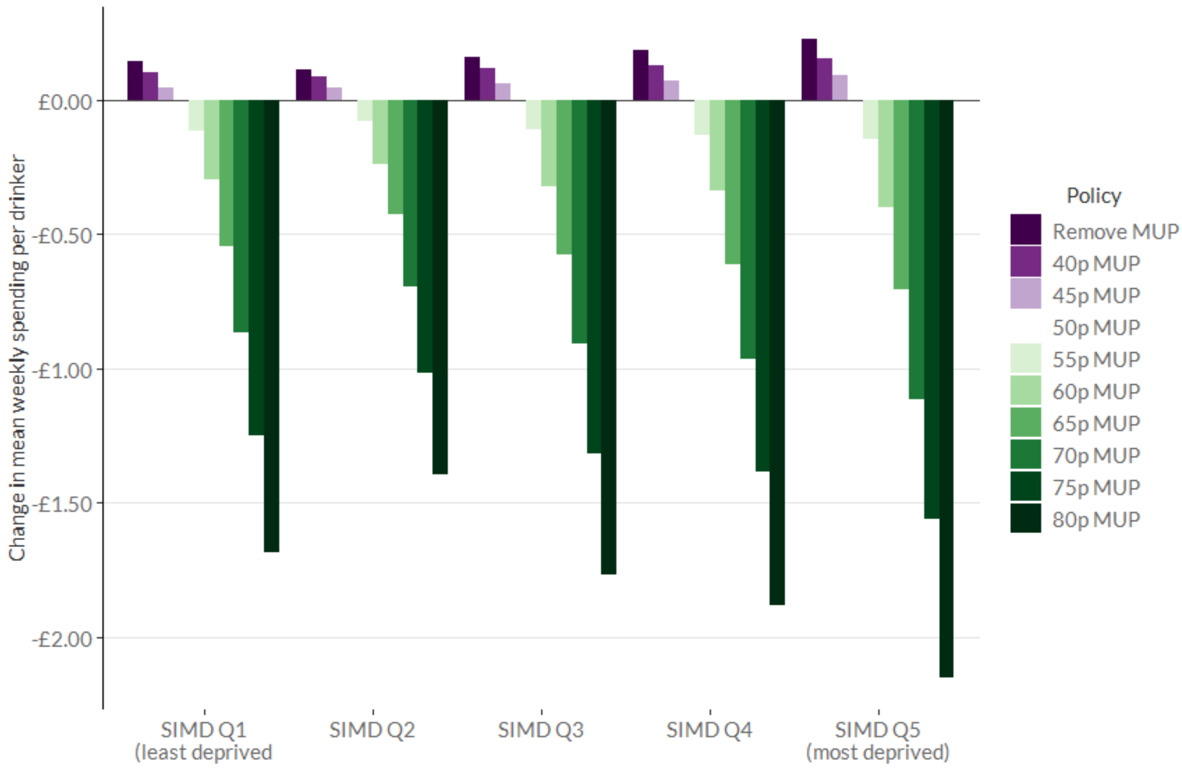

Figure 15: Modelled impacts of removing or changing the MUP threshold on consumer spending by SIMD quintile

The estimated impacts that these changes in alcohol consumption and spending have on revenue to the government through alcohol duty and VAT, separated into the revenue collected through the on- and off-trades, is shown in Table 13 and visualised in Figure 16. Reducing or removing the MUP threshold is estimated to lead to increased exchequer revenue while increasing the threshold is estimated to lead to reductions in alcohol tax revenue. These changes are largest in revenue from the off-trade, as it is off-trade prices which are directly impacted by changes in the MUP threshold, while on-trade prices are generally higher than the threshold levels being modelled.

	Estimated annual change in duty & VAT revenue to government (£million)		
	Off-trade	On-Trade	Total
Absolute change vs. control			
Remove MUP	£37.8	£5.8	£43.6
40p MUP	£23.3	£5.5	£28.7
45p MUP	£14.8	£3.9	£18.8
50p MUP	£0.0	£0.0	£0.0
55p MUP	-£21.4	-£4.4	-£25.7
60p MUP	-£53.8	-£10.5	-£64.3
65p MUP	-£89.1	-£17.0	-£106.1
70p MUP	-£129.6	-£24.7	-£154.3
75p MUP	-£172.1	-£32.6	-£204.7
80p MUP	-£218.3	-£40.8	-£259.2
Relative change vs. control			
Remove MUP	4.1%	0.7%	2.4%
40p MUP	2.5%	0.6%	1.6%
45p MUP	1.6%	0.4%	1.0%
50p MUP	0.0%	0.0%	0.0%
55p MUP	-2.3%	-0.5%	-1.4%
60p MUP	-5.9%	-1.2%	-3.6%
65p MUP	-9.7%	-1.9%	-5.9%
70p MUP	-14.2%	-2.8%	-8.6%
75p MUP	-18.8%	-3.7%	-11.4%
80p MUP	-23.9%	-4.7%	-14.5%

Table 13: Modelled impacts of removing or changing the MUP threshold on exchequer revenue from alcohol taxes

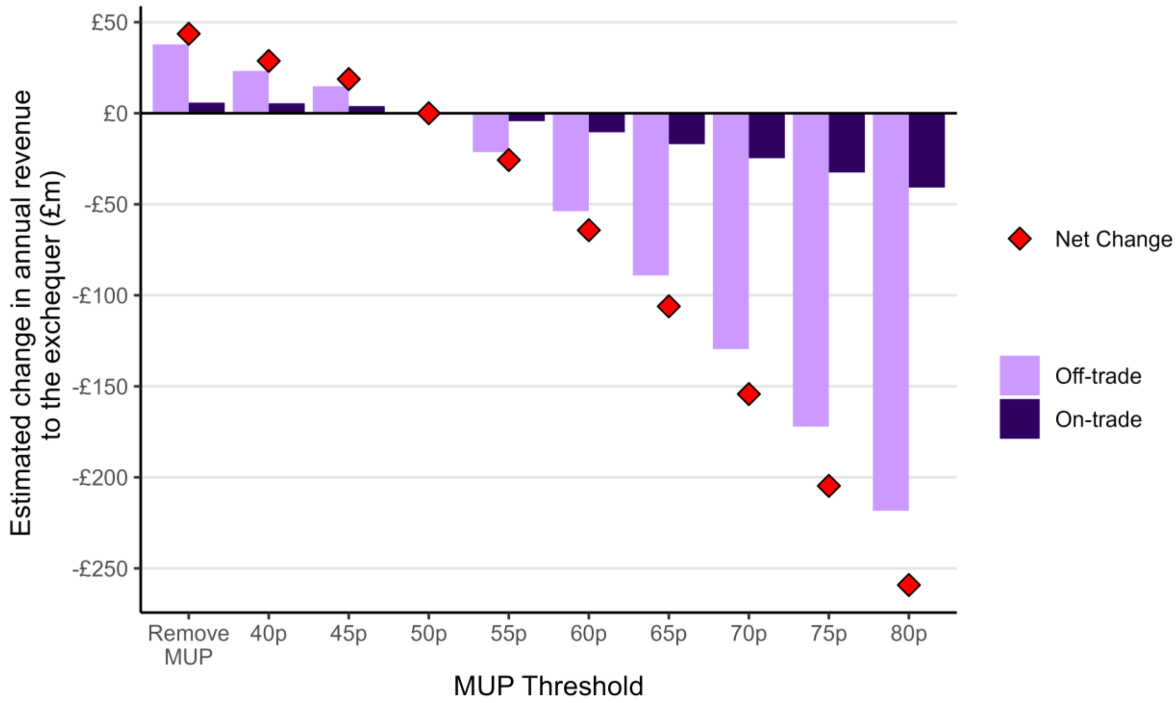

Figure 16: Modelled impacts of removing or changing the MUP threshold on exchequer revenue from alcohol taxes

After accounting for changes in taxation revenue, we can then estimate how changes in consumer spending lead to changes in retailer revenue. Note that without information on production costs and retailer overheads we cannot estimate changes in retailer profits. Retailer revenue figures are shown in Table 14 and Figure 17, illustrating that we estimate an increase in the MUP threshold to increase off-trade retailers' revenue while reducing revenue in the on-trade, and vice versa for a reduction in the MUP threshold level. As the MUP level increases, the patterns of changes in retailer revenue differ notably between the on- and off-trades. The revenue to on-trade retailers decreases almost linearly as the MUP threshold rises, while off-trade retailer revenue rises steadily until a 70p MUP and then levels off and is estimated to be lower under an 80p MUP than a 65-75p MUP. These different patterns arise because drinkers switch between products that bring in different levels of revenue to retailers as the MUP changes, particularly within the off-trade.

	Estimated change in annual revenue to retailers (£million)		
	Off-trade	On-Trade	Total
Absolute change vs. control			
Remove MUP	-£29.3	£15.8	-£13.5
40p MUP	-£22.9	£15.4	-£7.5
45p MUP	-£19.0	£11.3	-£7.7
50p MUP (control)	£0.0	£0.0	£0.0
55p MUP	£16.5	-£12.1	£4.4
60p MUP	£34.8	-£29.2	£5.6
65p MUP	£48.3	-£47.4	£0.9
70p MUP	£56.6	-£69.3	-£12.7
75p MUP	£56.3	-£91.4	-£35.1
80p MUP	£47.7	-£114.6	-£67.0
Relative change vs. control			
Remove MUP	-3.7%	0.6%	-0.4%
40p MUP	-2.9%	0.6%	-0.2%
45p MUP	-2.4%	0.4%	-0.2%
50p MUP (control)	0.0%	0.0%	0.0%
55p MUP	2.1%	-0.5%	0.1%
60p MUP	4.4%	-1.1%	0.2%
65p MUP	6.1%	-1.8%	0.0%
70p MUP	7.1%	-2.7%	-0.4%
75p MUP	7.1%	-3.5%	-1.0%
80p MUP	6.0%	-4.4%	-2.0%

Table 14: Modelled impacts of removing or changing the MUP threshold on retailer revenue from alcohol sales (excluding taxes)

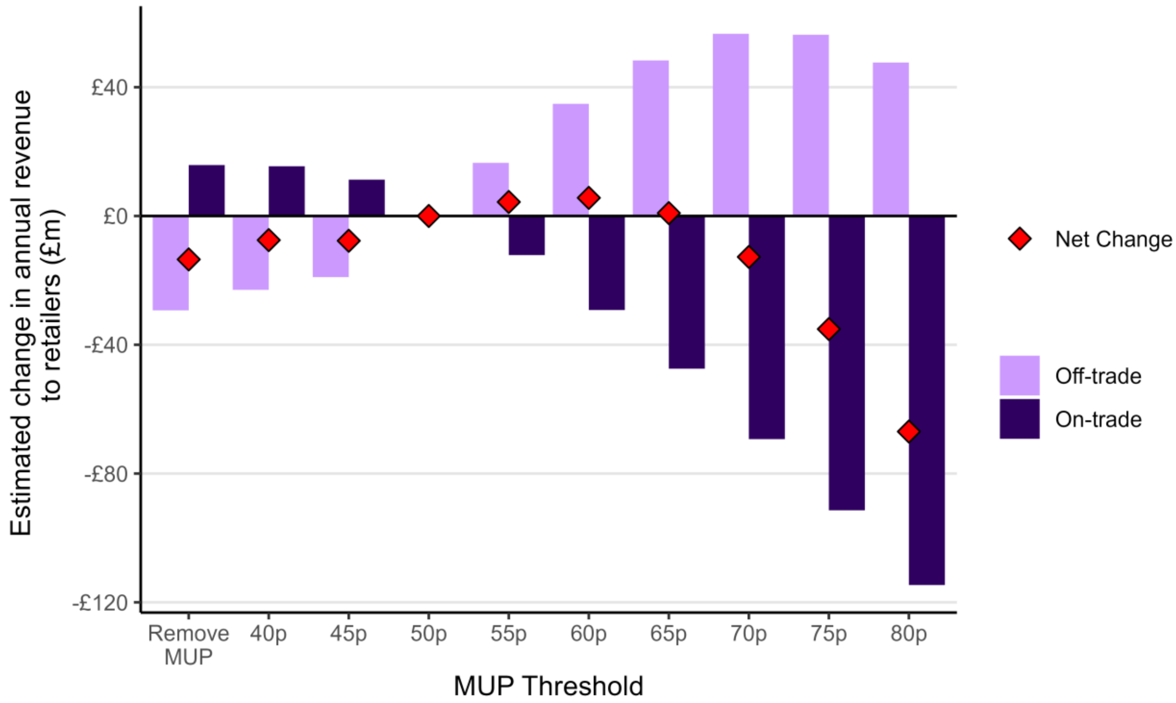

Figure 17: Modelled impacts of removing or changing the MUP threshold on retailer revenue from alcohol sales (excluding taxes)

Modelled impacts of MUP policies on health outcomes

Epidemiological evidence shows that changes in alcohol consumption can take up to 20 years to feed through to changes in the risk of alcohol-related health conditions (20). As a result, previous reports using SAPM, including for Scotland, have primarily focused on the health impacts of modelled policies in the 20th year after implementation as the 'full effect' of the policy. As discussed in the methods section, improvements to the epidemiological components of TAX-sim, as compared to SAPM, have some important implications for the estimated profile of health impacts over time. This is illustrated in Figure 18, which shows the changes in the number of deaths from all causes in each year of the model under a 60p MUP compared to the control arm assumption that the 50p MUP remains in place and increases in line with inflation. A similar plot showing all modelled policies is included in the Appendix.

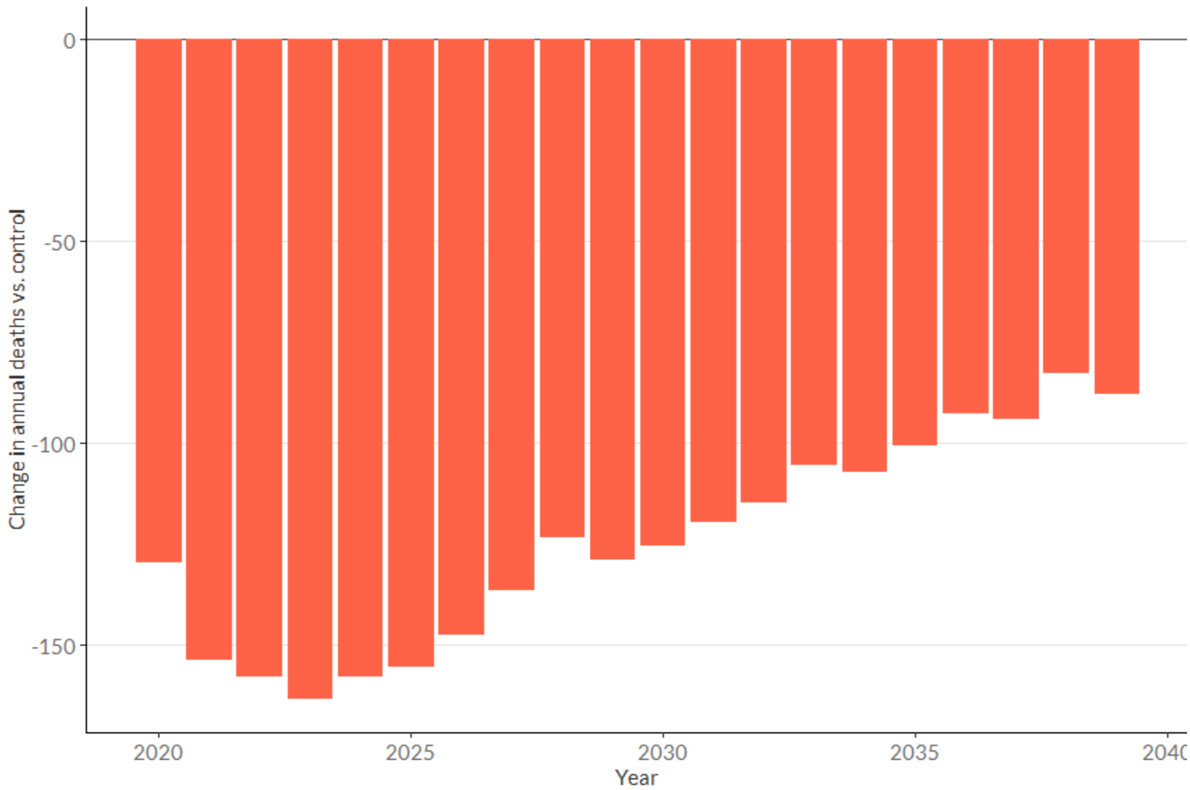

Figure 18: Modelled changes in all-cause mortality over time under a 60p MUP

Figure 18 illustrates that the modelled number of all-cause deaths averted rises initially, due to the effect of the delays in changing risk discussed above. However in the fifth year after policy implementation, the reductions in mortality compared to control begin to reduce. This reduction is the product of two separate effects:

- **Mortality selection**: as discussed in the methods section, TAX-sim's individual-level structure means that over time the individuals with the greatest mortality risk (i.e. those drinking at the highest levels) are most likely to die prematurely, leading to a gradual reduction in average alcohol consumption and therefore mortality over time, all else being equal.
- **Mortality displacement**: in the long-term no death can be prevented, merely postponed. Therefore where a policy reduces mortality in a given year, some of the people whose lives have been extended will pass away in later years within the time horizon of the model. With TAX-sim's focus on all-cause mortality, we account for all future deaths from any cause, rather than only those attributable to alcohol. As a result the model fully captures the displacement of deaths from earlier to later years, something which is captured in the YLL figures.

The influence of these two effects on the model results can be seen in Figure 19, which replicates the mortality impacts of a 60p MUP from Figure 18, but separates out the effect by health condition, with the dashed black line illustrating the net number of all-cause deaths from Figure 18. The effect of mortality selection can be seen in the number of deaths averted from alcohol-related conditions (i.e. the green, red and blue bars below the 0 line) gradually reducing over time as the average mortality risk falls as the highest risk drinkers are most likely to die prematurely. The effect of mortality displacement can be seen as the grey bars above the red line, which represent an increase in mortality from causes which have no link to alcohol among people for whom a premature alcohol-attributable death has been averted by the modelled MUP policy. This effect also has some impact on alcohol-attributable causes, as individuals who would otherwise have died from an alcohol-related cause in the absence of the 60p MUP may subsequently die from an alcohol-related cause in a later year. This can be seen most clearly in the 'other cardiovascular disease' red bars at the top of the graph in later years.

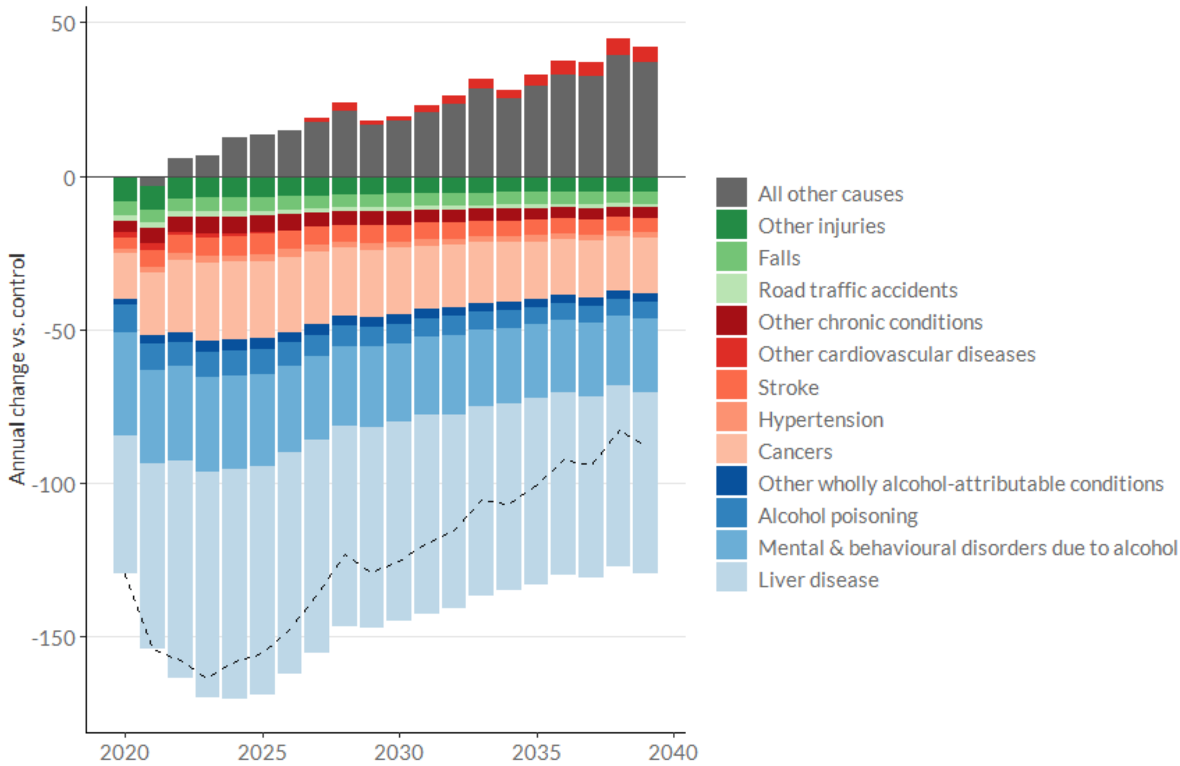

Figure 19: Modelled changes in annual mortality by health condition group over time under a 60p MUP (dashed line represents the net change)

Accounting for both of these effects is a strength of the TAX-sim model, but the more complex mortality dynamics over time that arise as a result mean that simply looking at the number of deaths averted in the 20th year after policy implementation does not give a full picture of the health impact of a policy. We therefore present the impacts in the 1st year after implementation, and the cumulative change in deaths over the first 5 and the first 20 years for each modelled policy for all health outcomes. Equivalent figures for the 20th year after implementation are included in the Appendix.

Table 15 shows the impact of removing or changing the MUP threshold on these outcomes both as absolute numbers of deaths and as rates per 100,000 person years. Figure 20 visualises the cumulative change in deaths over 20 years for each MUP threshold. These results highlight that removing or reducing the MUP threshold is expected to lead to increased all-cause mortality (additional deaths over 20 years if MUP is removed entirely), while increases in the MUP threshold are estimated to lead to reductions in deaths that are larger for higher thresholds.

	Year 1	Cumulative over 5 years	Cumulative over 20 years
Absolute change in deaths vs. control			
Remove MUP	131	690	1,669
40p MUP	82	434	1,098
45p MUP	49	244	514
50p MUP	0	0	0
55p MUP	-60	-363	-1,003
60p MUP	-130	-762	-2,483
65p MUP	-197	-1,230	-3,837
70p MUP	-278	-1,685	-5,454
75p MUP	-347	-2,146	-7,188
80p MUP	-435	-2,651	-9,088
Change in deaths per 100,000 person years vs. control			
Remove MUP	3.0	3.2	2.0
40p MUP	1.9	2.0	1.3
45p MUP	1.1	1.1	0.6
50p MUP	0.0	0.0	0.0
55p MUP	-1.4	-1.7	-1.2
60p MUP	-3.0	-3.5	-2.9
65p MUP	-4.6	-5.7	-4.5
70p MUP	-6.4	-7.8	-6.4
75p MUP	-8.0	-10.0	-8.4
80p MUP	-10.1	-12.3	-10.7

Table 15: Modelled impacts of removing or changing the MUP threshold on all-cause mortality

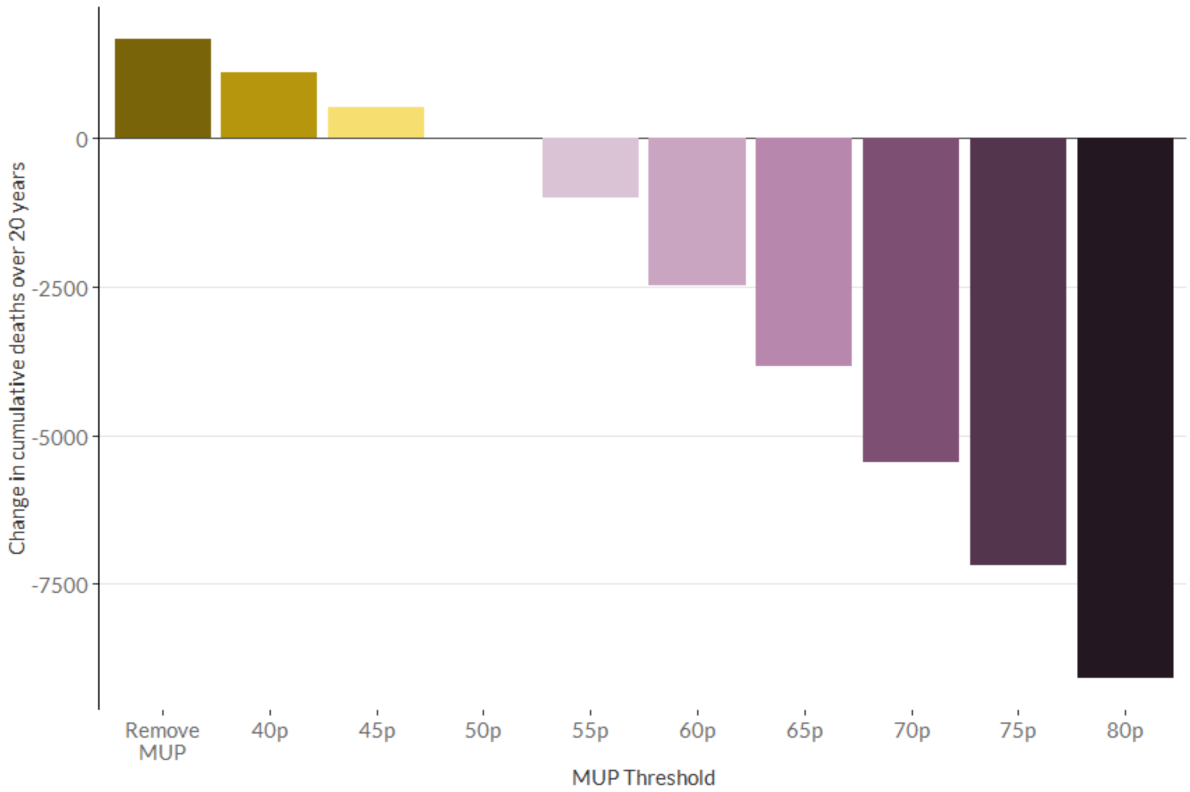

Figure 20: Modelled impacts of removing or changing the MUP threshold on cumulative all-cause deaths over 20 years

Comparable results for alcohol-specific deaths, including relative changes, are shown in Table 16. This shows that we estimate the removal of MUP would lead to a 7.8% increase in alcohol-specific deaths in the short term, and a cumulative 7.1% increase over 20 years, while increasing the MUP level would lead to substantial reductions in alcohol-specific mortality.

	Year 1	Cumulative over 5 years	Cumulative over 20 years
Absolute change in alcohol-specific deaths vs. control			
Remove MUP	76	432	1,297
40p MUP	47	278	875
45p MUP	28	166	456
50p MUP	0	0	0
55p MUP	-34	-214	-802
60p MUP	-77	-470	-1,781
65p MUP	-119	-746	-2,913
70p MUP	-165	-1,036	-4,150
75p MUP	-212	-1,336	-5,423
80p MUP	-261	-1,639	-6,764
Relative change vs. control			
Remove MUP	7.8%	9.3%	7.1%
40p MUP	5.0%	6.2%	4.9%
45p MUP	3.1%	3.8%	2.6%
50p MUP	0.0%	0.0%	0.0%
55p MUP	-4.0%	-5.4%	-5.0%
60p MUP	-9.5%	-12.6%	-11.8%
65p MUP	-15.5%	-21.6%	-20.8%
70p MUP	-22.8%	-32.7%	-32.5%
75p MUP	-31.3%	-46.6%	-47.2%
80p MUP	-41.5%	-63.8%	-66.7%

Table 16: Modelled impacts of removing or changing the MUP threshold on alcohol-specific mortality

The effects of removing or changing the MUP threshold on mortality, separated by SIMD quintile, are presented in Table 17 and Figure 21. Across all modelled policies these show a similar pattern, with the greatest changes in mortality in the most deprived groups.

	SIMD Q1 (least deprived)			SIMD Q2			SIMD Q3			SIMD Q4			SIMD Q5 (most deprived)		
	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr
Absolute change in deaths vs. control															
Remove MUP	13	74	231	16	74	170	21	120	278	27	150	433	55	272	556
40p MUP	9	49	156	9	43	98	12	77	202	14	82	271	37	184	370
45p MUP	7	31	90	6	20	28	8	44	108	8	38	116	21	111	172
50p MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55p MUP	-5	-36	-130	-6	-51	-164	-12	-64	-219	-15	-80	-206	-22	-132	-284
60p MUP	-13	-85	-334	-15	-105	-349	-25	-137	-572	-32	-173	-528	-45	-262	-700
65p MUP	-20	-137	-470	-27	-170	-571	-34	-234	-821	-48	-281	-907	-68	-408	-1,068
70p MUP	-29	-176	-653	-35	-234	-819	-46	-315	-1,142	-70	-394	-1,246	-98	-566	-1,594
75p MUP	-34	-245	-919	-45	-296	-1,054	-61	-398	-1,454	-89	-502	-1,606	-118	-705	-2,156
80p MUP	-42	-295	-1,157	-55	-372	-1,297	-75	-485	-1,792	-107	-612	-2,006	-156	-888	-2,835
Change in deaths per 100,000 person years vs. control															
Remove MUP	1	2	1	2	2	1	2	3	2	3	4	3	7	7	4
40p MUP	1	1	1	1	1	1	1	2	1	2	2	2	5	5	2
45p MUP	1	1	0	1	0	0	1	1	1	1	1	1	3	3	1
50p MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55p MUP	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2	-1	-3	-3	-2
60p MUP	-1	-2	-2	-2	-2	-2	-3	-3	-3	-4	-4	-3	-6	-7	-4
65p MUP	-2	-3	-2	-3	-4	-3	-4	-5	-5	-6	-7	-6	-8	-10	-7
70p MUP	-3	-4	-3	-4	-5	-5	-5	-7	-7	-8	-10	-8	-12	-14	-10
75p MUP	-4	-5	-5	-5	-7	-6	-7	-9	-9	-11	-12	-10	-15	-18	-14
80p MUP	-5	-6	-6	-6	-8	-7	-9	-11	-11	-13	-15	-13	-19	-22	-18

Table 17: Modelled impacts of removing or changing the MUP threshold on all-cause mortality by SIMD quintile

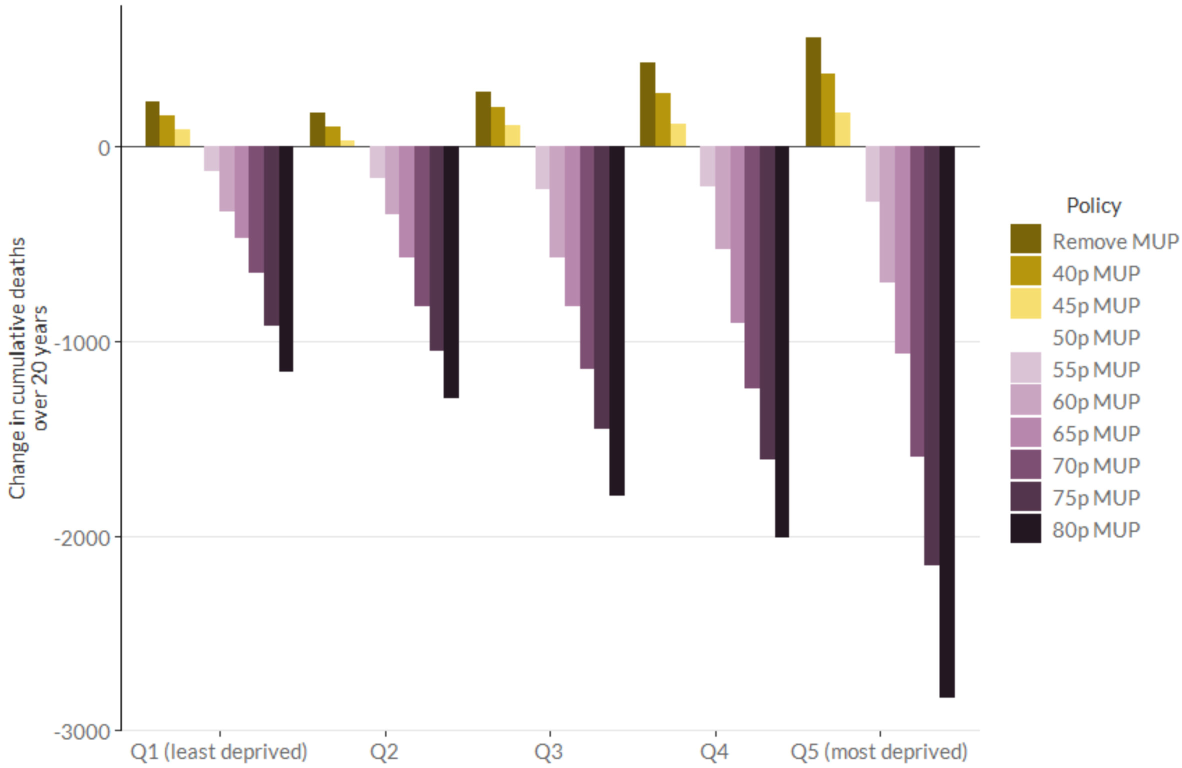

Figure 21: Modelled impacts of removing or changing the MUP threshold on cumulative all-cause deaths over 20 years by SIMD quintile

Model results showing the impact of each policy on annual hospital admissions and admission rates at full effect are presented for the population in Table 18 and Figure 22 and by SIMD quintile in Table 19 and Figure 23. These follow a similar pattern to the mortality results, with higher MUP thresholds leading to greater reductions in admissions, particularly in more deprived groups. Unlike the mortality results, however, a reduction in the MUP threshold, or its removal entirely, is estimated to increase harms to the largest extent in the two most deprived quintiles.

	Year 1	Cumulative over 5 years	Cumulative over 20 years
Absolute change in hospital admissions vs. control			
Remove MUP	1,751	8,451	22,179
40p MUP	1,125	5,487	15,057
45p MUP	654	3,220	7,621
50p MUP	0	0	0
55p MUP	-774	-4,207	-13,864
60p MUP	-1,732	-9,092	-30,484
65p MUP	-2,696	-14,509	-49,181
70p MUP	-3,779	-20,209	-70,018
75p MUP	-4,844	-26,134	-91,721
80p MUP	-6,015	-32,340	-115,310
Change in admissions per 100,000 person years vs. control			
Remove MUP	41	39	26
40p MUP	26	25	18
45p MUP	15	15	9
50p MUP	0	0	0
55p MUP	-18	-20	-16
60p MUP	-40	-42	-36
65p MUP	-62	-67	-58
70p MUP	-88	-94	-82
75p MUP	-112	-121	-108
80p MUP	-139	-150	-135

Table 18: Modelled impacts of removing or changing the MUP threshold on hospital admissions

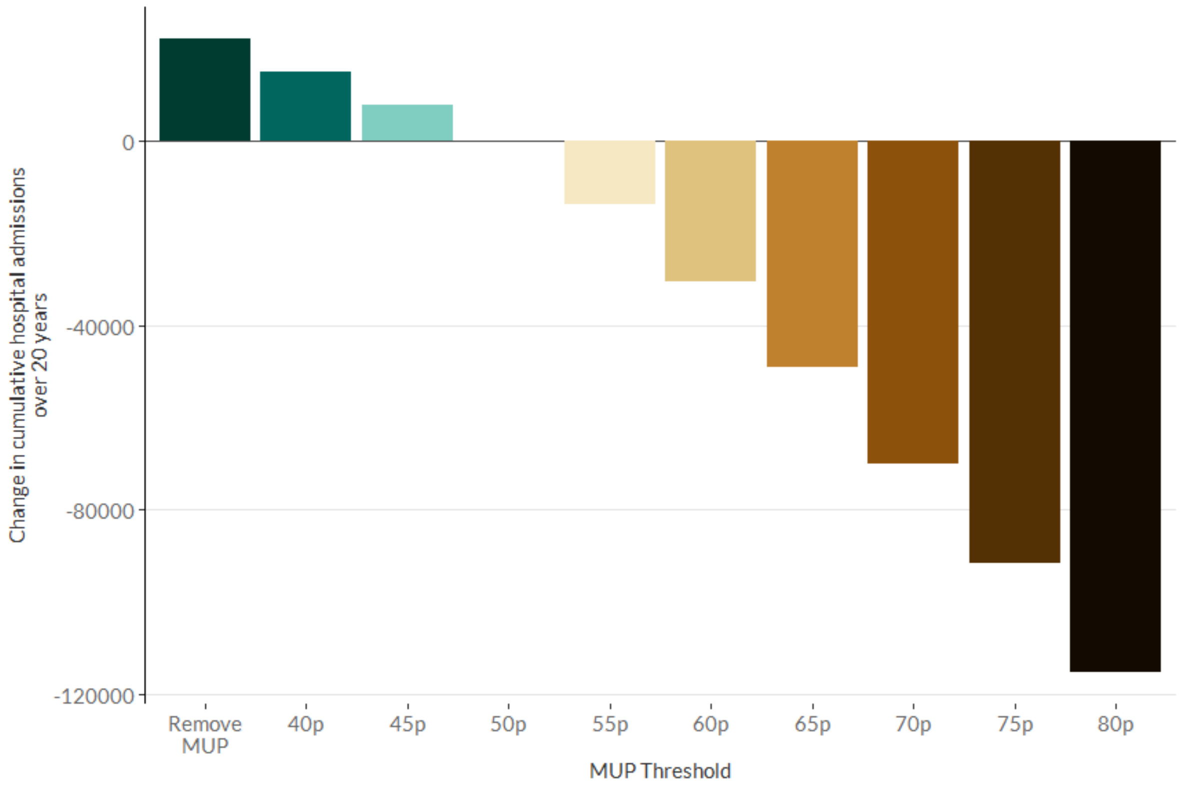

Figure 22: Modelled impacts of removing or changing the MUP threshold on cumulative hospital admissions over 20 years

	SIMD Q1 (least deprived)			SIMD Q2			SIMD Q3			SIMD Q4			SIMD Q5 (most deprived)		
	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr
Absolute change in hospital admissions vs. control															
Remove MUP	159	883	2,849	177	853	2,412	250	1,295	3,769	386	1,968	5,857	779	3,453	7,292
40p MUP	99	552	1,882	108	522	1,636	154	826	2,645	225	1,199	3,920	540	2,388	4,974
45p MUP	66	329	961	70	302	807	97	484	1,430	138	675	1,982	284	1,431	2,441
50p MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55p MUP	-76	-474	-1,798	-80	-478	-1,704	-131	-683	-2,503	-192	-980	-3,305	-296	-1,591	-4,554
60p MUP	-186	-1,077	-4,032	-197	-1,114	-3,928	-299	-1,525	-5,765	-421	-2,117	-7,077	-629	-3,259	-9,683
65p MUP	-294	-1,747	-6,527	-318	-1,791	-6,425	-459	-2,513	-9,201	-647	-3,377	-11,655	-978	-5,081	-15,373
70p MUP	-426	-2,447	-9,255	-445	-2,568	-9,469	-636	-3,463	-12,880	-917	-4,703	-16,213	-1,354	-7,029	-22,200
75p MUP	-540	-3,219	-12,415	-575	-3,318	-12,416	-826	-4,550	-16,725	-1,190	-6,109	-21,079	-1,713	-8,938	-29,086
80p MUP	-670	-3,965	-15,619	-705	-4,102	-15,501	-1,009	-5,579	-20,713	-1,434	-7,433	-26,209	-2,197	-11,260	-37,268
Change in admissions per 100,000 person years vs. control															
Remove MUP	17	19	15	20	19	14	29	30	22	47	48	37	97	86	46
40p MUP	11	12	10	12	12	9	18	19	16	27	29	25	67	60	31
45p MUP	7	7	5	8	7	5	11	11	8	17	16	13	35	36	15
50p MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55p MUP	-8	-10	-9	-9	-11	-10	-15	-16	-15	-23	-24	-21	-37	-40	-29
60p MUP	-20	-23	-21	-22	-25	-22	-35	-35	-34	-51	-52	-45	-78	-81	-61
65p MUP	-32	-38	-34	-35	-40	-36	-53	-58	-54	-78	-82	-74	-121	-127	-97
70p MUP	-46	-53	-49	-50	-57	-54	-74	-80	-76	-111	-115	-103	-168	-175	-140
75p MUP	-59	-69	-65	-64	-74	-70	-96	-106	-99	-143	-149	-134	-213	-223	-184
80p MUP	-73	-85	-82	-78	-91	-88	-117	-130	-122	-173	-181	-167	-273	-281	-235

Table 19: Modelled impacts of removing or changing the MUP threshold on hospital admissions by SIMD quintile

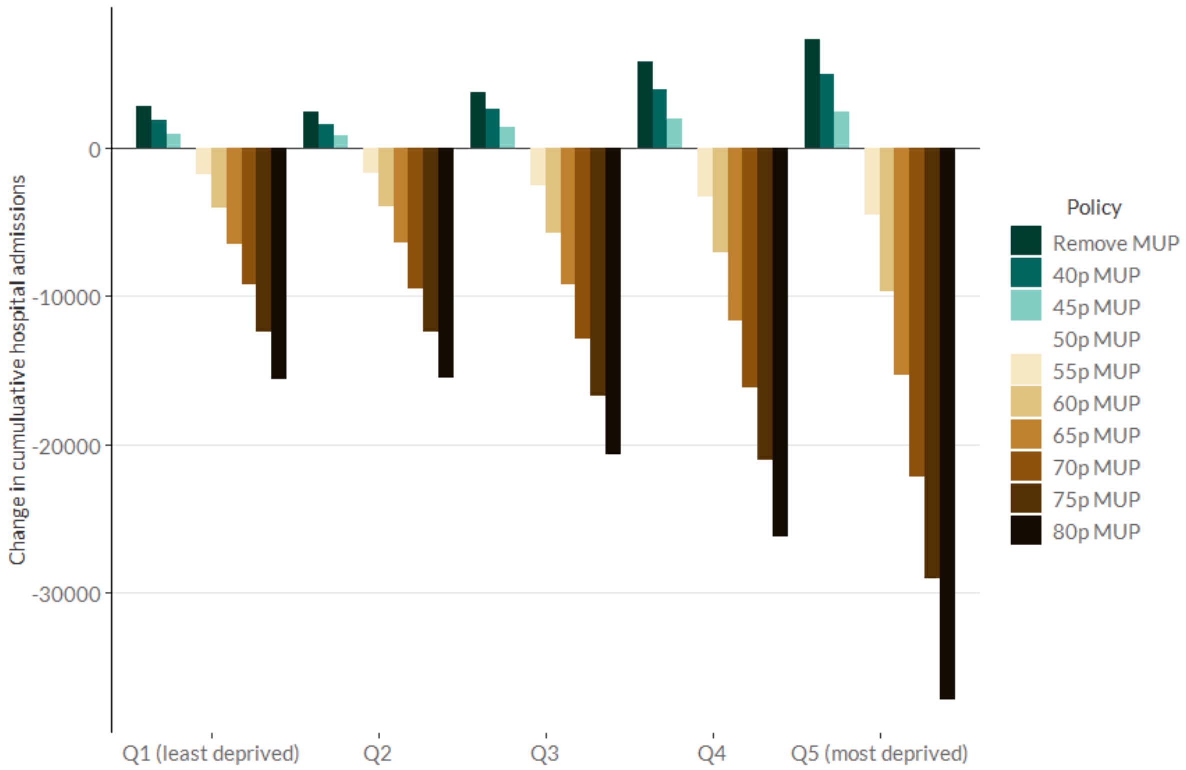

Figure 23: Modelled impacts of removing or changing the MUP threshold on cumulative hospital admissions over 20 years by SIMD quintile

The estimated impacts of each modelled policy on overall Years of Life Lost to premature death is shown in Table 20 and visualised in Figure 24, with comparable results by SIMD quintile in Table 21 and Figure 25. These again follow a similar pattern to the mortality results.

	Year 1	Cumulative over 5 years	Cumulative over 20 years
Absolute change in YLLs vs. control			
Remove MUP	4,123	22,355	58,348
40p MUP	2,654	14,532	39,208
45p MUP	1,512	8,594	19,965
50p MUP	0	0	0
55p MUP	-1,828	-10,800	-35,111
60p MUP	-4,008	-23,278	-78,150
65p MUP	-6,197	-36,930	-125,485
70p MUP	-8,651	-51,240	-178,245
75p MUP	-11,064	-65,820	-233,539
80p MUP	-13,644	-80,975	-293,138
Change in YLLs per 100,000 person years vs. control			
Remove MUP	96	104	69
40p MUP	61	67	46
45p MUP	35	40	23
50p MUP	0	0	0
55p MUP	-42	-50	-41
60p MUP	-93	-108	-92
65p MUP	-144	-171	-147
70p MUP	-200	-238	-209
75p MUP	-256	-305	-274
80p MUP	-316	-376	-344

Table 20: Modelled impacts of removing or changing the MUP threshold on Years of Life Lost to premature death

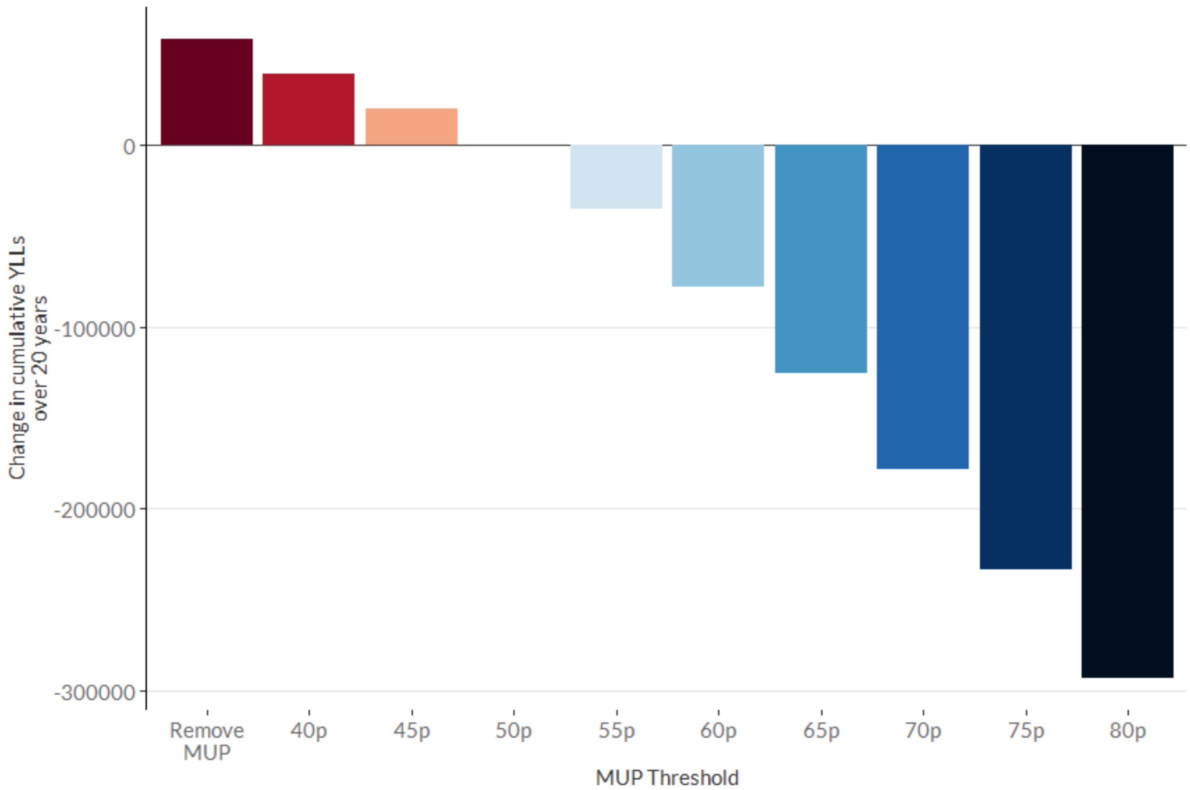

Figure 24: Modelled impacts of removing or changing the MUP threshold on cumulative YLLs over 20 years

	SIMD Q1 (least deprived)			SIMD Q2			SIMD Q3			SIMD Q4			SIMD Q5 (most deprived)		
	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr	Y1	Cumul. 5yr	Cumul. 20yr
Absolute change in YLLs vs. control															
Remove MUP	295	1,789	5,738	415	2,173	6,179	606	3,543	10,326	898	5,304	16,212	1,909	9,547	19,892
40p MUP	182	1,110	3,778	248	1,324	4,186	374	2,245	7,194	518	3,192	10,754	1,332	6,661	13,295
45p MUP	120	660	1,968	160	748	2,029	229	1,317	3,975	313	1,800	5,386	691	4,070	6,607
50p MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55p MUP	-135	-907	-3,432	-180	-1,172	-4,202	-305	-1,761	-6,747	-480	-2,596	-8,521	-728	-4,364	-12,208
60p MUP	-328	-2,090	-7,787	-446	-2,763	-9,664	-700	-3,974	-15,598	-1,039	-5,684	-18,718	-1,495	-8,766	-26,383
65p MUP	-519	-3,385	-12,536	-722	-4,428	-15,671	-1,080	-6,599	-24,597	-1,589	-9,092	-31,369	-2,287	-13,426	-41,312
70p MUP	-756	-4,758	-17,715	-989	-6,282	-22,972	-1,482	-9,038	-34,184	-2,261	-12,638	-43,576	-3,165	-18,523	-59,798
75p MUP	-950	-6,198	-23,669	-1,289	-8,075	-29,875	-1,945	-11,902	-44,356	-2,902	-16,311	-56,839	-3,978	-23,335	-78,801
80p MUP	-1,161	-7,573	-29,501	-1,572	-9,945	-37,088	-2,370	-14,507	-54,425	-3,477	-19,735	-70,558	-5,065	-29,215	-101,566
Change in YLLs per 100,000 person years vs. control															
Remove MUP	32	39	30	46	48	35	70	82	61	108	129	104	237	238	126
40p MUP	20	24	20	28	30	24	43	52	43	62	78	69	165	166	84
45p MUP	13	14	10	18	17	11	27	31	23	38	44	34	86	101	42
50p MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55p MUP	-15	-20	-18	-20	-26	-24	-35	-41	-40	-58	-63	-54	-90	-109	-77
60p MUP	-36	-45	-41	-50	-62	-55	-81	-92	-92	-125	-138	-119	-186	-218	-167
65p MUP	-56	-73	-66	-80	-99	-89	-125	-153	-145	-192	-221	-200	-284	-335	-261
70p MUP	-82	-102	-93	-110	-140	-130	-171	-210	-202	-273	-308	-278	-393	-462	-378
75p MUP	-103	-133	-124	-144	-180	-169	-225	-276	-262	-350	-397	-362	-494	-581	-498
80p MUP	-126	-163	-155	-175	-222	-210	-274	-337	-321	-419	-480	-450	-629	-728	-641

Table 21: Modelled impacts of removing or changing the MUP threshold on YLLs by SIMD quintile

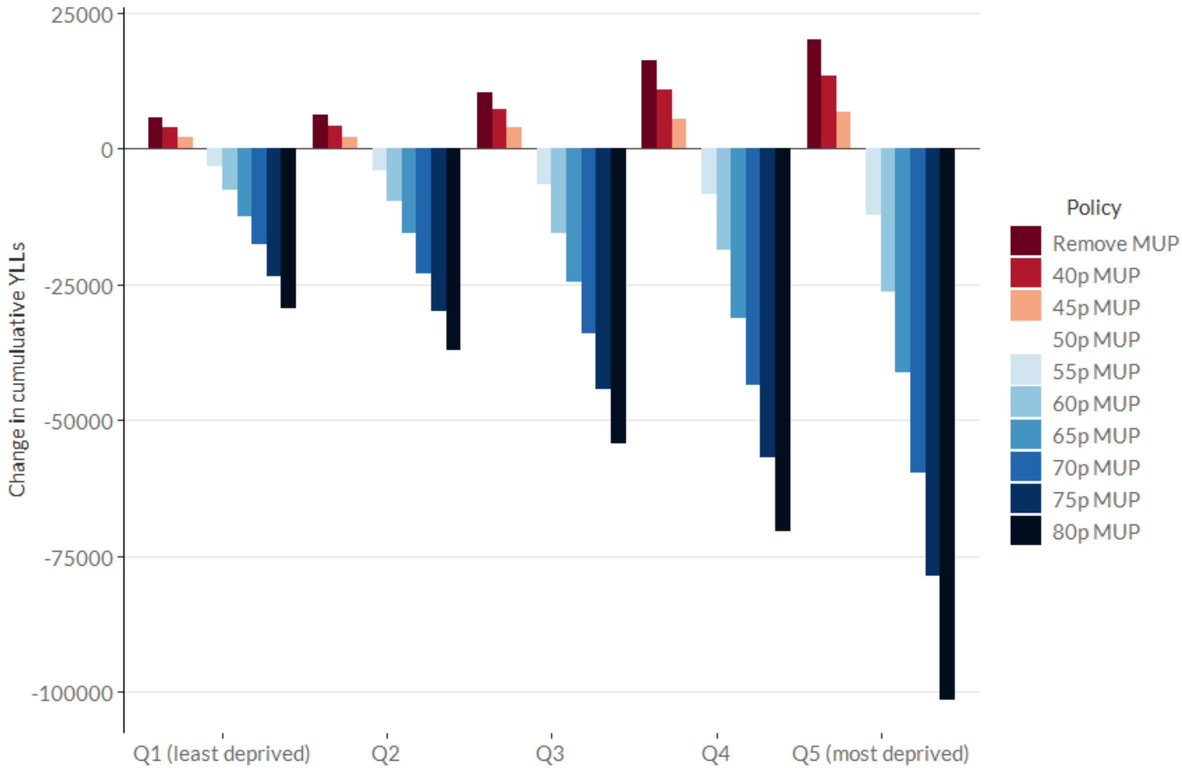

Figure 25: Modelled impacts of removing or changing the MUP threshold on cumulative YLLs over 20 years by SIMD quintile

Finally, the impact of each modelled MUP policy on NHS hospital costs, in comparison to a scenario where the current 50p MUP remains in place throughout the model period, is shown in Table 22. This table presents the cumulative cost changes over the first 5 years of the policy as well as over the full 20 year modelled period. Note that these figures are presented without discounting.

	Change in NHS hospital costs (£m)	
	Cumulative 5 year (Y1-5)	Cumulative 20 year (Y1-20)
Remove MUP	£10.0	£26.4
40p MUP	£6.5	£17.9
45p MUP	£3.8	£9.0
50p MUP	£0.0	£0.0
55p MUP	-£5.0	-£16.4
60p MUP	-£10.9	-£36.7
65p MUP	-£17.4	-£59.1
70p MUP	-£24.2	-£84.3
75p MUP	-£31.3	-£110.6
80p MUP	-£38.7	-£139.1

Table 22: Modelled impacts removing or changing the MUP threshold on NHS hospital costs cumulatively over 5 and 20 years following policy implementation - undiscounted

The full effect impacts of each policy on hospital costs is visualised in Figure 26. This shows an almost linear relationship between changes in the MUP threshold and changes in hospital costs.

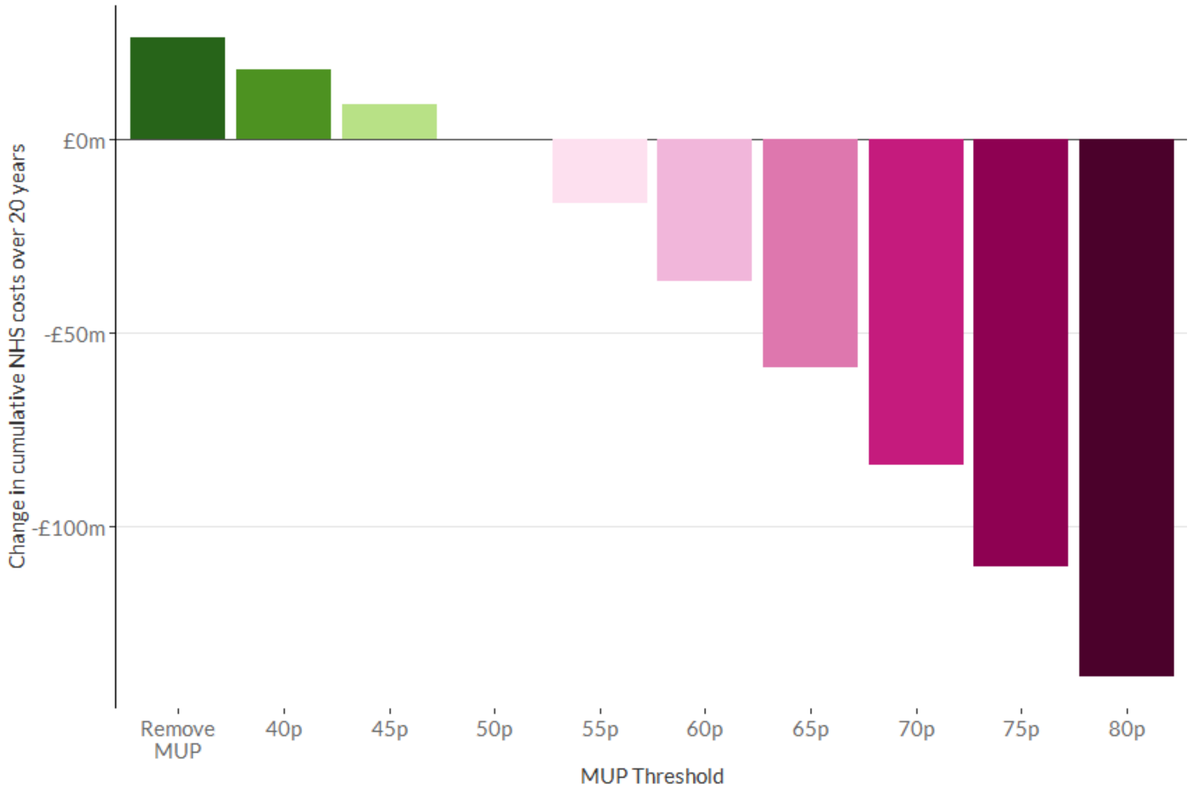

Figure 26: Modelled impacts removing or changing the MUP threshold on cumulative NHS hospital costs over 5 years following policy implementation - undiscounted

Sensitivity analysis

Table 23 shows the impact of the three sets of sensitivity analyses on our modelled estimates of changes in alcohol consumption and spending under a 60p MUP. This illustrates that there is no material difference in these outcomes where alcohol prices are estimated to rise in line with CPIH rather than RPI (SA1). When we use alternative price elasticities from Meng et al. (SA2) we see a considerably smaller estimated reduction in alcohol consumption and an *increase* rather than a decrease in spending. Where we upshift baseline alcohol consumption to account for underreporting of drinking by survey respondents (SA3) we find a similar pattern to the alternative elasticities, with smaller consumption reductions and an increase in consumer spending.

	Base case	SA1 - CPIH price increases	SA2 - Meng elasticities	SA3 - upshifted consumption
Baseline alcohol consumption (units/drinker/week)	12.0	12.0	12.9	17.6
Absolute change under 60p MUP vs. control	-0.8	-0.8	-0.2	-0.3
Relative change	-6.7%	-6.7%	-1.9%	-2.0%
Baseline spending (£/drinker/week)	£27.92	£27.92	£28.77	£28.21
Absolute change under 60p MUP vs. control	-£0.32	-£0.32	£0.58	£0.56
Relative change	-1.1%	-1.1%	2.0%	2.0%

Table 23: Modelled impacts of alternative model assumptions on alcohol consumption and spending

The impact of these sensitivity analyses on health outcomes is shown in Table 24. These demonstrate a similar pattern to the consumption results in Table 21, with relatively small differences between the base case and SA1, while SA2 and SA3 show smaller overall impacts on deaths, hospital admissions and YLLs.

	Base case	SA1 - CPIH price increases	SA2 - Meng elasticities	SA3 - upshifted consumption
Deaths				
Annual alcohol-attributable deaths	1,220	1,220	1,359	1,757
Absolute cumulative change in deaths under 60p MUP vs. control over 20 years	-2,483	-2,631	-818	-1,088
Hospital admissions				
Annual alcohol-attributable hospital admissions	20,700	20,700	22,503	27,801
Absolute cumulative change in hospital admissions under 60p MUP vs. control over 20 years	-30,484	-33,972	-11,614	-15,490
YLLs				
Annual YLLs to alcohol per 100,000 drinkers	1,185	1,185	1,303	1,597
Absolute cumulative changes in YLLs under 60p MUP vs. control over 20 years	-78,150	-86,444	-30,559	-38,906

Table 24: Modelled impacts of alternative model assumptions on health harms

Table 25 shows the impact of the alternative model assumptions on the impact on NHS costs of increasing the MUP threshold to 60p. These show similar patterns to Table 24, with similar changes in the base case and SA1, and smaller impacts in SA2 and SA3.

	Base case	SA1 - CPIH price increases	SA2 - Meng elasticities	SA3 - upshifted consumption
Change in NHS costial costs in 2020 vs. control under 60p MUP (£m)	-£2.0	-£2.0	-£0.7	-£0.9
Change in NHS hospital costs (cumulative 5 year) vs. control under 60p MUP (£m)	-£10.9	-£11.4	-£3.8	-£4.8
Change in NHS hospital costs (cumulative 20 year) vs. control under 60p MUP (£m)	-£36.7	-£40.9	-£13.2	-£18.0

Table 25: Modelled impacts of alternative model assumptions on NHS hospital costs

Finally, Figure 27 presents a summary overview of the impact of all 3 sensitivity analysis on 6 key model outcomes - alcohol consumption, spending, deaths, hospital admissions, YLLs and NHS costs. This illustrates that there is little difference between the base case and the alternative approach of assuming the MUP threshold rises in line with RPI rather than CPIH by default (SA1). The use of alternative price elasticities (SA2) and attempting to adjust the baseline consumption data for underreporting (SA3) have similar effects to each other - reductions in consumption and all health outcomes that are between 1/3 and 1/2 as large as the base case, and an opposite impact on consumer spending, which is estimated to fall under a 60p MUP rather than increase.

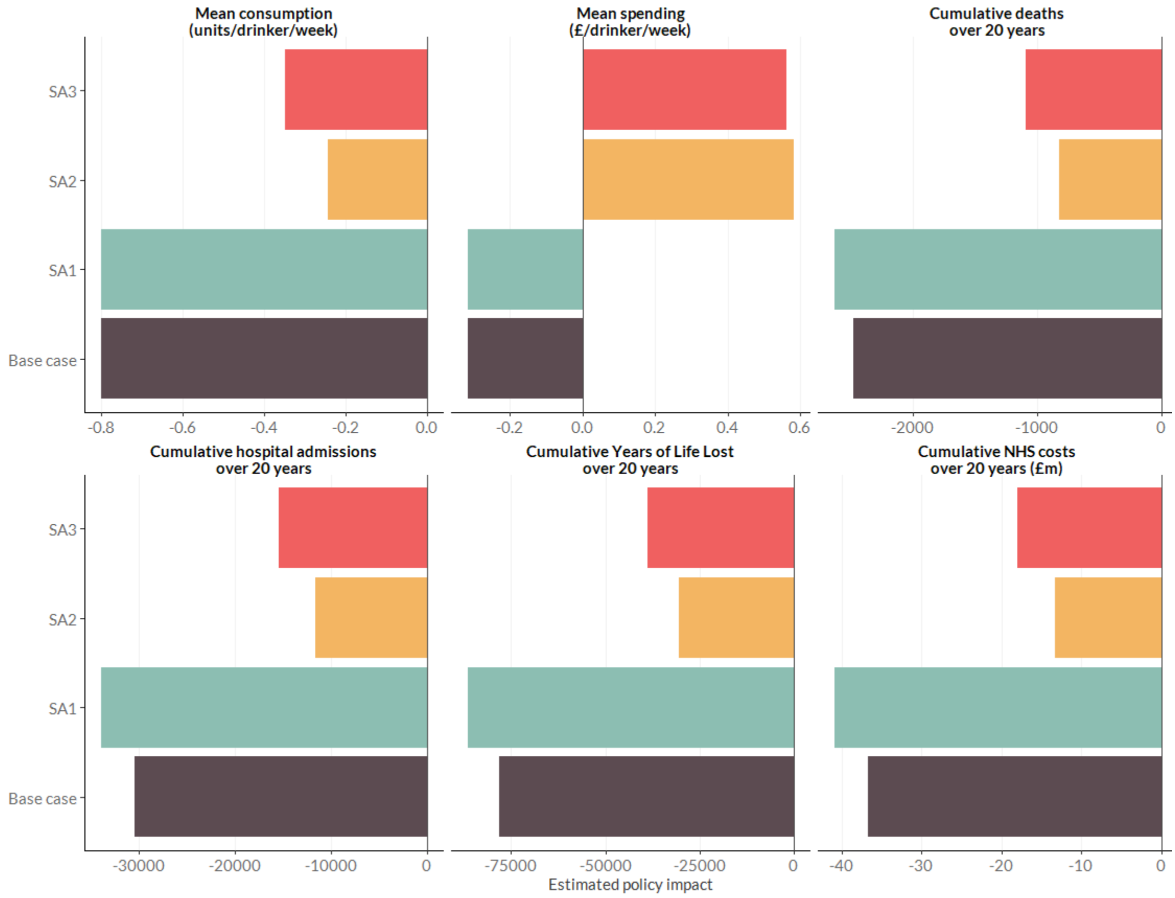

Figure 27: Modelled impacts of alternative model assumptions on outcomes

Discussion

The results in this chapter demonstrate that, although alcohol prices have changed markedly and overall alcohol consumption has fallen since the 50p MUP was first introduced in Scotland in 2018, the underlying patterns in alcohol consumption and purchasing preferences remain similar. Hazardous and harmful drinkers and, to a lesser extent, those from lower socioeconomic groups continue to purchase a greater proportion of the lower cost alcohol, although MUP has reduced the magnitude of these differences.

We estimate that increasing the MUP threshold in 2019 would have led to further reductions in alcohol consumption, in consumer spending on alcohol, in alcohol-related harm, including mortality, hospital admissions and Years of Life Lost, and in NHS costs associated with that harm. These estimated reductions are greater for larger increases in the MUP threshold. In contrast, we estimate that reducing the MUP threshold or removing the MUP altogether in 2019 would have led to increases in alcohol consumption, harm and NHS costs.

Increasing the MUP threshold in 2019 is also estimated to lead to reductions in government revenue from alcohol taxation, and increases in revenue to off-trade retailers, while reducing revenue to on-trade retailers. However, in our previous modelling of MUP the impact on on-trade retailers was uncertain and often changed between model versions, scenarios and sensitivity analyses as it arises primarily from the specific details of the cross-price elasticities describing how drinkers substitute between off- and on-trade drinks in response to price changes. The impact of on-trade retailers should therefore be considered relatively more uncertain than other findings as it appears particularly sensitive to other parameters in the model.

The distributional impact of changes in the MUP are similar to those estimated prior to the introduction of MUP, with greater reductions in alcohol consumption among those in more deprived groups. Conversely, lowering the threshold from its current 50p level or removing it entirely would lead to increases in consumption that are largest in these same groups. We have also shown, for the first time, that changes in the MUP threshold lead to larger relative changes in the number of harmful drinkers than the number of moderate or hazardous drinkers.

Increasing the MUP threshold is estimated to lead to modest reductions in annual all-cause mortality. Recent evaluation evidence suggests that the introduction of a 50p MUP in 2018 was associated with 268 fewer deaths per year in the initial years of implementation (156 fewer alcohol-specific and 112 fewer partially alcohol-attributable deaths) (43). Our analysis suggests that increasing the MUP to 70p would have a comparable additional impact on mortality (278 fewer all-cause deaths) in the first year after implementation. The evaluation of the introduction of MUP also found the largest reductions in mortality among the most deprived groups, something that our analysis estimates would also be the case if the MUP threshold were increased, with approximately a third of the deaths averted accruing in the most deprived quintile of the population. Results for hospital admissions and Years of Life Lost to premature death follow similar patterns to those for mortality, with patterns of the harm impacts of changing the MUP threshold across SIMD quintiles that are consistent across all outcomes. Raising the MUP threshold leads to larger reductions in harms among the most deprived groups, leading to a reduction in health inequalities, while lowering the threshold has the opposite effect.

Sensitivity analyses show that the direction of our results, and their patterns in terms of which groups are more or less affected, are robust to alternative assumptions, with the exception of estimated changes in spending, which appear more sensitive. However, where we use alternative price elasticities, or account for underreporting in population surveys of alcohol consumption, we find that our overall estimates of the effectiveness of increasing the MUP threshold are around 50-70% smaller then in our base case. Studies evaluating the impact of the introduction of MUP in Scotland suggest that previous estimates from SAPM were conservative. For example, the final pre-implementation version of SAPM, which used the same elasticities as used here in SA2, estimated that a 50p MUP would lead to a 3.5% reduction in alcohol consumption, a 3.2%% reduction in alcohol-specific deaths in the second year after implementation and a 5.9% reduction in partially alcohol-attributable deaths. The most robust evidence from the evaluation programme found a 3.0% reduction in consumption, a 13.4% reduction in alcohol-specific deaths and an 8.4% reduction in partially alcohol-attributable deaths in the first 2 years post-implementation (44). Given this, the estimates of policy effectiveness in SA2 and SA3 may be considered lower bounds of the potential impact of changing the MUP threshold. When comparing the modelled estimates from TAX-sim with the results from the MUP evaluation it is also notable that we estimate a 7.8% increase in alcohol-specific deaths in the first year if the MUP was to be removed entirely. This is substantially lower than the 13.4% reduction in alcohol-specific deaths found in the evaluation, suggesting that the modelled mortality estimates may be conservative relative to real-world evidence.

Overall, the results in this chapter illustrate that increasing the MUP threshold has the potential to lead to further reductions in alcohol consumption, including a reduction in the number of harmful drinkers. We also find that this would reduce alcohol-attributable harm, and that these reductions would be greatest among those in the most deprived groups. Removing, or lowering the MUP level would have the opposite effect, increasing harms, particularly among deprived groups.

Chapter 2 - A comparison of the impacts of MUP and alcohol duty changes

Introduction

This chapter presents analyses relating to three policy questions: i) What is the increase in duty rates required to have comparable effects to a change in the MUP threshold? ii) What is the impact of planned changes to the UK alcohol duty system? iii) What is the increase in duty rates required under that new system to have comparable effects fo a change in the MUP threshold? We briefly explain these three questions below.

In our previous modelling report on the potential impact of introducing a MUP in Scotland (4) we presented an analysis of the increase in alcohol duty rates which would be required to achieve a comparable effect to an MUP. In this chapter we replicate this approach to estimate the duty increase required to achieve the same number of:

a. Total deaths averted

b. Total deaths averted in hazardous and harmful drinkers

c. Total deaths averted in harmful drinkers

d. Total deaths averted in hazardous and harmful drinkers in the lowest quintile of the Scottish Index of Multiple Deprivation (SIMD)

e. Total deaths averted in harmful drinkers in the lowest SIMD quintile

as each of our modelled changes to the MUP thresholds used in Chapter 1 (40p, 45p, 55p, 60p, 70p, 75p, 80p).

The UK Government has also announced its intention to reform the alcohol duty system (45). This will change the basis on which duty is levied on wine and cider from unitary (where tax is levied on the basis of the product volume) to specific (where tax is levied on the basis of the alcohol volume) (46). It will also introduce a new ‘draught relief’ system that levies lower duty rates on alcoholic products sold in pubs, bars, restaurants and nightclubs (47). This new system is scheduled to come into effect in August 2023. We therefore present an analysis of the impact of the reform of the duty system on alcohol consumption, spending, exchequer and retailer revenue, health and NHS hospital costs in Scotland. Note that some aspects of the ‘draught relief’ system were revised in the Spring 2023 Budget, specifically the magnitude of this relief was increased (48). At the same time an 18 month ‘transition period’ was announced for the changes to wine duty. These changes were announced after the modelling had been completed and are therefore not reflected in the analysis presented here, although the impact of this is likely to be relatively small.

Finally, we explore whether the reform of the alcohol duty system is likely to alter our assessment of the changes in duty rates required to match the impact of each change to the MUP threshold, as described above.

The analysis in this chapter mirrors previous analysis undertaken using SAPM, with four of the five target populations set out above being defined in relation to their drinker group. As discussed in Chapter 1 and the Appendix there are important differences in the way in which drinker group results should be interpreted between TAX-Sim and SAPM and these numbers should not be directly compared between the two models.

Methods

Modelling changes to duty rates

Changes in alcohol duty rates are modelled by decomposing each price paid in the observed price distributions in the model into three components: excise duty, Value-Added Tax (VAT) and the remaining revenue to retailers. Calculating the excise duty component is complicated by the fact that different duty rates apply to products sold in different alcoholic strength bands, but we do not have precise ABV data in order to match each product to the relevant band. We resolve this by calculating the consumption-weighted average of duty rates within each ABV band and applying this average across all products of that type (e.g. beer). Weights for this calculation were derived from analysis of data from Kantar Alcovision, which includes detailed ABV data (see (49) for further details of this data) and stratified by drinker group in order to allow for different beverage strength preferences of moderate, hazardous and harmful drinkers.

As beer, spirits and RTDs are taxed by their alcohol content, it is straightforward to calculate the relevant duty per unit of alcohol. Cider and wine are taxed on the basis of product volume and therefore in order to calculate duty per unit we use further analysis of the Kantar Alcovision data to estimate the mean ABV within each ABV band.

Having decomposed each price into these three components, changes in duty rates are used to recalculate the excise duty component of the price and the overall price is reconstructed assuming no changes in the net revenue to retailers and with a recalculation of the VAT component to reflect the new duty component. This overall value reflects the expected price following the duty change, which is then adjusted for tax pass-through to account for supply-side (e.g. producer and retailer) responses to the change in duty. The model applies separate pass-through coefficients to products sold in the on-trade and off-trade, taken from Ally et al. (16) and Wilson et al. (17) respectively. The adjustment for tax-passthrough completes the updating of alcohol prices to reflect changes in duty rates.

Question 1: Estimating the change in duty rates required to have the same impact as changes to the MUP

We model changes to current duty rates using 2019 as the policy effect year. We apply duty changes in 2019 as a uniform percentage increase to all of the modelled rates used in 2018. All models maintain the 50p MUP indefinitely after 2019, uprating it by CPIH inflation (i.e. the MUP trajectory is identical to the control arm). Comparisons of these models with the control arm can therefore be interpreted as the impact of changing alcohol duties in 2019.

Estimating required increases in alcohol duties

We estimate the duty increase required to have the same effect as changes to the MUP through a process called ‘equivalisation’. The first stage of the equivalisation process is to estimate, for each MUP scenario, the uniform rise in all duty rates required to reach the same number of deaths averted (relative to the 50p MUP / no duty change scenario (i.e. the control arm)) . To do so, we ran a number of exploratory models applying duty changes in 10% increments from -50% to +130%. These models were estimated to provide a range of results that could be used as inputs to a calibration process allowing us to estimate the required duty change for each of the five target populations listed above (i.e. total deaths, deaths in hazardous and harmful drinkers etc.) and for each of the MUP threshold scenarios.

The calibration process involves, for each of the target populations, plotting all of the policy effects from the initial exploratory models and connecting the points. This produced an approximately linear relationship between the size of the tax rise and the estimated policy effect. We therefore used linear interpolation to estimate the duty rise that would be required to obtain the same policy effect in the respective target population as under each of the MUP threshold scenarios. These duty rises were obtained by reading the required duty rise visually from the plotted relationship between percentage duty rise, and deaths averted relative to the control arm. For each of the five populations of interest in the equivalisation, the total deaths figure which is the target for equivalising duty rises with MUP policies is cumulative deaths over 20 years starting from the policy effect year for the MUP policy (2019-2038). This process is illustrated in Figure 28

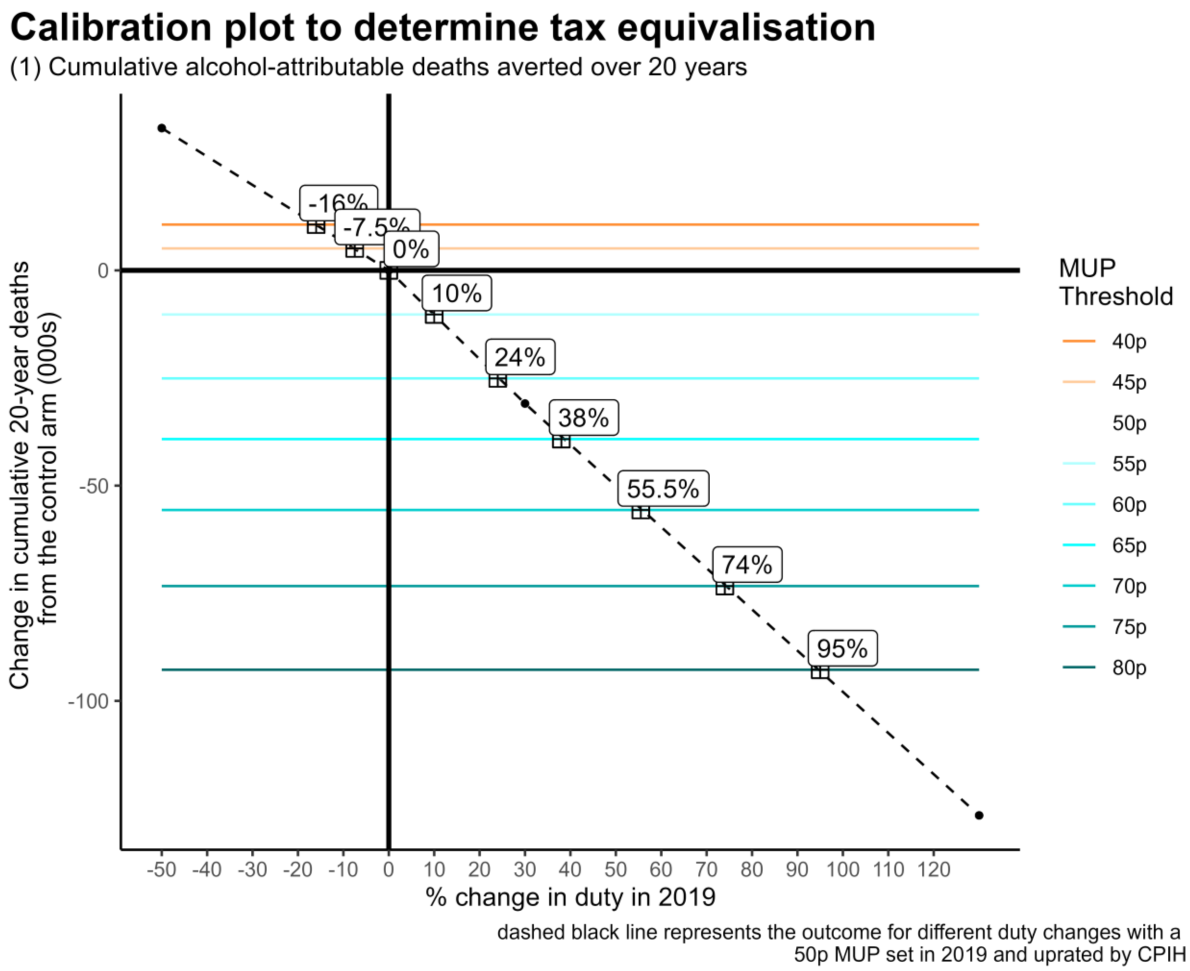

Figure 28: Example of the equivalisation process

The calibration process provides the duty rate change required to have the same impact as the MUP threshold changes, but does not model the full impacts of that duty increase. We do not run duty change models for each of the five target populations for each of the eight MUP thresholds (i.e. 40 models). Instead, we focus our analysis on the 60p threshold scenario, and model the five duty rises corresponding to the five target populations in that scenario.

Question 2: Estimating the impact of planned changes to the alcohol duty system

Figure 29 compares the current and incoming alcohol duty systems. The new duty system involves fewer separate duty rates, alignment of the strength bands to which duty is applied across products, and charges duty for all products based on alcohol volume, ensuring stronger products pay more duty. The draught relief element of the reform is an approximately 9% reduced duty rate for products sold below 8.5% ABV in containers of at least 40 litres and sold to connect to a dispensing system. This means that, for example, the main duty rate per litre of pure alcohol for all products between 1.3% - 3.4% ABV is £9.27, but is reduced to £8.42 for products that qualify for draught relief.

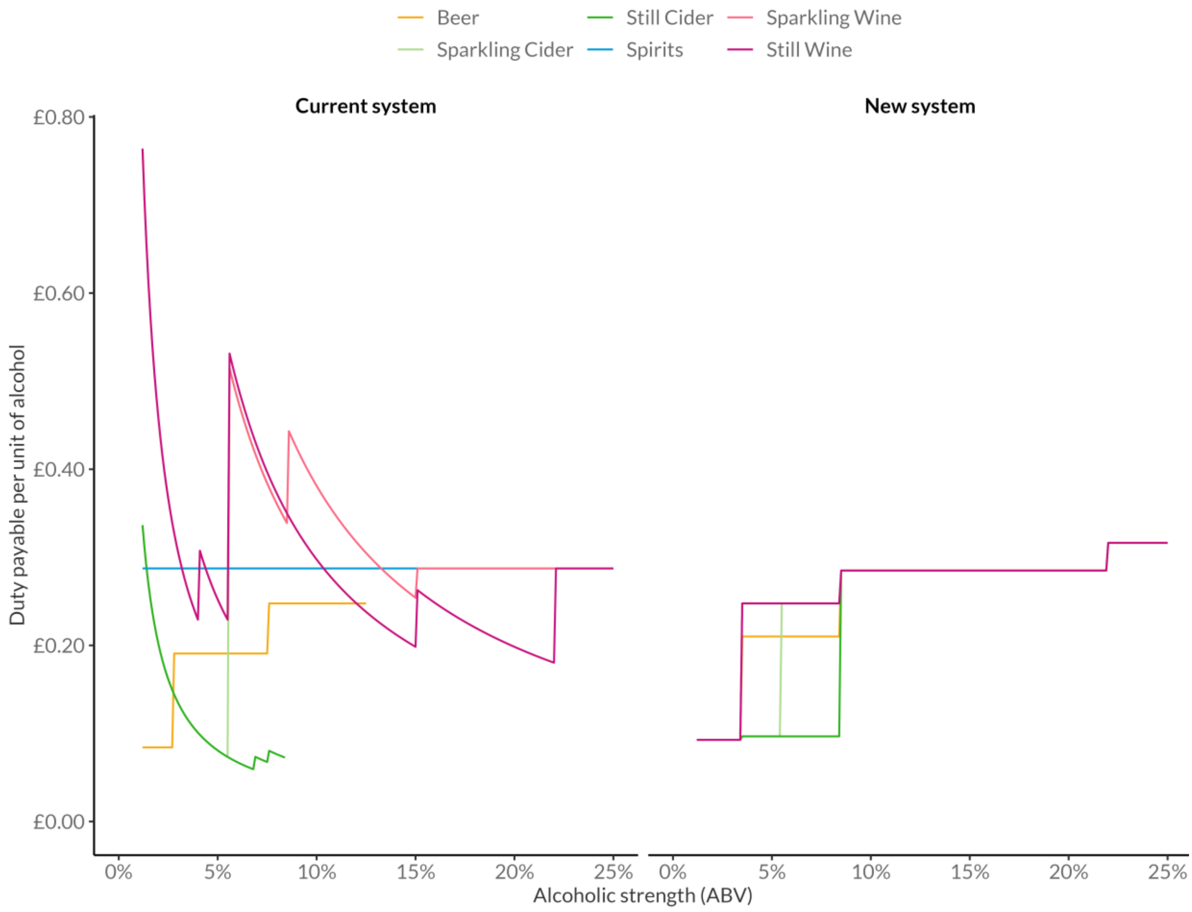

Figure 29: Graphic overview of the reforms to alcohol duty

The duty reform is modelled in a single intervention arm in which the new duty system and rates are implemented in 2023, while retaining the same MUP policy as in the control arm (i.e. 50p MUP in 2018 and 2019, and uprated by CPIH thereafter). The LCFS data that provides our price distributions toes not enable us to distinguis between sales in the on-trade that do and do not qualify for draught relief. We therefore assume that all on-trade products qualify and consequently overestimate the impact of draught relief. This is unlikely to substantively affect our results or conclusions as previous modelling we have undertaken in response to the UK Government's consultation on the duty reforms indicated that the draught relief component of the reform had a negligible impact on outcomes.

Question 3: Estimating the duty rate changes required under the new duty system to have the same impact as changes to the MUP threshold

We repeat the tax equivalisation analysis assuming the new duty system is in place using the same methods described for Question 1 above. The only difference is that we implement the new duty system in 2023 and the uniform duty rate changes are applied alongside this introduction, rather than in 2019 as in Question 1. The target populations remain those over the 20-year period from 2019-2038, as in Question 1, rather than the period from 2023 onwards.

Results

Change in duty rates required to have the same impact as changes to the MUP

Table 26 demonstrates the changes to duty rates required to achieve the same change in cumulative deaths over 20 years (2019-2038) in the relevant target population. The increases in duty range from a 10% increase to match the reduction in total deaths in the population from increasing the MUP threshold to 55p MUP up to 109% to match the reduction in deaths among harmful drinkers from the most deprived SIMD quintile when increasing the MUP threshold to 80p. Similarly, the duty reductions required to have the same impact as reductions in the MUP threshold are between 7% and 20%.

	Target population				
	Population	Hazardous & harmful drinkers	Harmful drinkers	Hazardous & harmful drinkers in the most deprived SIMD quintile	Harmful drinkers in the most deprived SIMD quintile
40p	-16%	-14%	-18%	-16%	-21%
45p	-8%	-8%	-9%	-8%	-11%
50p	0%	0%	0%	0%	0%
55p	10%	9%	12%	10%	12%
60p	24%	22%	25%	23%	28%
65p	38%	36%	42%	38%	47%
70p	56%	51%	64%	56%	68%
75p	74%	68%	85%	74%	89%
80p	95%	86%	105%	94%	112%

Table 26: Increases in alcohol duty required to achieve the same impact as each MUP threshold for five target populations

Figure 30 shows how the duty increases required to have the same impact as increasing the MUP threshold to 60p affect the mean prices paid for different beverage types in both the on- and off-trade. Increasing the MUP threshold only affects the price of alcohol sold for between 50p and 60p per unit whereas duty increases affect the price of all alcohol. This means the MUP increase has a larger impact on off-trade prices and a much smaller (if any) impact on on-trade prices when compared to any of the duty increases. This difference in the extent to which MUP and duty policies target cheaper alcohol is key to understanding the results that follow.

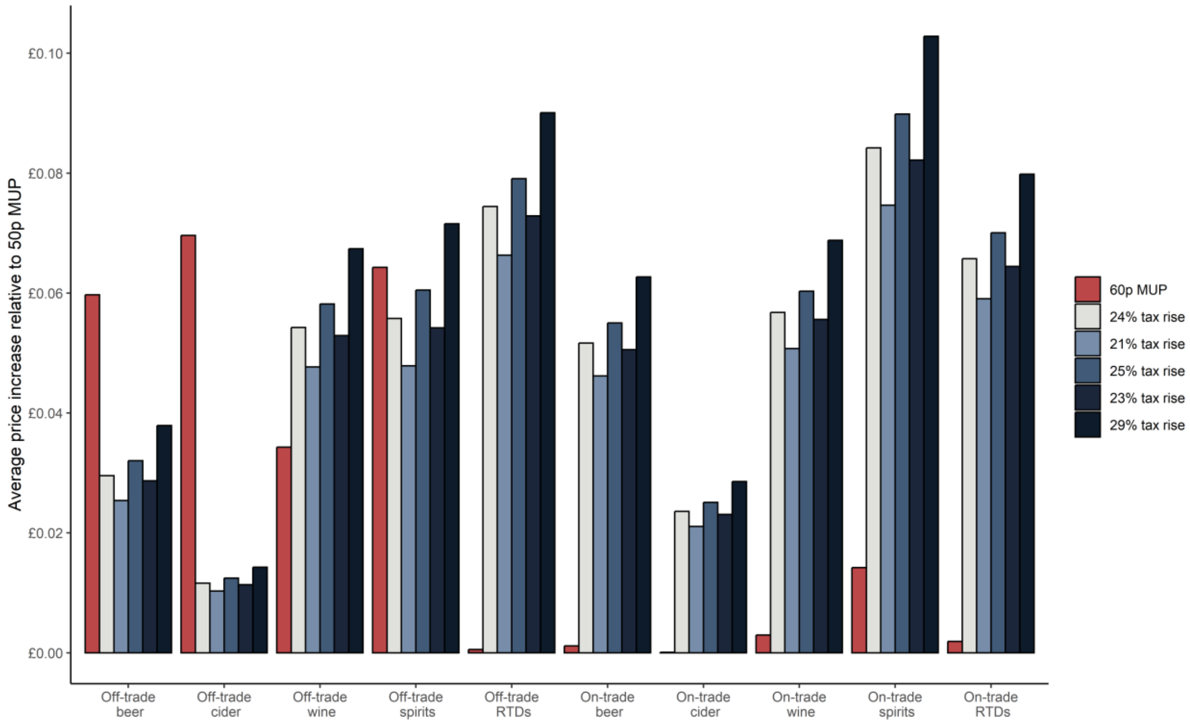

Figure 30: Estimated changes in mean price paid for alcohol under equivalised duty rates for a 60p MUP

The modelled impact on alcohol consumption of the duty increases compared to a 60p MUP at the population level is shown in Table 27 and the impact on the number of drinkers in each drinker group is shown in Table 28 and illustrated in Figure 31. These show that while the duty rises and MUP have a fairly similar impact on population level alcohol consumption, they have different impacts on the heaviest drinkers. All policies lead to reductions in in the number of hazardous drinkers and a corresponding increase in the number of people drinking at moderate levels. However, a 60p MUP leads to a larger fall in the number of harmful drinkers compared to any of the equivalised duty increases. As in the other chapters, full results by drinker group are presented in the Appendix to this report.

	Absolute change	Relative change
Mean consumption per drinker per week (control)	12.03	
Change in weekly consumption vs. control		
60p MUP	-0.80	-6.7%
24% tax rise	-0.64	-5.3%
22% tax rise	-0.69	-5.7%
25% tax rise	-0.62	-5.2%
23% tax rise	-0.56	-4.6%
28% tax rise	-0.80	-6.6%

Table 27: Comparative impact of a 60p MUP and duty increases on mean weekly alcohol consumption

	Moderate	Hazardous	Harmful
Absolute change vs. control			
60p MUP	68,050	-41,406	-26,644
24% tax rise	58,762	-42,038	-16,963
22% tax rise	50,650	-35,867	-14,914
25% tax rise	63,253	-45,374	-18,097
23% tax rise	57,213	-41,013	-16,397
28% tax rise	73,566	-52,984	-20,954
Relative change vs. control			
60p MUP	2.7%	-4.7%	-18.6%
24% tax rise	2.3%	-4.8%	-11.8%
22% tax rise	2.0%	-4.1%	-10.4%
25% tax rise	2.5%	-5.2%	-12.6%
23% tax rise	2.2%	-4.7%	-11.4%
28% tax rise	2.9%	-6.0%	-14.6%

Table 28: Comparative impact of a 60p MUP and duty increases on the number of drinkers in each group

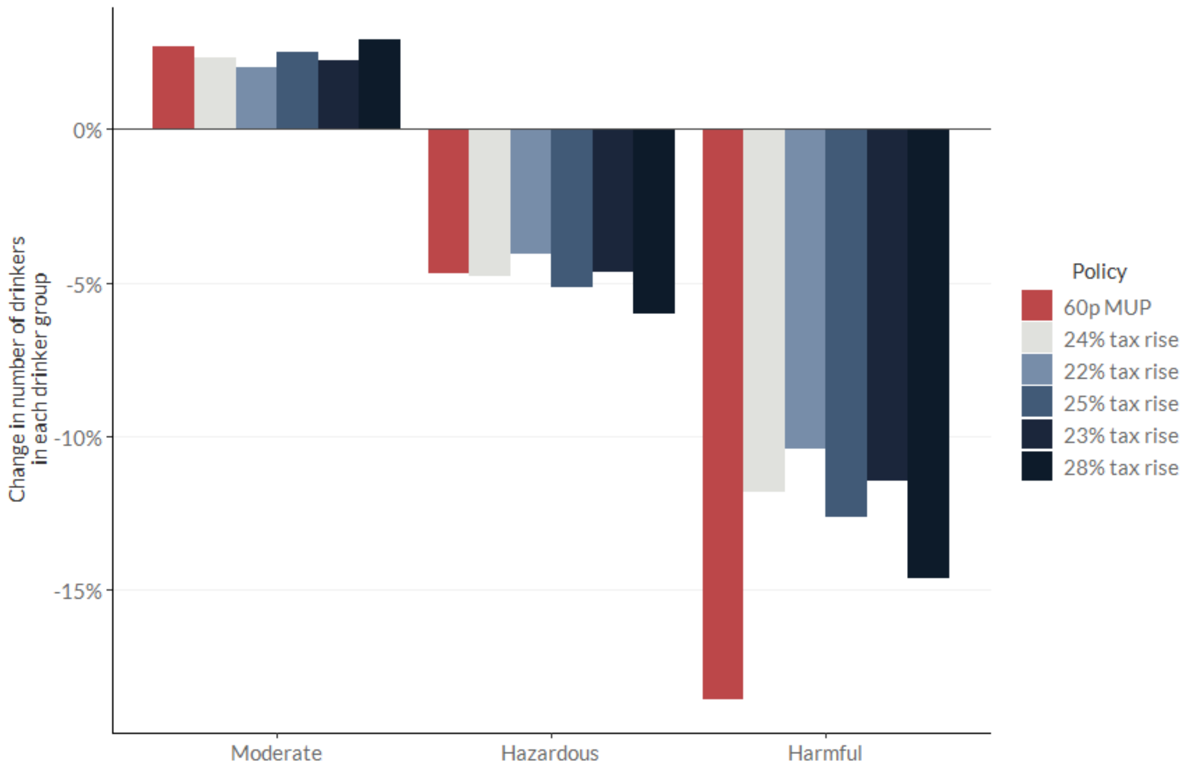

Figure 31: Comparative impact of a 60p MUP and duty increases on the number of drinkers in each group

The equivalent figures across SIMD quintiles are presented in Table 29 and Figure 32. These show less clear differences then when looking across drinker groups, although these is some indication that raising the MUP level has a marginally greater impact on the drinking of more deprived drinkers, while the equivalised duty increases have a larger effect on the drinking of less deprived groups.

		Modelled policy					
	Baseline consumption (units/drinker/week)	60p MUP	24% tax rise	22% tax rise	25% tax rise	23% tax rise	28% tax rise
Absolute change vs. control							
SIMD Q1 (least deprived)	13.61	-0.81	-0.70	-0.61	-0.75	-0.68	-0.87
SIMD Q2	11.44	-0.66	-0.59	-0.51	-0.63	-0.57	-0.74
SIMD Q3	12.09	-0.81	-0.64	-0.56	-0.70	-0.63	-0.81
SIMD Q4	11.24	-0.82	-0.61	-0.53	-0.65	-0.59	-0.77
SIMD Q5 (most deprived)	11.48	-0.93	-0.64	-0.55	-0.68	-0.62	-0.81
Relative change vs. control							
SIMD Q1 (least deprived)		-5.9%	-5.1%	-4.5%	-5.5%	-5.0%	-6.4%
SIMD Q2		-5.8%	-5.1%	-4.5%	-5.5%	-5.0%	-6.4%
SIMD Q3		-6.7%	-5.3%	-4.7%	-5.8%	-5.2%	-6.7%
SIMD Q4		-7.3%	-5.4%	-4.7%	-5.8%	-5.3%	-6.9%
SIMD Q5 (most deprived)		-8.1%	-5.6%	-4.8%	-5.9%	-5.4%	-7.0%

Table 29: Modelled consumption impacts of different equivalised rates for a 60p MUP by SIMD quintile

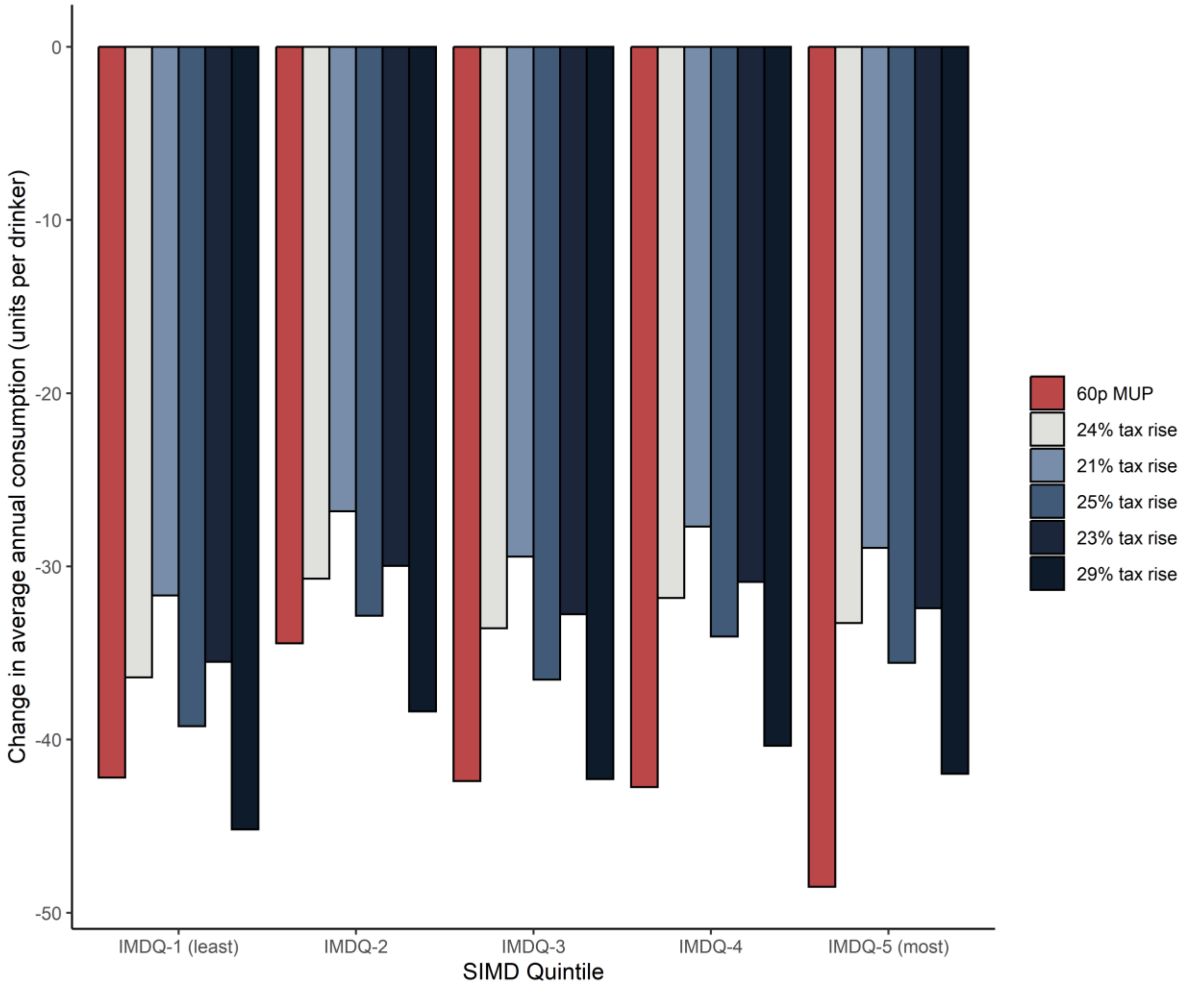

Figure 32: Comparative impact of a 60p MUP and duty increases on consumption by SIMD quintile

The comparative impact of the equivalised duty increases and raising the MUP threshold to 60p on cumulative mortality rates can be seen in Table 30. This shows much less variation than in changes in alcohol consumption, in part because the duty increases by definition lead to comparable reductions in mortality to a 60p MUP.

	Change in deaths per 100,000 person-years	Relative change in deaths
60p MUP	-2.92	-0.23%
24% tax rise	-2.64	-0.21%
22% tax rise	-2.47	-0.20%
25% tax rise	-2.95	-0.24%
23% tax rise	-2.65	-0.21%
28% tax rise	-3.35	-0.27%

Table 30: Modelled impacts of different equivalised rates and a 60p MUP on cumulative mortality rates over 20 years

The comparative mortality impacts of a 60p MUP and the duty rates across SIMD quintiles are shown in Table 31 and Figure 33 and are broadly similar across all policies, with the largest impact on mortality consistently in the most deprived groups. These gradients are much steeper than the gradient in consumption impacts illustrated in Figure 32 due to the higher rates of baseline harm due to alcohol among drinkers in more deprived areas.

		Modelled policy					
	Cumulative 20-year deaths (control)	60p MUP	24% tax rise	21% tax rise	25% tax rise	23% tax rise	29% tax rise
Absolute change vs. control							
SIMD Q1 (least deprived)	174,140	-339	-347	-311	-372	-340	-431
SIMD Q2	202,105	-345	-361	-334	-410	-389	-468
SIMD Q3	217,384	-572	-528	-491	-576	-526	-644
SIMD Q4	223,590	-551	-478	-459	-496	-470	-614
SIMD Q5 (most deprived)	234,802	-717	-559	-515	-679	-551	-724
Relative change vs. control							
SIMD Q1 (least deprived)		-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
SIMD Q2		-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
SIMD Q3		-0.3%	-0.2%	-0.2%	-0.3%	-0.2%	-0.3%
SIMD Q4		-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.3%
SIMD Q5 (most deprived)		-0.3%	-0.2%	-0.2%	-0.3%	-0.2%	-0.3%

Table 31: Modelled mortality impacts of different equivalised rates for a 60p MUP by SIMD quintile

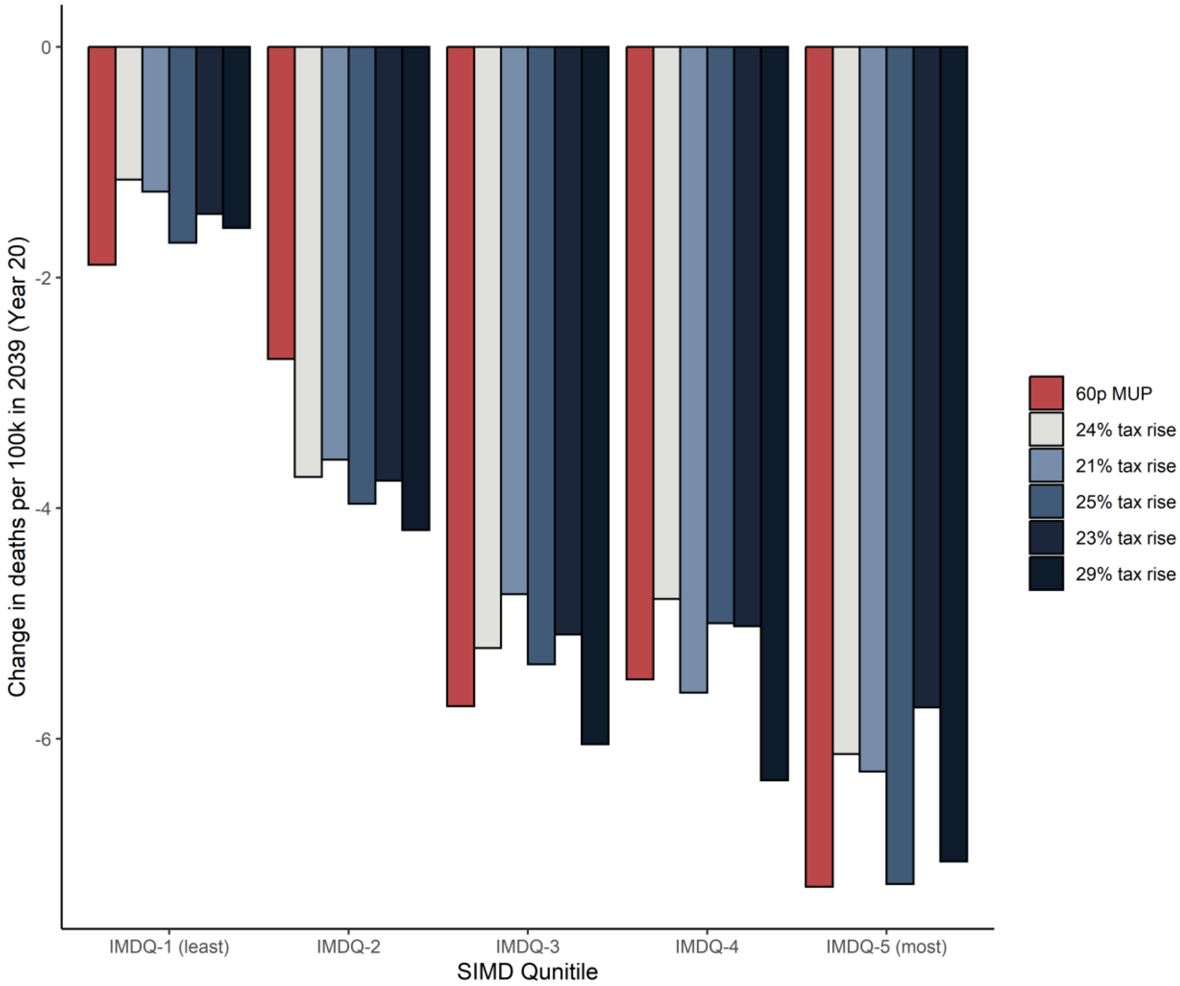

Figure 33: Comparative impact of a 60p MUP and duty increases on mortality by SIMD quintile

The modelled impact of reform to the alcohol duty system

The estimated impact of the duty reforms on the average duty payable per unit of alcohol within each beverage type in the off-trade and on-trade is shown in Figure 34. This highlights a large reduction in duty rates for RTDs (pre-mixed spirit-based drinks such as canned gin and tonic or alcopops), although these represent only a small proportion of alcohol consumption in Scotland. Wine makes up a much greater proportion of the alcohol market and the duty reform is estimated to lead to a 12.2% increase in duty per unit for off-trade wine and a 9.5% increase for on-trade wine. The difference between the on-trade and off-trade, which is also seen for beer and cider, is due to the ‘draught relief’ system. The overall effects of the duty reforms across all beverage types is an estimated (2.5%) increase in the average duty paid per unit of alcohol.

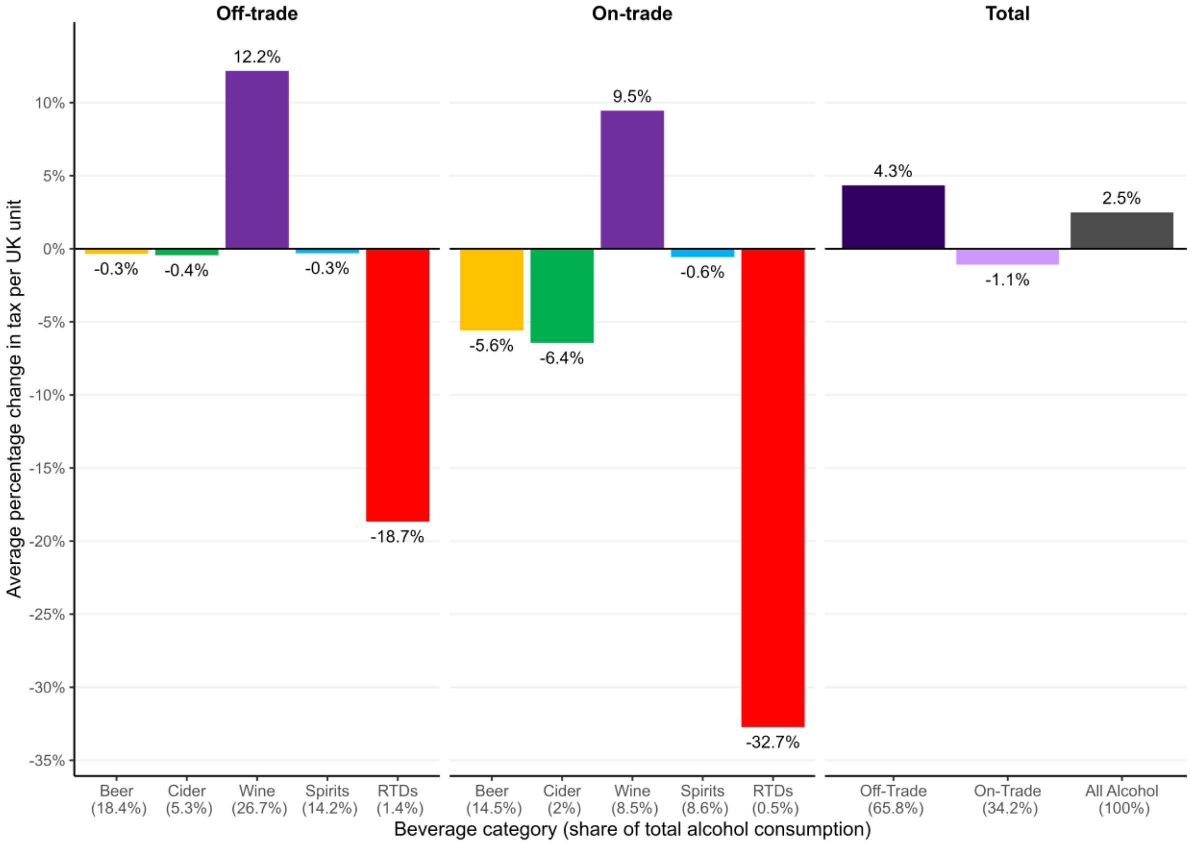

Figure 34: Estimated differential impacts on mean prices paid under duty reform

The extent to which the duty changes illustrated in Figure 34 are experienced by different population groups and therefore lead to changes in their alcohol consumption depends on the extent to which the groups consume different beverage types in different locations. The impact of the duty reforms on overall alcohol consumption is shown in Table 32, compared to the impact of increasing the MUP threshold to 60p.

The impact of the duty reforms is estimated to be a small reduction in overall alcohol consumption of -0.4%, whereas increasing the MUP threshold to 60p is estimated to reduce consumption by -5.8%. Table 33 and Figure 35 present the extent to which the alcohol duty reforms and a 60p MUP are estimated to move drinkers between groups. Both policies reduce the numbers of hazardous and harmful drinkers, but raising the MUP threshold from 50p to 60p does this to a much greater extent than the duty reforms. Note that the caveats around interpreting changes in mean consumption within drinker groups discussed in Chapter 1 also apply to these results, however drinker group-specific figures for all modelled outcomes are presented in the Appendix.

	All drinkers	
	Absolute change	Relative change
Drinker population	3,525,540	
Consumption in 2023 (units per drinker per week - control)	12.1	
Change in weekly consumption vs. control		
Duty reform	-0.05	-0.4%
60p MUP	-0.70	-5.8%

Table 32: Modelled impacts of alcohol duty reform on consumption compared to a 60p MUP

	Moderate	Hazardous	Harmful
Absolute change vs. control in 2023			
Duty reform	4,862	-3,707	-1,156
60p MUP	60,179	-37,590	-21,891
Relative change vs. control in 2023			
Duty reform	0.2%	-0.4%	-0.9%
60p MUP	2.4%	-4.2%	-16.6%

Table 33: Modelled impacts of alcohol duty reform compared to a 60p MUP on the number of drinkers in each group

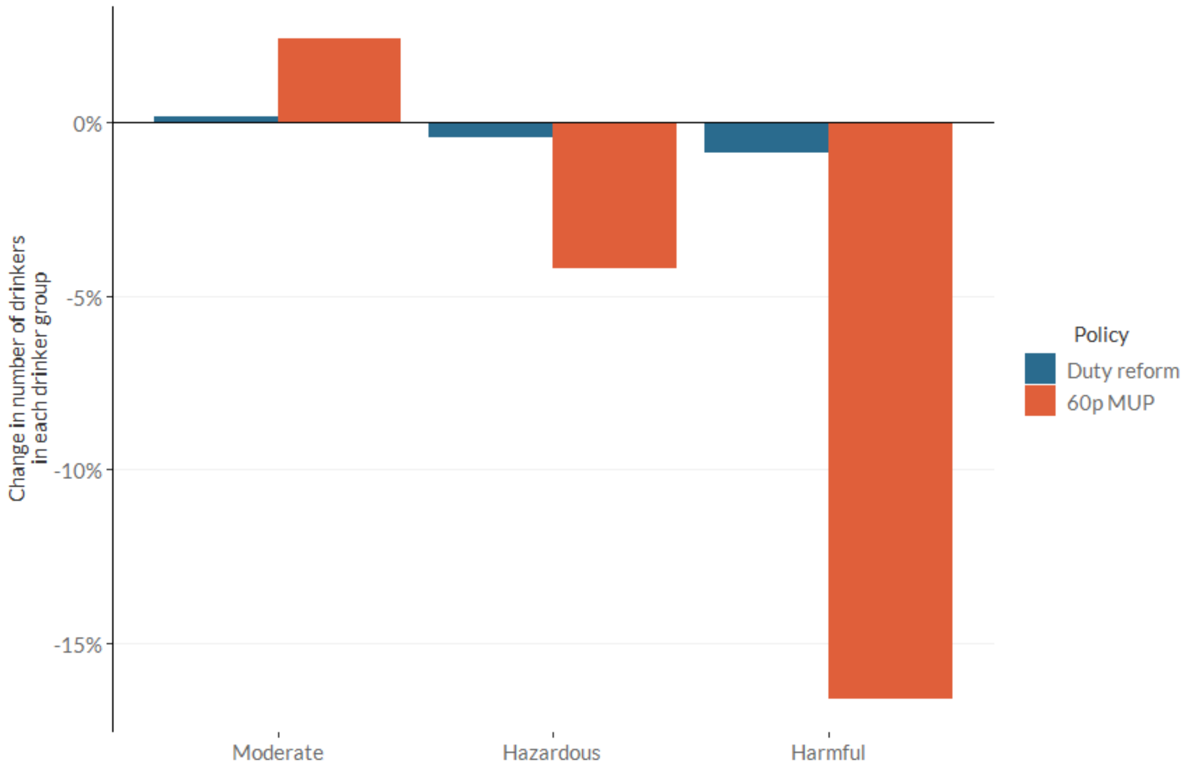

Figure 35: Modelled impacts of alcohol duty reform compared to a 60p MUP on the number of drinkers in each group

The extent to which the modelled impacts of the duty reform and a 60p MUP on alcohol consumption differ between SIMD quintiles is shown in Table 34 and Figure 36. Again the impact of the duty reform is much smaller than a 60p MUP across all SIMD quintiles. The pattern of changes across SIMD groups is also reversed, with a 60p MUP having the largest impact on alcohol consumption in the most deprived group, while duty reform is estimated to have the biggest effect on the drinking of the least deprived group. This is largely due to the fact that duty reform primarily affects taxes on wine, which tend to be consumed more by less deprived groups, as shown in Figure 4.

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Consumption in 2023 (units per week per drinker - control)	13.64	11.56	11.83	11.61	11.47
Absolute change vs. control					
Duty Reform	-0.07	-0.06	-0.05	-0.03	-0.02
60p MUP	-0.72	-0.57	-0.70	-0.73	-0.80
Relative change vs. control					
Duty Reform	-0.5%	-0.5%	-0.4%	-0.3%	-0.2%
60p MUP	-5.3%	-4.9%	-5.9%	-6.3%	-7.0%

Table 34: Modelled impacts of alcohol duty reform on consumption by SIMD quintile

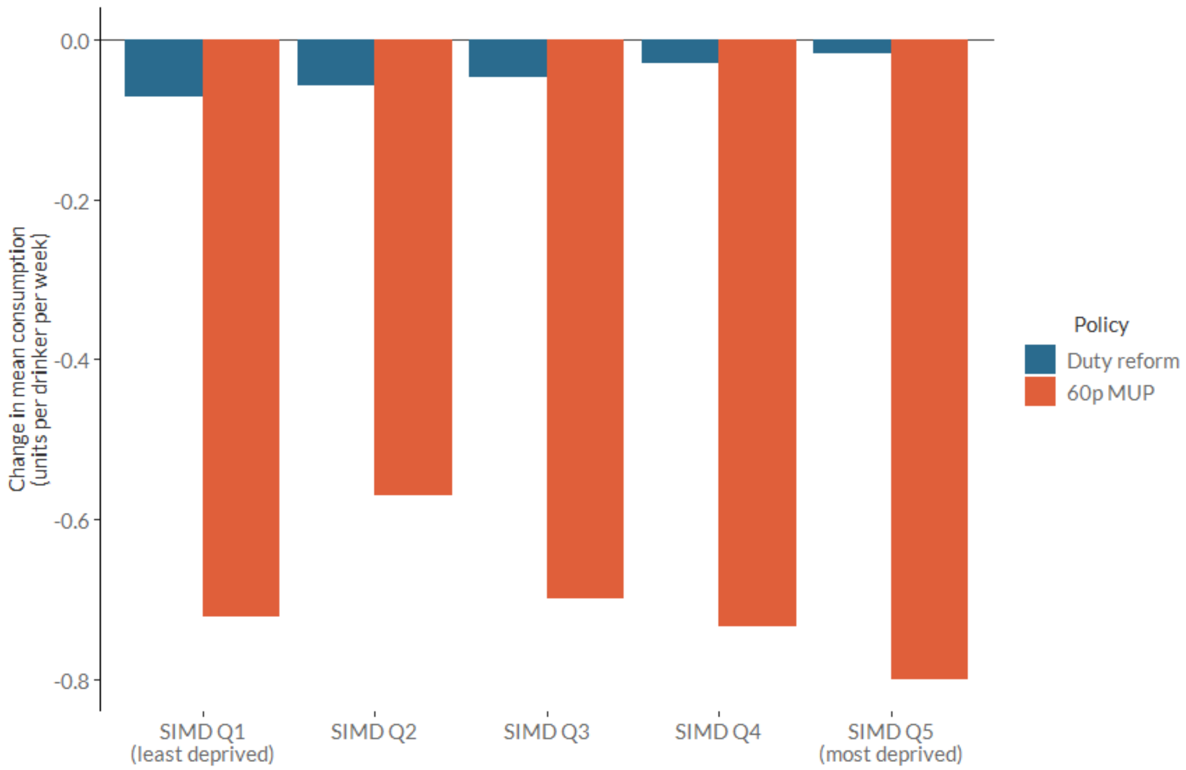

Figure 36: Modelled impacts of alcohol duty reform on alcohol consumption compared to a 60p MUP by SIMD quintile

The modelled impacts of the duty reform on consumer spending, compared to a 60p MUP, is shown in Table 35 and separated by SIMD quintile in Table 36. These results demonstrate that duty reform is estimated to increase consumer spending on alcohol in the population overall and across all SIMD groups as increases in duty are not fully offset by reductions in consumption. In contrast a 60p MUP is estimated to reduce consumer spending on alcohol overall and in all but the most deprived SIMD quintile. Note that these figures represent the estimated impact in 2023 and therefore the 60p MUP figures differ from those presented in Chapter 1. In addition, the socioeconomic profile of spending impacts of MUP differ over time - see Figure A2 in the Appendix for further details.

	All drinkers	
	Absolute change	Relative change
Drinker population	3,525,540	
Mean weekly spending in 2023 (per drinker - control)	£29.11	
Change in weekly spending vs. control		
Duty reform	£0.13	0.4%
60p MUP	-£0.17	-0.6%

Table 35: Modelled impacts of alcohol duty reform on consumer spending compared to a 60p MUP

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Mean weekly spending in 2023 (per drinker - control)	£32.59	£29.21	£27.91	£27.23	£27.66
Absolute change vs. control					
Duty Reform	£0.17	£0.15	£0.13	£0.10	£0.06
60p MUP	-£0.43	-£0.37	-£0.07	-£0.02	£0.15
Relative change vs. control					
Duty Reform	0.5%	0.5%	0.5%	0.4%	0.2%
60p MUP	-1.3%	-1.3%	-0.3%	-0.1%	0.6%

Table 36: Modelled impacts of alcohol duty reform on consumer spending by SIMD quintile

Table 37 shows the estimated impact of duty reform on exchequer revenue from alcohol taxation (duty plus VAT). Overall duty reform is estimated to increase government revenue by £20.68million per year, in contrast to a 60p MUP which is estimated to reduce revenue.

	Annual duty revenue (£ millions)
Total alcohol tax revenues in 2023 (control)	£1,814.62
Absolute change vs. control	
Duty Reform	£20.68
60p MUP	-£51.59
Relative change vs. control	
Duty Reform	1.1%
60p MUP	-2.8%

Table 37: Modelled impacts of alcohol duty reform on exchequer revenue

The modelled impact of duty reform and a 60p MUP on retailer revenue from alcohol sales is shown in Table 38, demonstrating a small increase in retailer revenue under duty reform (£2.69million), compared to a much larger increase under MUP (£20.89million).

	Annual retailer revenue (£ millions)
Total alcohol retail revenues in 2023 (control)	£3,521.36
Absolute change vs. control	
Duty Reform	£2.69
60p MUP	£20.89
Relative change vs. control	
Duty Reform	0.1%
60p MUP	0.6%

Table 38: Modelled impacts of alcohol duty reform on retailer revenue from alcohol sales (excluding tax)

Table 39 shows the modelled impacts of both policies on cumulative alcohol-specific and all-cause deaths over 20 years. Although both policies are estimated to reduce deaths, a 60p MUP has around a 10 times greater impact on mortality than duty reform, which is estimated to avert 220 deaths in Scotland over 20 years.

	Alcohol-specific deaths	All-cause deaths
Cumulative deaths over 20 years (control)	16,905	1,060,466
Absolute change vs. control		
Duty reform	-101	-220
60p MUP	-1,781	-2,483
Relative change vs. control		
Duty reform	-0.6%	-0.0%
60p MUP	-10.5%	-0.2%

Table 39: Modelled impacts of alcohol-specific and all-cause mortality

A similar pattern is repeated across all SIMD quintiles, as illustrated in Table 40 and Figure 38. Duty reform is estimated to have a small impact on mortality across all SIMD quintiles, except for the most deprived where there is no reduction in all-cause deaths. This is in contrast to a 60p MUP which leads to much larger reductions in mortality in the most deprived group than the least deprived.

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Cumulative deaths (2019-2038)	177,109	204,795	218,931	224,321	235,309
Absolute change vs. control					
Duty Reform	-49	-93	-22	-56	0
60p MUP	-334	-349	-572	-528	-700
Relative change vs. control					
Duty Reform	-0.0%	-0.0%	-0.0%	-0.0%	-0.0%
60p MUP	-0.2%	-0.2%	-0.3%	-0.2%	-0.3%

Table 40: Modelled impacts of alcohol duty reform on mortality by SIMD quintile

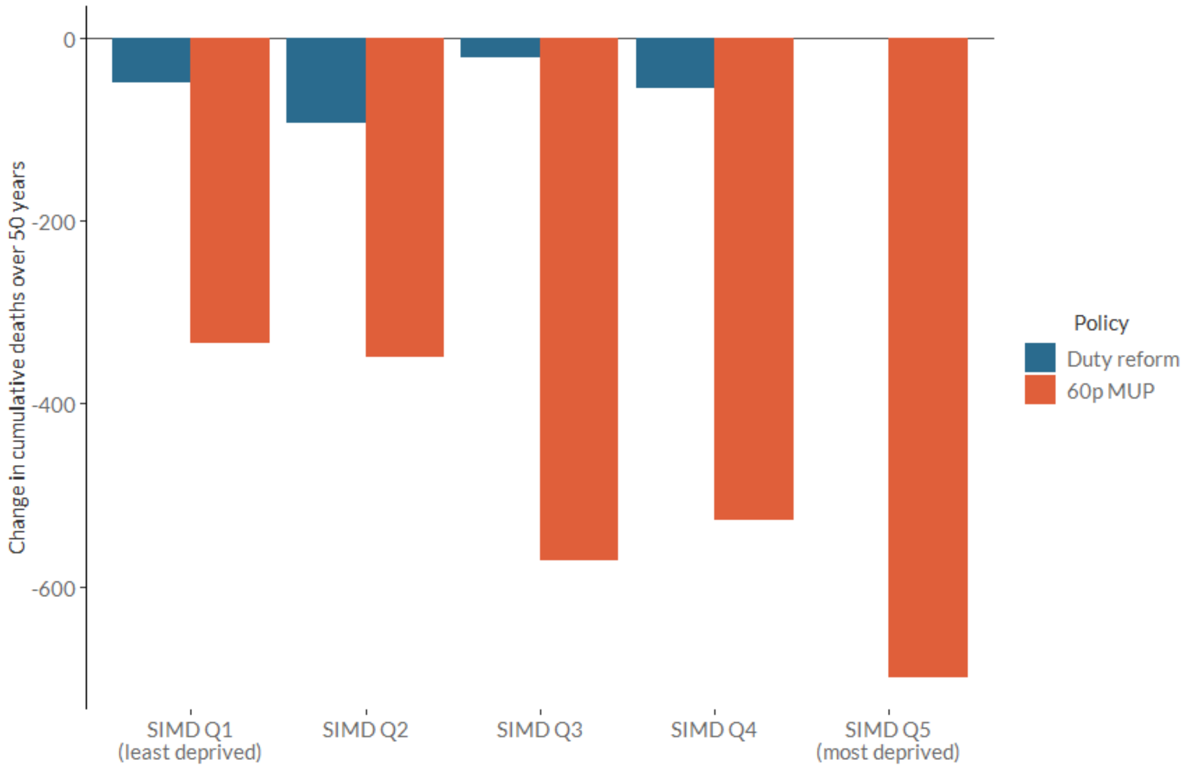

Figure 38: Modelled impacts of alcohol duty reform on mortality by SIMD quintile

The pattern of results for mortality is repeated for both hospital admissions and Years of Life Lost, with a 60p MUP estimated to lead to much larger impacts on both outcomes, as illustrated in Table 41, and a larger impact in the most deprived groups, whereas duty reform is estimated to have the smallest impact in the most deprived groups, as shown in Tables 42 and 43.

	Hospital admissions	YLLs
Cumulative harms over 20 years (control)	5,393,872	16,914,372
Absolute change vs. control		
Duty reform	-1,620	-3,979
60p MUP	-30,484	-78,150
Relative change vs. control		
Duty reform	-0.0%	-0.0%
60p MUP	-0.6%	-0.5%

Table 41: Modelled impacts of alcohol duty reform on hospital admissions and Years of Life Lost

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Cumulative hospitalisations (2019-2038)	2,371,753	2,890,780	3,275,613	3,749,143	4,627,083
Absolute change vs. control					
Duty Reform	-886	-1,207	-725	-970	-192
60p MUP	-7,787	-9,664	-15,598	-18,718	-26,383
Relative change vs. control					
Duty Reform	-0.0%	-0.0%	-0.0%	-0.0%	-0.0%
60p MUP	-0.3%	-0.3%	-0.5%	-0.5%	-0.6%

Table 42: Modelled impacts of alcohol duty reform on hospital admissions by SIMD quintile

	SIMD Q1 (least deprived)	SIMD Q2	SIMD Q3	SIMD Q4	SIMD Q5 (most deprived)
Cumulative YLLs (2019-2038)	903,617	953,129	1,029,525	1,159,987	1,347,614
Absolute change vs. control					
Duty Reform	-517	-494	-282	-282	-45
60p MUP	-4,032	-3,928	-5,765	-7,077	-9,683
Relative change vs. control					
Duty Reform	-0.1%	-0.1%	-0.0%	-0.0%	-0.0%
60p MUP	-0.4%	-0.4%	-0.6%	-0.6%	-0.7%

Table 43: Modelled impacts of alcohol duty reform on Years of Life Lost to premature death by SIMD quintile

Equivalisation under the proposed new duty system

Repeating the equivalisation process assuming the new, rather than current, alcohol duty system is in place leads to the duty increases shown in Table 44. These are close to the increases under the current duty system shown in Table 26, suggesting that the impact of duty reform on the equivalisation process is minimal.

	Target population				
	Population	Hazardous & harmful drinkers	Harmful drinkers	Hazardous & harmful drinkers in the most deprived SIMD quintile	Harmful drinkers in the most deprived SIMD quintile
40p	-19%	-19%	-23%	-19%	-26%
45p	-10%	-11%	-12%	-11%	-14%
50p	-3%	-3%	-2%	-1%	-1%
55p	10%	9%	15%	12%	15%
60p	27%	23%	34%	26%	35%
65p	44%	38%	56%	43%	56%
70p	64%	57%	79%	63%	79%
75p	85%	76%	101%	85%	100%
80p	108%	97%	124%	107%	124%

Table 44: Equivalised increases in alcohol duty under the proposed new duty system required to achieve the same impact as each MUP threshold

Discussion

Overall this analysis demonstrates that increasing the MUP threshold from 50p to 60p would have a similar impact to a duty increase of between 22 % and 28 %. Duty increase of this scale would be large compared to the historical changes in duty over the past century. Duty rate increases and increases in the MUP threshold affect different products to different degrees, with an increase in the MUP only affecting cheaper off-trade products, while duty increases affect the prices of all alcohol . This means the effects of these policies are distributed differently across the population. Increasing the MUP threshold has a greater impact on the number of harmful drinkers than any equivalised duty rises (-18.6% compared to a maximum of -14.6%). Differences in health outcomes are much smaller, as the duty increases by definition lead to comparable mortality changes to the MUP increase.

The distributional differences between MUP and duty increases presented here are substantially smaller than those in our previous 2016 report (4). This is due to the present analysis incorporating the MUP that is already in place in Scotland and preventing the sale of alcohol at very low prices. As a result, the difference in average prices paid by moderate and harmful drinkers is considerably smaller than it was in 2016. However, the results in this report demonstrate that there are still differences in the extent to which different groups are affected by an increase in MUP and a rise in alcohol duties, particularly for alcohol consumption.

We estimate that the alcohol duty reforms being implemented in 2023 will have only a small impact on alcohol consumption and related harms. The estimated reduction in population level alcohol consumption is 0.4%, with the largest impacts on less deprived groups. The reform is estimated to increase spending on alcohol across all population groups, but the size of these increases is small (+13p/week on average). The corresponding reduction in mortality is also small -220 deaths and -1,620 hospital admissions over 20 years.

Chapter 3 - Modelling the impact of changes in alcohol consumption during the COVID-19 pandemic on alcohol-related harm

Introduction

From early 2020, the COVID-19 pandemic had a huge effect on many aspects of people's daily lives. These included substantial reductions in people's movements and their interactions with others, both through mandated restrictions and voluntary changes to behaviour. There were also significant health impacts. These include the direct risks to health posed by COVID-19 itself, the knock-on effects of the pandemic on health and social care systems and the immediate and long-term effects of mandated and voluntary behaviour changes on people's physical and mental health. In Scotland, national 'lockdowns' were in place in March-July 2020 and January-April 2021. Additional restrictions, including the closing of pubs, bars and restaurants (but not most off-trade retailers) were in place across different stages of the pandemic. These changes and restrictions have led to substantial shifts in the ways and locations that people purchase alcohol and the places and contexts in which they drink.

Evidence on the extent of these changes and how they may vary between different groups in the population has painted a mixed picture. At the UK-level, data from HMRC suggests that total alcohol sales increased by 1.8% in 2020 and 4.9% in 2021 compared to the previous 5-year average (50). Survey data from England suggests a polarisation of drinking behaviour during the early pandemic, with moderate drinkers reducing their alcohol intake, or even stopping drinking altogether, while heavier drinkers increased their consumption (51,52). Similar analysis of Scottish survey data produced a less clear picture (53), although the pattern of increasing drinking among heavy drinkers even as consumption in the wider population falls has been observed consistently in studies across Europe (54).

Alongside these changes in drinking behaviour, rates of alcohol-specific deaths rose sharply in Scotland in 2020 by 15.6%, although to a lesser extent than the 19.3% rise seen in England & Wales (55–57). Taken together this data raises concerns for public health. However, the longer-term impacts of pandemic-era changes in drinking behaviour are unclear. Two recent studies have used short-term changes in alcohol consumption in England to model the long-term harm consequences associated with a set of scenarios describing what might happen to alcohol consumption in future years (58,59). These studies found that alcohol-attributable harms would increase even under relatively optimistic assumptions about the extent and speed that alcohol consumption patterns return to pre-pandemic levels.

In this chapter we seek to replicate these modelling approaches for Scotland. We first undertake new analysis of data on individual-level alcohol consumption to understand how drinking levels in Scotland changed during the pandemic and develop a range of plausible scenarios around how alcohol consumption trends may develop in future years. We then use the STAPM platform to model the health impacts of these scenarios.

Methods

Analysis of alcohol consumption data

In order to estimate the changes in alcohol consumption during the pandemic, we analysed data from the Scottish sample within Kantar Alcovision, a large-scale, continuous cross-sectional survey of adults (aged 18+) in Great Britain collected by Kantar, a market research company. The Kantar Alcovision survey collects data from respondents on alcohol consumption in the previous week and is the same data source used to analyse changes in drinking in the initial COVID-19 lockdown in Scotland (53,60).

Data was analysed by removing individuals who report a typical drinking frequency of once a year or less and selecting a balanced sample of months prior to and during the initial pandemic period: April-December 2019 and March-December 2020. March 1st to March 22nd 2020 were analysed as pre-pandemic, while drinking diaries including any days from 23rd of March 2020 onwards were analysed as post-pandemic. Previous analyses for England suggested that changes in drinking during the pandemic varied in scale between groups of different age, sex and socioeconomic position (59), however a previous study in Scotland found no evidence of similar variation (53) and controlling for variables representing these groups did not significantly improve the fit of our models in the present analysis. We therefore focused instead on estimating the mean change in consumption across the population.

We fitted two statistical models to the data. The first used the full sample (i.e. all drinkers) and used a tobit regression model censored at 0 to account for the large number of drinkers who did not consume any alcohol in the 7 days prior to taking the survey. This model found a reduction in mean consumption of 2.5 units per person per week (95% Confidence Interval -3.5 to -1.4) compared to pre-pandemic after controlling for age, sex and socioeconomic position. The second model was fitted only on drinkers who reported consuming at least 14 units in the 7 days prior to taking the survey and used a Generalised Logistical Model (GLM) with an inverse Gaussian family and log link function to account for the censored nature of the consumption measure. This model found an increase in mean consumption of 2.0 units per person per week (95% Confidence Interval -0.6 to 4.7). We also attempted to fit a third model on moderate drinkers only, but the results of this model were not consistent with the other models and we therefore did not pursue this approach further. Figure 39 illustrates the final changes in alcohol consumption used in the modelling.

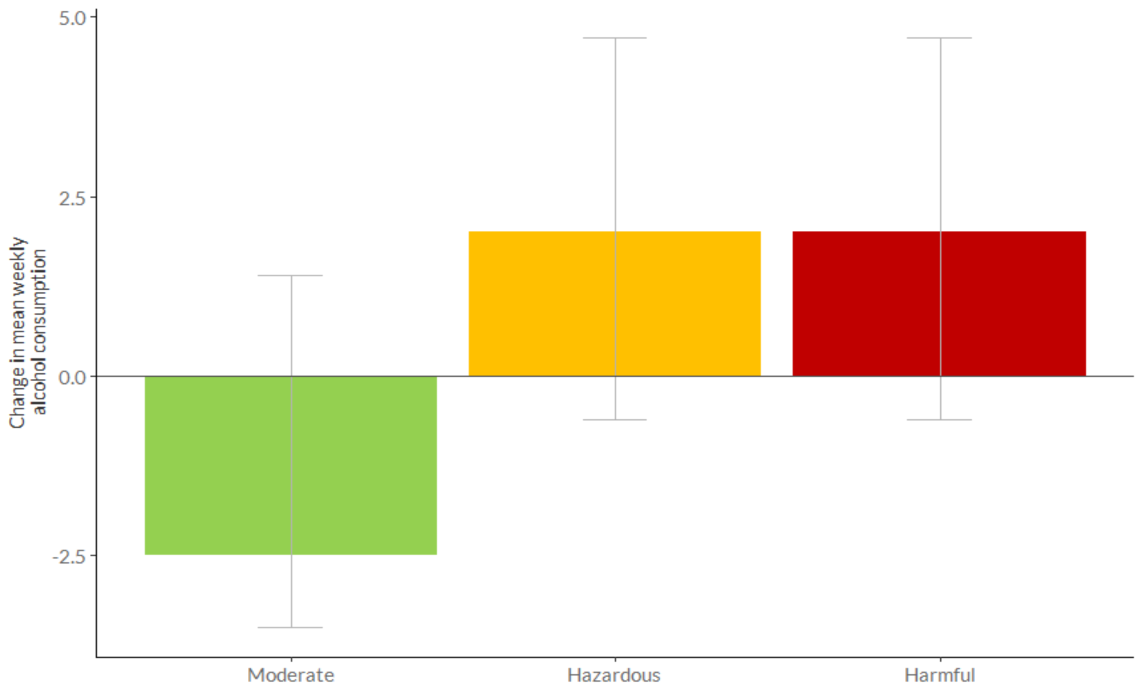

Figure 39: Modelled changes in mean weekly alcohol consumption during the COVID-19 pandemic by drinker group

Modelling the harm consequences of pandemic-era changes in drinking

The analysis of the Kantar Alcovision data described in the previous section gives us estimates of the short-term changes in alcohol consumption during 2020 and 2021. In order to model the longer term health impacts it is necessary to make some assumptions about how consumption trends will develop in the longer term or whether people's drinking will return to pre-pandemic levels and if so, how quickly this will happen. We therefore developed four illustrative scenarios that represent more or less optimistic future alcohol consumption trajectories for drinkers in Scotland. These trajectories are defined relative to the counterfactual control arm, in which there is no pandemic. For clarity, we also do not model any changes to alcohol pricing policies, including the MUP threshold in this chapter. The four scenarios are as follows:

1. **Immediate rebound** - alcohol consumption for all drinkers returns to counterfactual levels (i.e. the levels they would have been at had the pandemic never happened) immediately in 2022.
2. **Slow heavy rebound** - alcohol consumption for moderate drinkers returns to counterfactual levels in 2022, but hazardous and harmful drinkers linearly return to counterfactual levels over 5 years.
3. **No heavy rebound** - alcohol consumption for moderate drinkers returns to counterfactual levels in 2022, but hazardous and harmful drinkers retain their higher levels of consumption indefinitely
4. **No rebound** - alcohol consumption for all drinkers remains at the level of 2020/21, meaning that moderate drinkers retain their lower consumption levels while hazardous and harmful drinkers maintain their elevated drinking levels

These four scenarios and their implications for population mean alcohol consumption, alongside the counterfactual no-COVID scenario are illustrated in Figure 40.

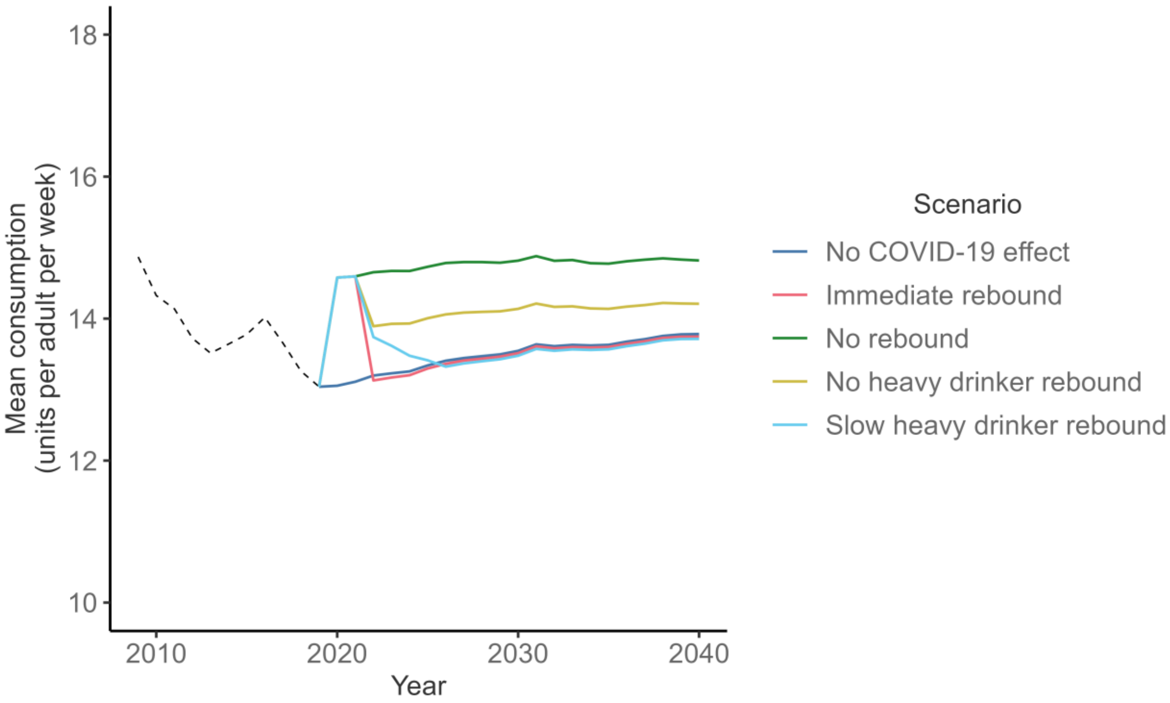

Figure 40: Modelled changes in alcohol consumption under alternative assumptions about future drinking

The equivalent mean consumption trajectories for each drinker group are shown in Figure 41 (note the different y-axis scales). For moderate and hazardous drinkers these graphs show the patterns you might intuitively expect, with alcohol consumption reducing among moderate drinkers then rebounding, or not, back up to a higher level, while the converse is true for hazardous drinkers, whose drinking increases, then rebounds, or not, back down. For harmful drinkers the pattern appears inverted, with consumption ending up lower in the scenarios where drinking does not rebound back down to counterfactual levels. This result arises from the fact that the increase in drinking during the pandemic among hazardous drinkers pushes some of them over the threshold into harmful drinking, where they lower the overall average consumption for the group, even though the consumption level of all individuals in the group has increased. This a similar situation, only in reverse, to that described in Chapter 1 in relation to patterns of alcohol consumption when the MUP threshold is increased. This can be seen clearly in Figure 42 which illustrates changes in the number of people drinking at harmful levels under each modelled scenario compared to the no-COVID counterfactual.

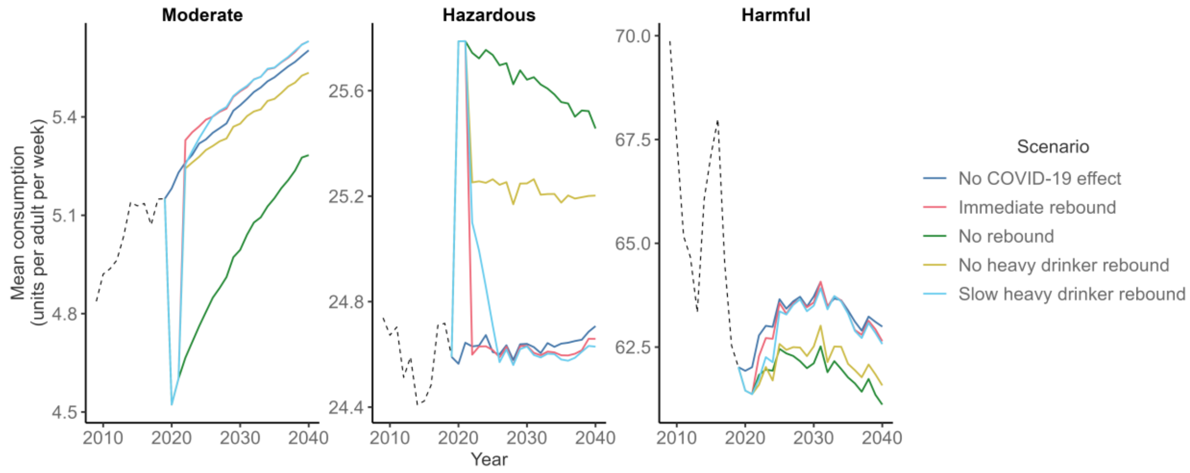

Figure 41: Modelled changes in alcohol consumption by drinker group under alternative assumptions about future drinking

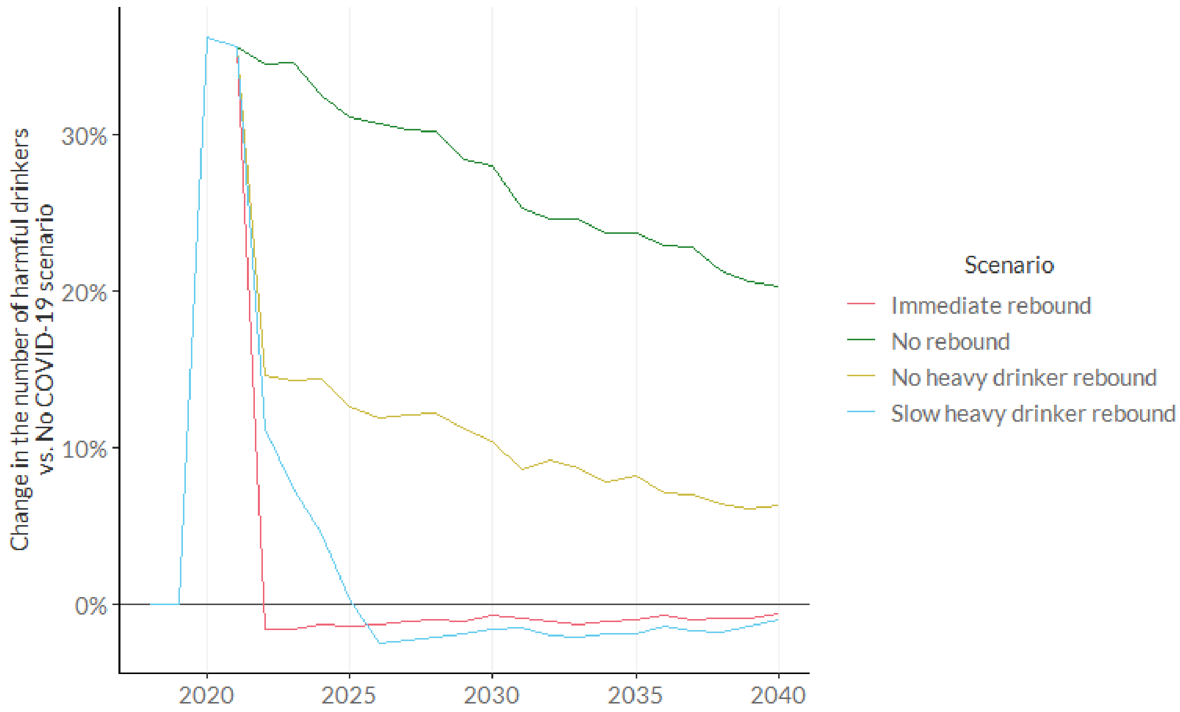

Figure 42: Modelled changes in the number of harmful drinkers under alternative assumptions about future drinking

These modelled trajectories for all individuals in the TAX-Sim model are used to replace the simulated future consumption trajectories generated by the model in the absence of any policy intervention. The model then estimates the corresponding health consequences over the 20 year time horizon of the model.

Results

The annual difference between each of the 4 modelled scenarios and the no-COVID counterfactual in deaths, hospital admissions and Years of Life Lost to premature mortality (YLLs) is shown in Figure 43. Across all outcomes this shows a similar pattern, with a large initial increase as a consequence of short-term increases of drinking, followed by a reduction over time that is determined by the speed with which alcohol consumption rebounds to counterfactual levels. Note that even under the scenario where drinking rebounds immediately in 2022, health harms fall more gradually. This is due to the well-evidenced delays between changes in alcohol consumption and changes in risk of harm for a range of chronic health conditions related to alcohol, including liver disease and several cancers (20).

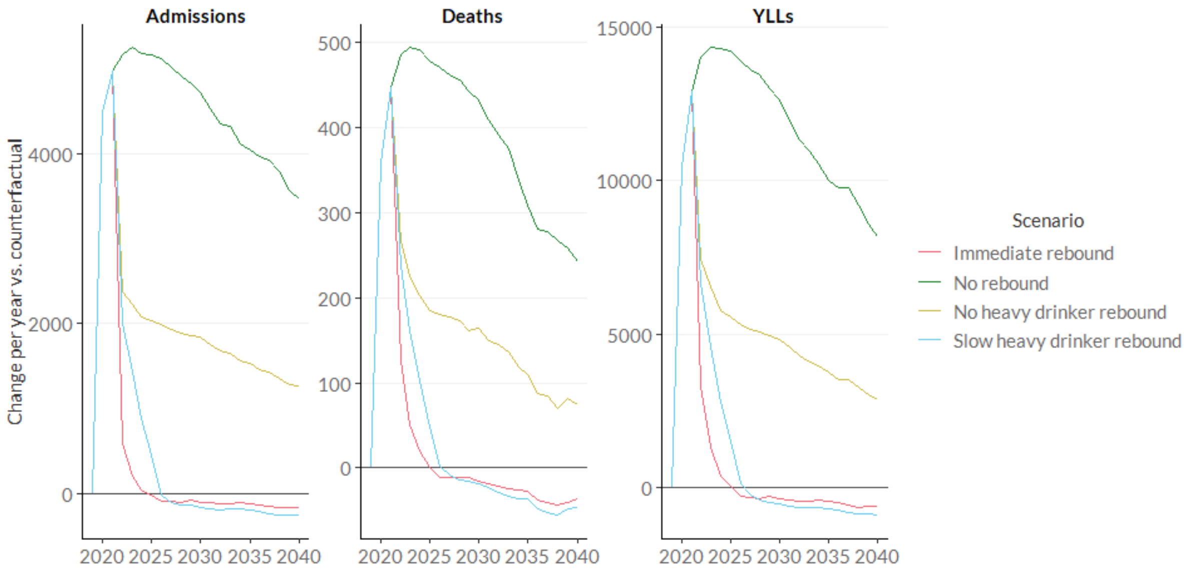

Figure 43: Annual changes in hospital admissions, deaths and YLLs compared to control

The consequences of these annual changes on cumulative numbers of deaths, admissions and YLLs is shown in Figure 44. This illustrates the significance for long-term levels of alcohol-related harm of whether or not alcohol consumption across the whole population returns to pre-pandemic levels.

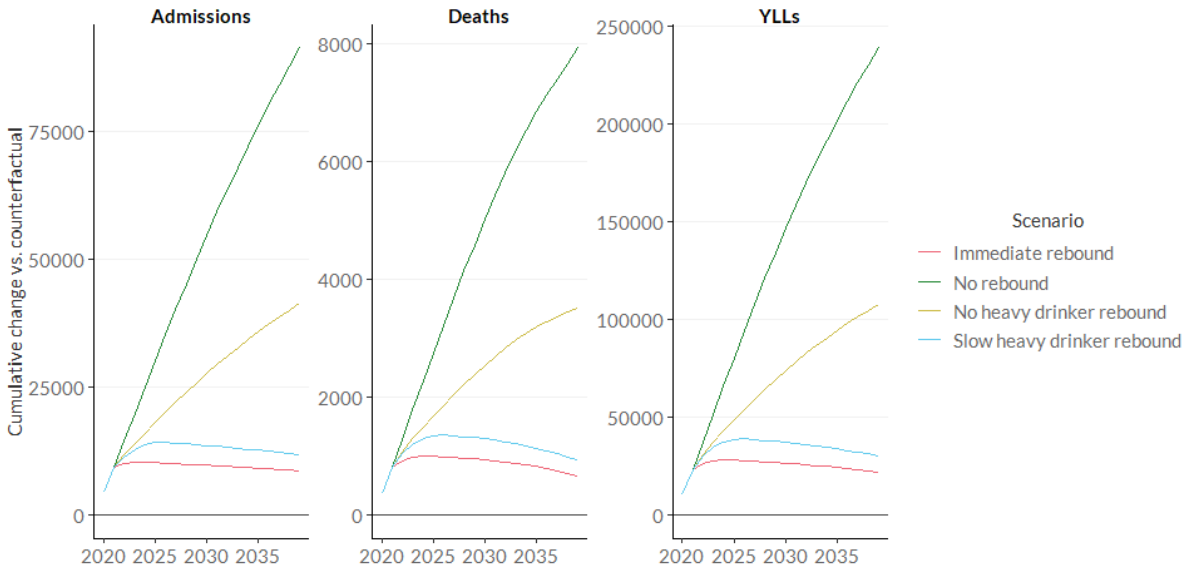

Figure 44: Cumulative changes in hospital admissions, deaths and YLLs compared to control

The impacts on all-cause mortality in each scenario, are shown in Table 45. Even in the most optimistic scenario where consumption returns to pre-pandemic levels in 2023, the cumulative impact over 5 years is over 1,000 additional deaths. In the most pessimistic scenario where consumption remains at pandemic-era levels in the long-term, the cumulative impact over 20 years is almost 8,000 additional deaths compared to the no COVID-19 effect counterfactual. As for the other Chapters in this report, full results by drinker group are presented in the Appendix.

	Differences vs. counterfactual		
	Year 1	Cumulative over 5 years	Cumulative over 20 years
Immediate rebound	358	1,002	663
No rebound	358	2,276	7,924
No heavy drinker rebound	358	1,500	3,523
Slow heavy drinker rebound	358	1,306	937

Table 45: Modelled differences in mortality compared to control

The cumulative morality impacts of each scenario are broken down by SIMD quintile in Table 46 and Figure 45. These show that under all scenarios the largest increases in deaths are among the most deprived groups.

	Difference vs. counterfactual				
	SIMDQ1	SIMDQ2	SIMDQ3	SIMDQ4	SIMDQ5
Cumulative change in deaths over 20 years					
Immediate rebound	73	111	87	130	262
No rebound	951	1,045	1,474	1,890	2,564
No heavy drinker rebound	508	573	640	804	999
Slow heavy drinker rebound	112	153	136	215	321
Change in rates per 100,000 person-years					
Immediate rebound	0	1	1	1	2
No rebound	5	6	9	13	17
No heavy drinker rebound	3	3	4	5	7
Slow heavy drinker rebound	1	1	1	1	2

Table 46: Modelled cumulative differences in mortality over 20 years by SIMD quintile compared to control

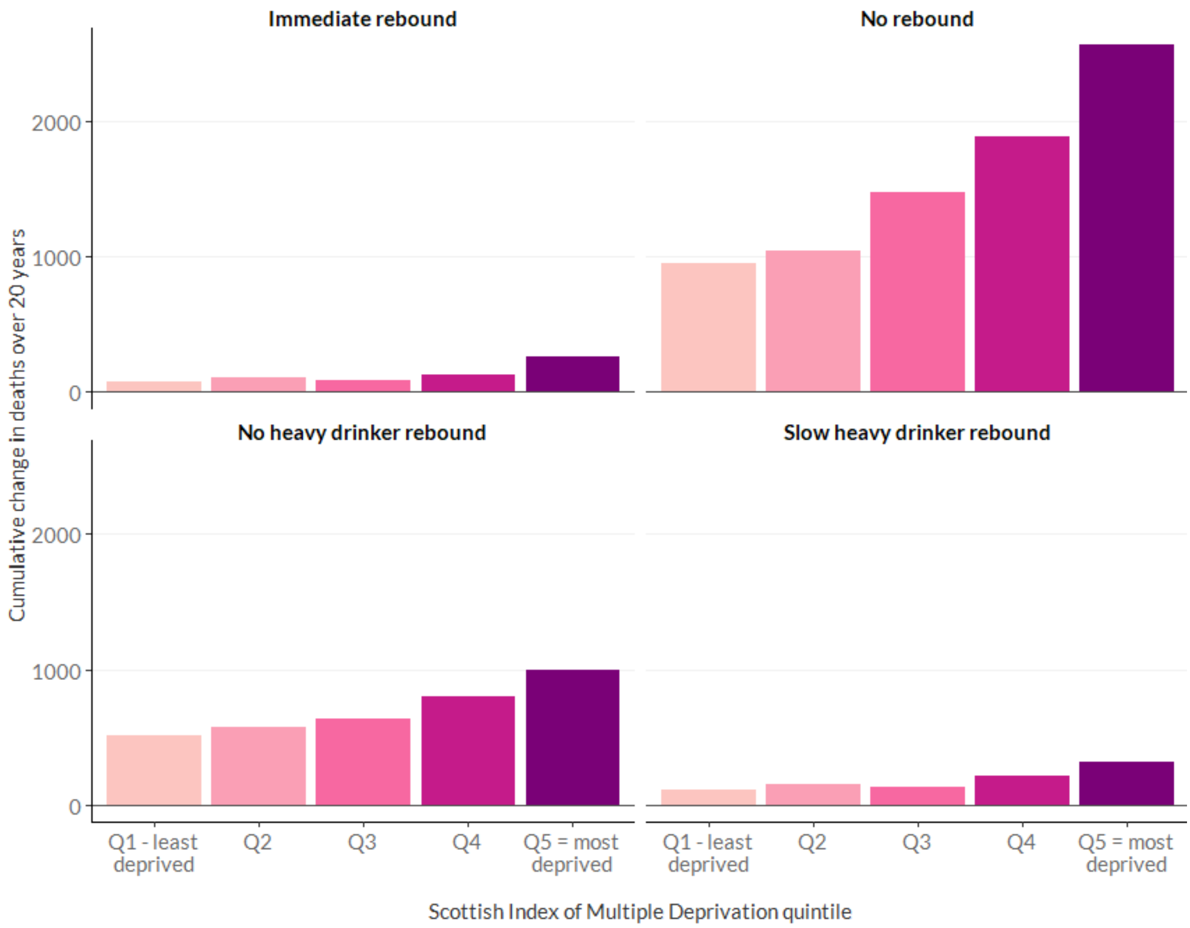

Figure 45: Modelled cumulative differences in mortality over 20 years by SIMD quintile compared to control

Equivalent results for hospital admissions and YLLs at the population level and by SIMD quintile are presented in Tables 47-50 and Figures 46-47. These show the same broad patterns as the mortality outcomes, with reductions in harm among moderate drinkers, increases among hazardous and harmful drinkers and the greatest increases in the most deprived SIMD quintile.

	Differences vs. counterfactual		
	Year 1	Cumulative over 5 years	Cumulative over 20 years
Immediate rebound	4,481	10,298	8,653
No rebound	4,481	25,033	91,332
No heavy drinker rebound	4,481	16,115	41,389
Slow heavy drinker rebound	4,481	13,763	11,817

Table 47: Modelled differences in hospital admissions compared to control

	Difference vs. counterfactual				
	SIMDQ1	SIMDQ2	SIMDQ3	SIMDQ4	SIMDQ5
Cumulative change in hospital admissions over 20 years					
Immediate rebound	946	967	1,398	1,888	3,454
No rebound	11,364	10,607	15,617	20,748	32,996
No heavy drinker rebound	6,314	6,051	6,985	9,218	12,822
Slow heavy drinker rebound	1,481	1,533	1,897	2,646	4,259
Change in rates per 100,000 person-years					
Immediate rebound	5	6	9	13	23
No rebound	61	64	96	138	221
No heavy drinker rebound	34	37	43	61	86
Slow heavy drinker rebound	8	9	12	18	29

Table 48: Modelled cumulative differences in hospital admissions over 20 years by SIMD quintile compared to control

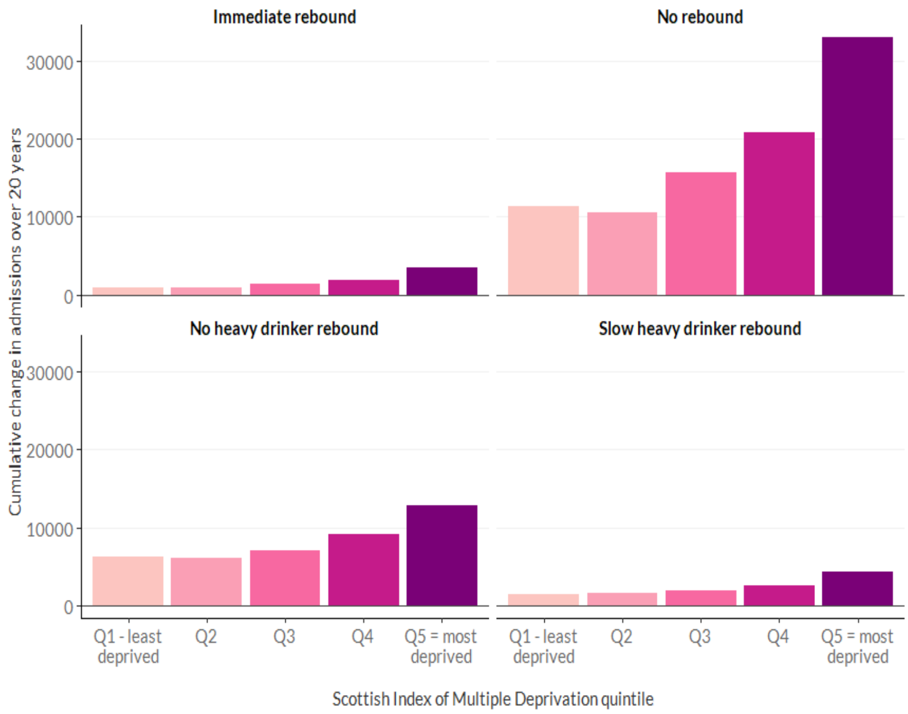

Figure 46: Modelled cumulative differences in hospital admissions over 20 years by SIMD quintile compared to control

	Differences vs. counterfactual		
	Year 1	Cumulative over 5 years	Cumulative over 20 years
Immediate rebound	10,446	28,332	22,122
No rebound	10,446	66,041	239,002
No heavy drinker rebound	10,446	43,131	107,906
Slow heavy drinker rebound	10,446	37,362	30,603

Table 49: Modelled differences in YLLs compared to control

	Difference vs. counterfactual				
	SIMDQ1	SIMDQ2	SIMDQ3	SIMDQ4	SIMDQ5
Cumulative change in YLLs over 20 years					
Immediate rebound	1,594	2,677	3,716	5,200	8,935
No rebound	20,800	27,878	42,126	57,542	90,657
No heavy drinker rebound	12,063	15,795	19,508	26,315	34,224
Slow heavy drinker rebound	2,697	4,093	5,162	7,597	11,054
Change in rates per 100,000 person-years					
Immediate rebound	9	16	23	35	60
No rebound	112	169	258	383	608
No heavy drinker rebound	65	96	119	175	229
Slow heavy drinker rebound	15	25	32	51	74

Table 50: Modelled cumulative differences in YLLs over 20 years by SIMD quintile compared to control

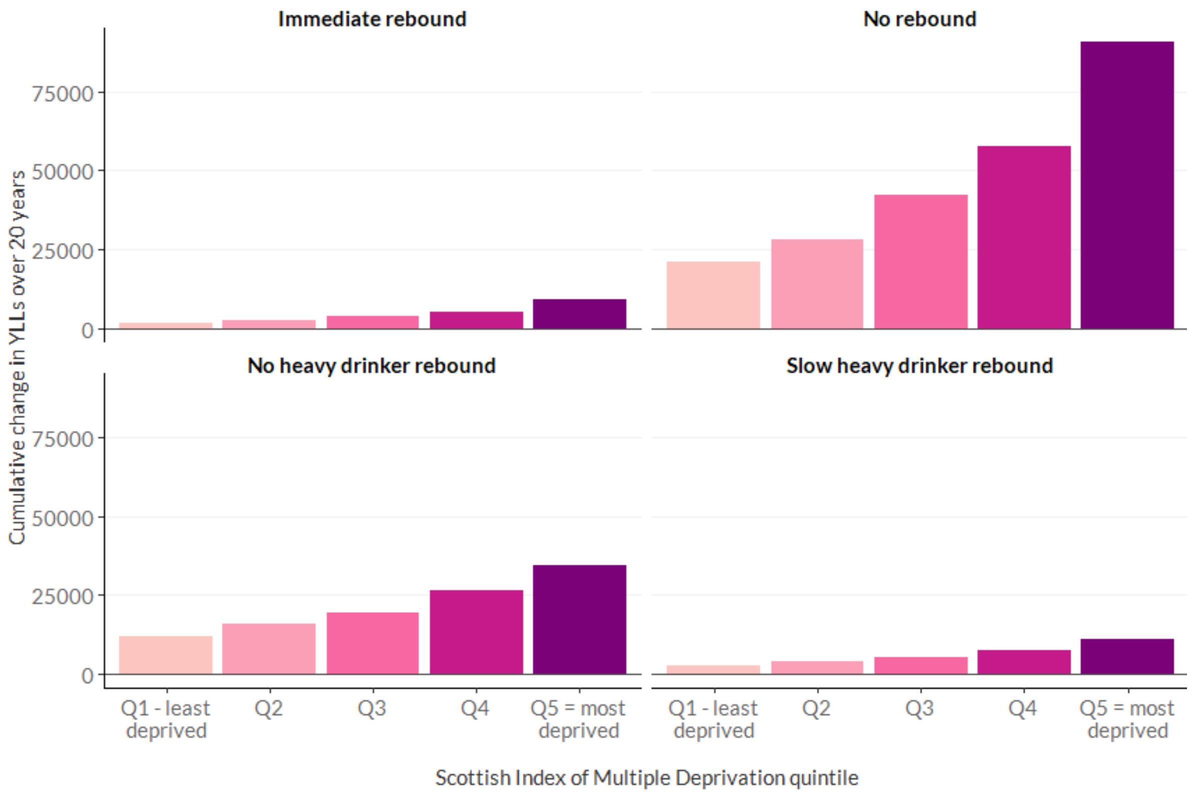

Figure 47: Modelled cumulative differences in Years of Life Lost to premature death over 20 years by SIMD quintile compared to control

Finally, the impact of each modelled scenario on cumulative NHS costs over 20 years is shown in Figure 48. In line with the hospital admissions figures these show the largest increases in costs are in the most pessimistic no rebound scenario and the smallest increase is in the most optimistic immediate rebound scenario.

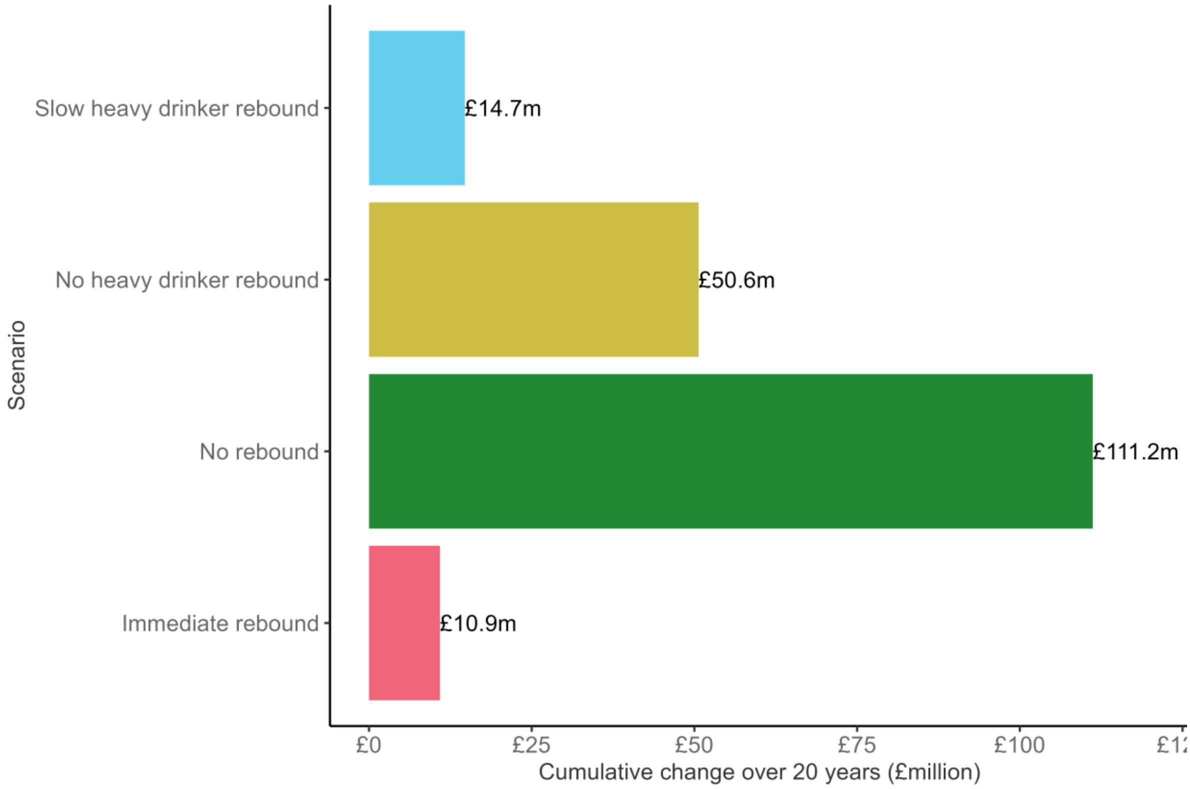

Figure 48: Modelled changes in cumulative NHS hospital costs over 20 years compared to control (no discounting)

Discussion

Our analyses show that alcohol consumption in Scotland became more polarised during the early phase of the pandemic, with moderate drinkers reducing their drinking while hazardous and harmful drinkers consumed more, a finding that has been seen across many other contexts (61). We have modelled a range of future scenarios about the extent to which these changes in consumption may persist in the future, from the most optimistic scenario where drinking returns to pre-pandemic levels immediately to the most pessimistic, where these changes persist indefinitely.

We estimate that under the most optimistic scenario, the long-term impact of the pandemic-era changes in alcohol consumption will be an additional 663 deaths and 8,653 hospital admissions in Scotland over 20 years. These figures correspond to an additional 22,122 Years of Life Lost and an additional cost of £10.9m to the NHS. If alcohol consumption does not return to pre-pandemic levels and remains at its current levels in the longer-term then the potential harms are far greater - 7,924 deaths, 91,332 hospital admissions, 239,002 YLLs and a cost to the NHS of £111.2m. In addition, across all scenarios the greatest burden falls upon heavier drinkers and those from the lowest socioeconomic groups, leading to an increase in health inequalities.

The analysis presented here largely replicates previous analyses for England, using SAPM to estimate the long-term impacts of changes in alcohol consumption during the pandemic (62). In spite of the different underlying models, the results are similar, reflecting substantial potential increases in harms and an increase in health inequalities, particularly if the drinking of heavier drinkers remains at elevated levels.

One limitation of the analysis presented here is the nature of the data available to understand changes in drinking behaviour. Although there have been many studies on changes in alcohol consumption during the early phase of the COVID pandemic (63), many of these studies suffer from methodological flaws (64), there is limited evidence relating to Scotland specifically (65), and the ideal dataset - following individual drinkers' changes in consumption over time, with a pre-pandemic baseline - does not exist. Alternative sources, such as market research data on alcohol sales, suggests that overall alcohol sales may have fallen in Scotland in 2020 and 2021, but increases in alcohol-related harms suggest that consumption may have increased among some heavier drinkers, in line with our analysis (66,67).

An additional limitation of the approach taken in this study is that we have only assessed the impact of the COVID pandemic on health as mediated by changes in alcohol consumption. We have not accounted for changes in people's willingness or ability to access healthcare, particularly during acute phases of the pandemic, nor have we attempted to model changes in the availability or accessibility of specialist alcohol treatment services, many of which switched from in-person to online-only delivery during the first lockdown period. As such the estimates in this report may understate the true impact of the COVID pandemic on alcohol-related health outcomes.

Overall our analysis shows that alcohol-related harms are likely to increase significantly as a result of the COVID pandemic and that these increases may be sustained if increases in alcohol consumption among heavier drinkers persist in the longer-term.

Chapter 4 - Modelling the impact of alternative approaches to uprating (or not) the MUP threshold over time

Introduction

Since its introduction in May 2018, Scotland's Minimum Unit Price (MUP) threshold has remained constant, in cash terms[4], at 50p/unit. Prior to its introduction, there was extensive public debate of MUP in Scotland from the late 2000's onwards. This debate often noted that, like other policies based on monetary thresholds, the MUP level would need to rise over time to maintain its effectiveness. However, the debate did not give sustained attention to specific approaches to achieving this end. The original legislation makes provision for the MUP threshold to be periodically reviewed, an approach also taken in Wales and the Republic of Ireland, however we are unaware of any substantive research or commentary that discusses the relative strengths and limitations of alternative approaches to 'uprating' the MUP level.

This chapter addresses this gap in the existing research through a dual approach. Firstly we report on the results of a pair of roundtable discussions with stakeholders which were conducted to identify and critically assess potential approaches to uprating Scotland's MUP level. Secondly, we use the Sheffield Alcohol and Tobacco Policy Model (STAPM) to appraise the potential impact over time of implementing these alternative approaches, or the consequences of leaving the MUP at its present level indefinitely.

Stakeholder workshops

Methods

We invited stakeholders with experience of working in alcohol charities, advocacy organisations, think tanks, economic consultancies, academia and the Scottish and UK civil service to two roundtable discussions. The first roundtable included stakeholders whose expertise broadly lay within public health and the second roundtable included those with economic expertise. This division allowed for more focused discussion of certain points within each roundtable (e.g. comparison of different inflation measures in the economic roundtable). The roundtables took place online in early December 2022. The researcher started each discussion with a short introductory presentation that outlined the history of MUP in Scotland, why uprating matters and the purpose of this report. The following discussion was then loosely structured and guided by the researcher to cover the following topics although, in practice, most topics arose organically:

- Key considerations for those thinking about how to uprate the MUP threshold over time;
- Whether and how those considerations should inform the Scottish Government's policy;
- Uprating approaches used in other areas of Government policy (e.g. tax, benefits);

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[4] Throughout this report (and in keeping with standard economic terminology), we use the phrase 'cash terms' refers to the absolute monetary value of something, ignoring the impact of inflation, and 'real terms' to refer to the *value* of something, relative to incomes and the costs of other goods, i.e. after accounting for the impact of inflation.

- Relative merits of different indices to which the MUP could be linked (economic roundtable only);
- How to accommodate economic instability, including the current cost-of-living crisis, within approaches to uprating;
- Key recommendations for the Scottish Government.

Stakeholders were encouraged to focus on approaches approaches to the long-term uprating of MUP over a 10-20 year period rather than any immediate uprating to address inflation since implementation of the policy in 2018. The discussions were recorded and the researcher also made detailed notes. An initial review of these materials suggested a large degree of agreement between stakeholders. This enabled the researcher to summarise the discussions as recommendations and present these alongside the supporting arguments, considerations and critiques. We shared a draft of the summary with the roundtable participants to confirm it accurately reflected the discussion, offer the opportunity to amend or develop any points, and ensure we captured dissenting arguments. The final summary does not attribute any contributions to particular stakeholders or use direction quotations as the purpose is to identify and assess policy options, not analyse the perspectives of different individuals or stakeholder groups.

Main recommendations

The roundtable discussions produced four main recommendations:

1. ***Adopt a clear, long-term policy on MUP uprating.***

All stakeholders agreed that the Scottish Government should act to ensure that MUP continues to provide the type of floor-price envisaged by its 2009 Framework for Action (68). Several individuals expressed concern that MUP is at risk currently of being perceived or portrayed as a measure that affects only the very cheapest alcohol purchased by those with serious alcohol problems rather than a targeted population-level measure as originally conceived. Others noted examples of similar policies left to ‘wither on the vine’. A typical example was US alcohol taxes, which declined in real-teams value by approximately 70% from 1970 to 2018 (69). The stakeholders therefore argued the Scottish Government should publicly adopt a clear and long-term policy for decision-making on uprating the MUP.

2. ***Prioritise an approach that is simple and proportionate to the scale of the policy problem.***

The roundtable discussions examined a number of approaches to uprating the MUP. These included: (i) linking the MUP to indices of inflation, earnings or affordability; (ii) commissioning an expert panel to make recommendations on uprating the MUP, akin to the Low Pay Commission, which makes recommendations on the National Living Wage; (iii) setting the MUP at a level commensurate to achieving specific targets, such as a particular reduction in alcohol consumption or alcohol-specific deaths and (iv) calculating the MUP with reference to the median of the alcohol price distribution akin to the standard measure of relative poverty (i.e. 60% of median household income). However, discussion of these alternatives consistently prioritised the need for a simple and proportionate approach that would offer reasonable certainty to all stakeholders. Approaches to uprating that appeared attractive for political reasons (e.g. setting the MUP with reference to specific target outcomes) or that allowed a greater consideration of evidence (e.g. an analogue to the Low Pay Commission) were viewed as disproportionate, challenging to implement or not offering a stable business environment. The roundtables therefore recommended adopting a simple, evidence-led approach that did not seek to overcomplicate the uprating process.

3. ***Update the MUP annually by indexing to CPIH, earnings or a measure of affordability in Scotland.***

In line with the focus on simplicity, the stakeholders agreed that the Government should uprate MUP annually and index it to a measure of inflation or affordability. This would bring MUP into line with other policies that have similar monetary elements, such as excise duties, income tax thresholds and Universal Credit. The stakeholders did however acknowledged that the Government sometimes chooses not to actually implement annual increases for these comparable policies (see below for more on this point).

The roundtables discussed the relative merits of different inflation measures including RPI, CPI and CPIH, as well as related indices such as earnings or measures of affordability (i.e. price rises relative to earnings). They also considered alcohol-specific indices, such as the alcohol affordability index (70). However, stakeholders ultimately rejected alcohol-specific indices as they introduce circular calculations where the alcohol price increases arising from the MUP are an input used when calculating the index used to set the MUP. Of course, increasing the MUP affects any inflation index, but the effect of alcohol prices on overall inflation indices is much smaller than its effect on alcohol-specific indices. The roundtables considered an alternative approach that relied on alcohol-specific indices from England but rejected this as well as it would not be viable if England implemented an MUP in future.

The economic roundtable noted that the UK Government indexes alcohol excise duties to RPI for historical reasons, but saw no justification for using this measure as economists generally view it as inferior to CPI and CPIH. The stakeholders therefore recommended indexing to one of: (i) CPIH in Scotland as the best measure of inflation currently available; (ii) earnings in Scotland to ensure cheap alcohol did not become more affordable if earnings growth substantially exceeded price inflation or (iii) general affordability indices such as nominal income growth or inflation multiplied by real income growth. Comments from stakeholders on the draft of this report suggested several preferred affordability indices to the alternatives as maintaining affordability over time aligns most clearly with the intended purpose of uprating.

4. ***Review the operation and effectiveness of the MUP periodically to inform further adjustments to its level.***

Both roundtables noted that setting an appropriate level for the MUP is a political judgement and that the factors informing that judgement, such as the scale of public health problems, characteristics of the alcohol market and general economic conditions, may change over time. They also noted that governments do not consistently implement inflation-linked increases in other policy areas. For example, UK Government budgetary forecasts assume fuel duty will increase in line with RPI each year, but no Government has implemented an increase in fuel duty since 2011. Therefore, both roundtables concluded that there was a need for a periodic review of the operation and effectiveness of the MUP in addition to decisions taken annually.

There was less consensus on the nature and timing of this review. Stakeholders were clear it should not be comparable in scope or scale to the current MUP evaluation. They viewed the evaluation programme favourably for its unusual comprehensiveness and commitment to rigour. However, they also saw the programme as a major undertaking that drew resources away from other areas. The stakeholders therefore believed the Scottish Parliament should regard the basic case for MUP as settled after it considers the evaluation programme's final report. In line with this, they did not envisage a need for the proposed periodic reviews to re-evaluate the main links in the theory of change that underpins the evaluation of MUP (71). They did however note the value of the detailed Regulatory Impact Assessment (RIA) for the 2012 Minimum Pricing Act, which addressed a wide range of risks associated with the policy. In their view, the detail within the RIA demonstrated that the Scottish Government had considered appropriately all relevant concerns and therefore contributed to the UK Supreme Court ruling that the policy was proportionate under EU law. As such, the roundtables recommended that the periodic review should consider newly emerging or evolving concerns associated with MUP, and that it should draw on existing or newly commissioned evidence where appropriate.

Broadly, therefore, the stakeholders favoured a substantive but proportionate review by an independent or quasi-independent body (e.g. Public Health Scotland). The review would have clear terms of reference that focused on the general functioning of the policy, changes in the primary outcomes targeted by the policy (e.g. alcohol consumption, alcohol-attributable deaths), the identification and monitoring of unintended or unforeseeable outcomes and relevant shifts in the wider policy context. The purpose would be to allow the Scottish Government to hear and consider evidence and views from stakeholders on the strengths and limitations of MUP in practice and take any necessary action, including further adjustments to the level of MUP, to ensure the policy operates and delivers outcomes in line with the Government's intentions. Suggested intervals between periodic reviews ranged from three to ten years, although most stakeholders suggested figures of five years or greater to ensure efficient use of resources. Overall, the roundtables concluded that periodic reviews were an important aspect of any uprating policy, as they would ensure a long-term mechanism to counteract any short-term factors that affect annual uprating decisions.

Further considerations

The roundtables also discussed a number of related issues that add to or expand on the above recommendations.

Addressing the lack of uprating since 2018: Although the roundtables focused largely on long-term uprating of MUP, several stakeholders noted that their view depended partly on whether the Government took short-term action to address the lack of uprating since 2018. Their support for annual inflation-linked uprating was contingent on first raising the MUP to an appropriate level. Some stakeholders therefore recommended the Government identify a desired level of MUP, not necessarily the 2018 level adjusted for inflation, and move towards this before implementing the longer-term recommendations above. The Government might achieve this change through an immediate one-off increase, an annual escalator to bring the MUP up to the desired real-terms level over time (e.g. three or five years) or some combination of these approaches.

Maintaining political discretion: Both roundtables believed that the annual uprating of MUP should be included within legislation and should happen automatically, but that the Government would have discretion to alter, defer or cancel the uprating after providing justification to the Scottish Parliament. They recognised that this could lead to a decrease in the real-terms level of the MUP over time, or less likely, an increase, but they viewed ministerial discretion as an important principle of democratic accountability. However, they also believed that legislation and related policy documents should make clear that deciding not to update the MUP should be exceptional and that the Scottish Parliament should hold ministers accountable on this point. As noted above, the roundtables saw the periodic review of MUP as an appropriate counterbalance to any risk of the policy diminishing in effectiveness due to persistent cancellation of annual increases.

Uprating MUP during periods of economic instability: The stakeholders recognised that uprating the MUP during the current cost-of-living crisis or future periods of economic instability may give rise to social, economic, health and political challenges. This strengthened their view that combining political discretion over annual uprating of the MUP with periodic reviews of the policy would allow the Government to balance competing policy goals in the short- and long-term. Broadly, however, most stakeholders believed the Government should uprate the MUP as normal in most circumstances. With regard to the current cost-of-living crisis, the stakeholders noted that MUP remained at the same level originally proposed circa 2011 and that alcohol-specific inflation was lower than inflation for other major food and drink categories. They also noted that the particular impact of both inflation and MUP on low-income households might justify a different approach. Ultimately, however, they regarded this as a political judgement for the Government.

Considerations for producers and retailers: The roundtables discussed the importance of providing clarity and stability for alcohol producers, retailers and related businesses. They noted the importance of considering whether the timing of changes in the MUP should align with changes in excise duties to ensure businesses are able to adjust pricing at a single time point during a typical year. They also suggested identification of an appropriate time of year from which inflation-linked uprating could be dated. The economic roundtable did not see good reasons for this being substantially earlier than the date of the announcement. With regard to the periodic review, some stakeholders recommend that industry actors should not be involved in this process, while others disagreed and felt industry actors should be able to offer their perspective. Finally, some stakeholders in the public health roundtable also raised concerns that increases in the MUP would lead to higher profits for alcohol producers and retailers. They recommended the Government consider an alcohol harm levy to address these additional profiles.

Integration with wider alcohol policies: Several stakeholders also raised the importance of considering uprating the MUP alongside as part of a broader alcohol strategy. They noted that the WHO 'best buy' policy areas (72), pricing, availability and marketing, are interconnected, so the Government should act across all of these areas. This reflected a general belief that adopting population-level measures was an appropriate approach to reducing the public health burden of alcohol and tackling health inequalities.

Scenarios for modelling

Following the recommendations of the roundtables, we developed 8 potential approaches to uprating which we carried through to the modelling work. These were:

1. **No uprating** - A 50p MUP is retained indefinitely and allowed to depriciate in real-terms with no uprating;

2. **Continuous CPIH uprating** - A 50p MUP remains in place until 2023, at which point there is a one-off increase in line with CPIH inflation since 2018, such that the revised MUP threshold has the same real-terms value in 2023 as 50p had in 2018 when it was first introduced. Thereafter the MUP threshold is uprated each year in line with CPIH inflation;

3. **Stepped CPIH uprating** - As for 2., but instead of uprating by CPIH post-2023, the MUP threshold is held constant in cash terms until 2028, when it is uprated to be the same value in real terms as 2023 (and 2018), and so on, with uprating occurring every 5 years;
4. **Future CPIH uprating** - A 50p MUP remains in place until 2023 and is then increased in line with CPIH each year (i.e. as for 2., but without the stepped increase in 2023);
5. **Continuous earnings uprating** - As for 2., but using average earnings in place of CPIH for all uprating calculations;
6. **Future earnings uprating** - As for 4., but using average earnings in place of CPIH for all uprating calculations;
7. **Continuous affordability uprating** - As for 2., but using an affordability index determined by CPIH multiplied by growth in real household disposable income;
8. **Future affordability uprating** - As for 4., but using an affordability index determined by CPIH multiplied by growth in real household disposable income.

For all modelled scenarios we assume that alcohol prices will rise each year in line with CPIH after 2019. This differs from the assumptions in the base case and in interventions in Chapters 1 and 2, where we assume prices rise each year in line with RPI. Note that monetary values in the model are still expressed in 2019 real terms as measured by RPI, regardless of the indices used to increase prices and the MUP thresholds. Outputs on spending, costs, and revenues therefore should still be interpreted in 2019 RPI real terms.

Modelling of future uprating scenarios

Modelling methods

Additional data was required to construct the different growth indices used in the uprating scenarios. In addition to the RPI and CPIH data already outlined in the methods description for Chapter 1, we additionally sourced data to construct indices for average earnings (in nominal terms, rather than real terms) and real disposable household income (RDHI) in order to implement uprating scenarios 5 - 8. As with the inflation time series already discussed, data were obtained from a mixture of ONS and OBR sources.

The average earnings series is obtained from forecast and assumed future average earnings growth from the OBR long term economic determinants (32).

After the 2025-26 fiscal year (the last year in the baseline projection) the assumption for average earnings growth is 3.7% per year until the 2035-36 fiscal year after which it is revised to 3.8% per year. Based on these assumptions, we constructed an index of average earnings to 2040 and used this index to uprate the MUP threshold in scenarios 5 and 6. The affordability scenarios index is constructed by multiplying RDHI with CPIH inflation. RDHI is forecast in the OBR Economic and fiscal outlook document up to 2027 (32). In order to construct an index for RDHI we needed to make an assumption about future growth in RDHI beyond 2027. We assumed that the growth in RDHI per year from 2028 onwards will be 2%, carrying forward the 2% figure forecast for 2027 by the OBR.

To construct the affordability measure based on RDHI and CPIH we then constructed an index based on the growth of both real household incomes and prices. Beginning with the policy effect year, 2019, as the base year the index grows as a product of CPIH and RDHI growth. The change in the index generated by this combined growth rate is used to uprate the MUP threshold in scenarios 7 and 8.

Figures 49 and 50 illustrate the uprating scenarios in nominal/cash terms and in real CPIH terms respectively. In most of the uprating scenarios (with the exception of 1 and 3), uprating takes place on an annual basis. In these scenarios the MUP threshold is increased in line with the relevant price, earnings or affordability index. Scenario 1 has no uprating in the intervention arm. As Figure 50 shows , compared to the control arm this means the MUP threshold declines in real terms. The stepped uprating in Scenario 3 applies an increase to the MUP threshold once every 5 years and is uprated so as to reflect the change in RPI over the respective 5 years. Figure 50 illustrates that under this approach to uprating, the MUP threshold will generally be lower (and therefore have less of an impact) than an annual uprating scenario such as the control arm assumes.

The six annual uprating models compare CPIH, earnings, and affordability uprating methods where MUP is held at 50p in cash terms from 2019 to 2022. Comparing the continuous uprating scenarios in Figure 49, the affordability approach results in faster uprating than earnings, which in turn yields faster uprating than CPIH.

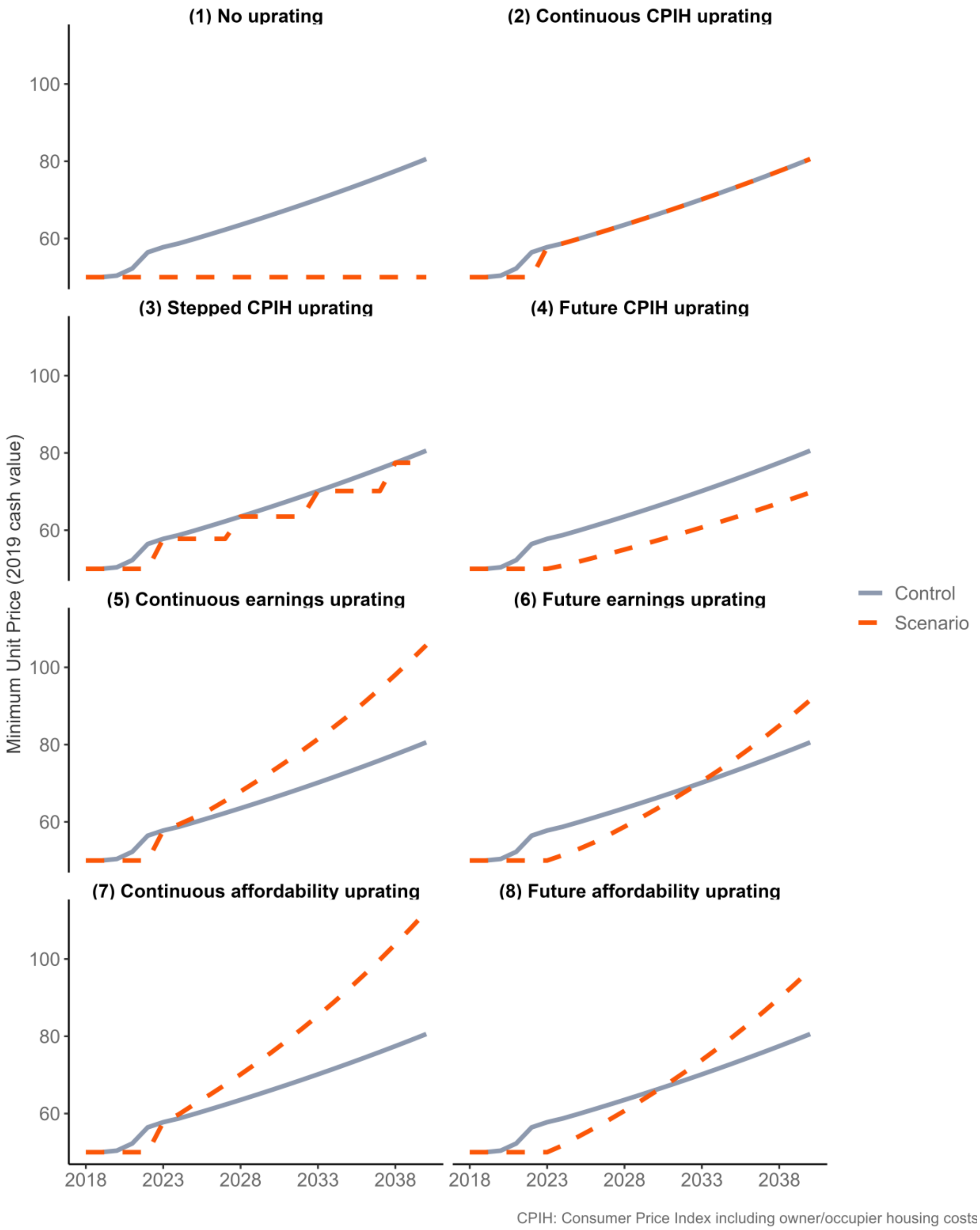

Figure 49: Illustrative overview of the 8 uprating scenarios in cash terms

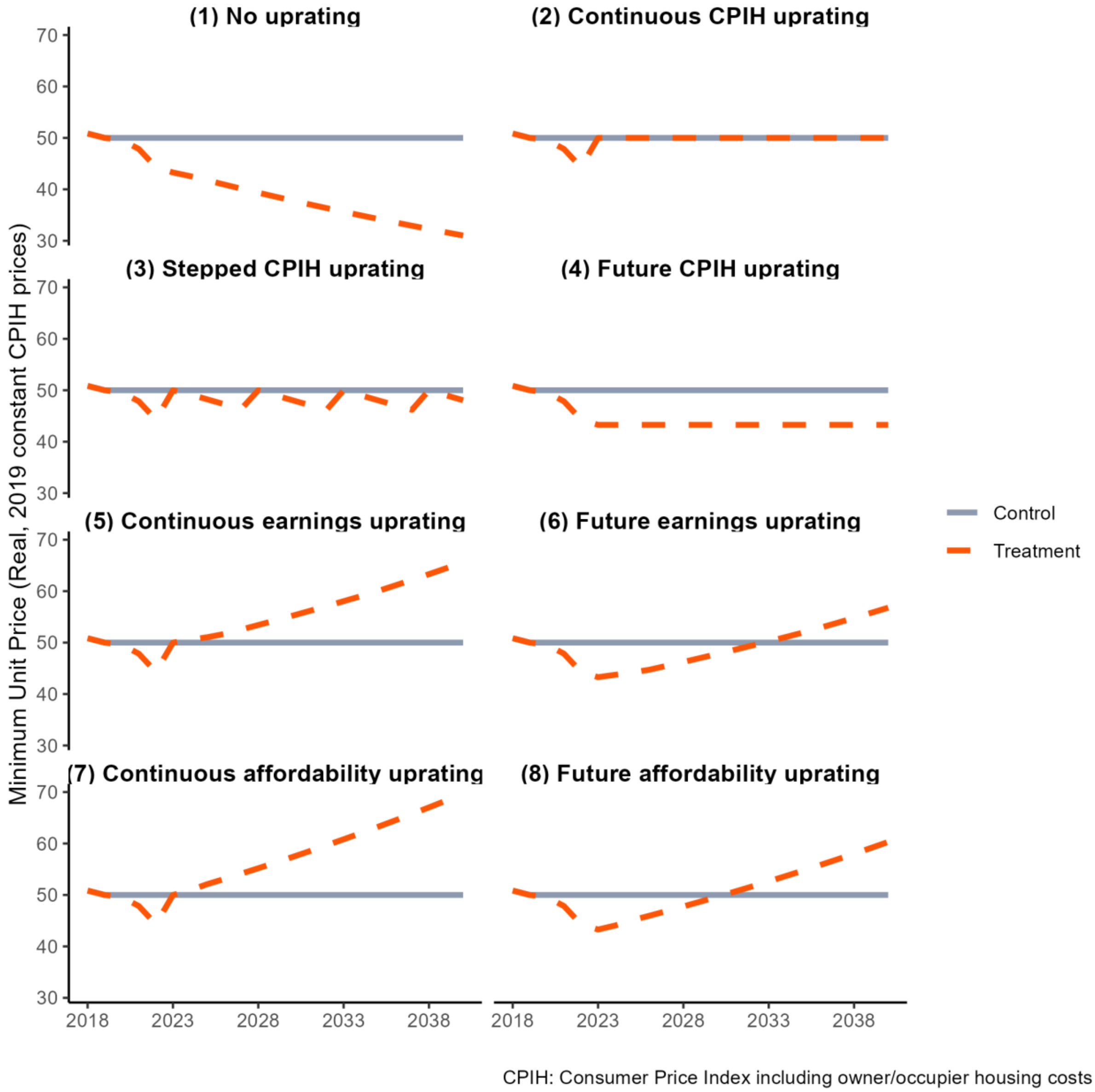

Figure 50: Illustrative overview of the 8 uprating scenarios in real terms

Results

Impacts of uprating policies on alcohol consumption and spending

The impact of each of the 8 modelled uprating scenarios on mean population alcohol consumption over time is shown in Figure 51. In each sub-plot the grey lines show all modelled scenarios and the red line the focal scenario of interest. These follow broadly the inverse pattern of the orange dashed lines in Figure 50, which represents the real terms value of the MUP threshold. As the real terms value of the MUP falls, for example in the no uprating scenario (1), mean consumption increases. In contrast, when the MUP level is pegged closely to inflation, e.g. under the continuous CPIH uprating scenario (2), consumption remains at similar levels to 2019.

Figure 51 demonstrates that a stepped approach to uprating, as in scenario 3, achieves a generally similar effect to continuous uprating, while uprating only in the future without accounting for the real terms fall in the MUP threshold between 2018 and 2023, means that the corresponding increase in alcohol consumption that we model over this initial 5-year period remains in the longer term. Alternative approaches to uprating using earnings (scenarios 5-6), or a measure of affordability (scenarios 7-8) lead to falls in alcohol consumption, as both of these measures are estimated to rise faster than inflation in the coming years.

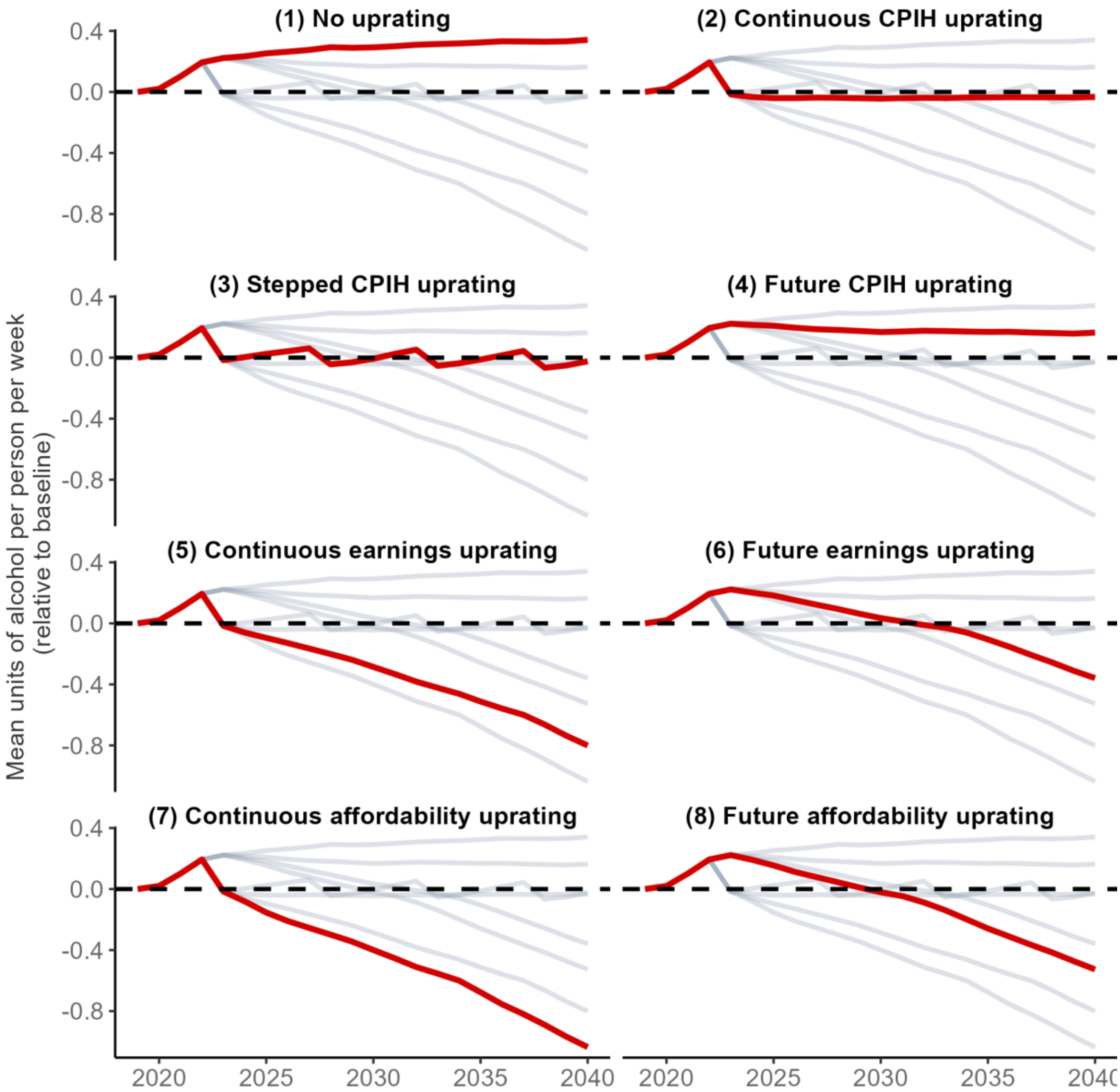

Figure 51: Modelled impacts of uprating scenarios on alcohol consumption compared to control. Grey lines represent other modelled scenarios

The overall difference in mean alcohol consumption for each modelled scenario in the final year of the model - 2040 - compared to control is shown in Table 51.

	Mean consumption (units/week)	
	Absolute change	Relative change
(1) No uprating	0.34	3.4%
(2) Continuous CPIH uprating	-0.03	-0.3%
(3) Stepped CPIH uprating	-0.02	-0.2%
(4) Future CPIH uprating	0.16	1.6%
(5) Continuous earnings uprating	-0.80	-8.0%
(6) Future earnings uprating	-0.36	-3.6%
(7) Continuous affordability uprating	-1.04	-10.3%
(8) Future affordability uprating	-0.53	-5.3%

Table 51: Modelled impacts of alternative approaches to uprating on population alcohol consumption in 2040

In order to understand the differential impact across drinker groups, we follow the same approach described in Chapter 1, looking at changes in the number of drinkers in each drinker group in Table 52. This demonstrates patterns that are in line with the mean consumption changes shown in Table 51, however the relative scale of the change in the number of harmful drinkers is considerably larger than the reduction in population mean consumption (e.g. no uprating leads to an increase in mean consumption of 3.4%, but an 11.6% increase in the number of harmful drinkers). This difference reflects the fact that MUP policies target the cheaper alcohol preferred by heavier drinkers, so changes to the MUP level have a greater impact on the drinking of harmful compared to moderate drinkers.

	Moderate	Hazardous	Harmful
Absolute change vs. control			
(1) No uprating	-25,838	9,594	14,609
(2) Continuous CPIH uprating	4,034	-2,486	-1,810
(3) Stepped CPIH uprating	5,778	-3,925	-2,137
(4) Future CPIH uprating	-12,232	4,339	6,694
(5) Continuous earnings uprating	76,466	-44,240	-31,441
(6) Future earnings uprating	34,080	-20,081	-14,260
(7) Continuous affordability uprating	101,563	-60,855	-39,443
(8) Future affordability uprating	49,495	-28,520	-20,866
Relative change vs. control			
(1) No uprating	-1.1%	1.1%	11.6%
(2) Continuous CPIH uprating	0.2%	-0.3%	-1.4%
(3) Stepped CPIH uprating	0.3%	-0.5%	-1.7%
(4) Future CPIH uprating	-0.5%	0.5%	5.3%
(5) Continuous earnings uprating	3.4%	-5.1%	-24.9%
(6) Future earnings uprating	1.5%	-2.3%	-11.3%
(7) Continuous affordability uprating	4.5%	-7.0%	-31.2%
(8) Future affordability uprating	2.2%	-3.3%	-16.5%

Table 52: Modelled impacts of alternative approaches to uprating on the number of drinkers in each drinker group in year 20

The extent to which each approach to uprating affects the consumption of drinkers across the deprivation spectrum differently is shown in Table 53 and Figure 52. These suggest that there is little in the way of clear patterns across SIMD quintiles in terms of the impact of alternative uprating approaches on mean consumption.

	Q1 (least deprived)	Q2	Q3	Q4	Q5 (most deprived)
Absolute change vs. control					
(1) No uprating	0.38	0.29	0.31	0.41	0.32
(2) Continuous CPIH uprating	-0.04	-0.03	-0.03	-0.04	-0.03
(3) Stepped CPIH uprating	-0.01	-0.02	-0.04	-0.03	-0.02
(4) Future CPIH uprating	0.18	0.13	0.16	0.20	0.15
(5) Continuous earnings uprating	-0.85	-0.71	-0.72	-0.95	-0.78
(6) Future earnings uprating	-0.37	-0.31	-0.29	-0.46	-0.37
(7) Continuous affordability uprating	-1.11	-0.93	-0.93	-1.24	-0.99
(8) Future affordability uprating	-0.55	-0.45	-0.45	-0.65	-0.54
Relative change vs. control					
(1) No uprating	3.1%	2.8%	3.6%	4.0%	3.8%
(2) Continuous CPIH uprating	-0.3%	-0.3%	-0.4%	-0.4%	-0.3%
(3) Stepped CPIH uprating	-0.1%	-0.2%	-0.4%	-0.3%	-0.3%
(4) Future CPIH uprating	1.5%	1.3%	1.8%	1.9%	1.8%
(5) Continuous earnings uprating	-7.1%	-7.0%	-8.3%	-9.2%	-9.2%
(6) Future earnings uprating	-3.1%	-3.0%	-3.4%	-4.5%	-4.3%
(7) Continuous affordability uprating	-9.3%	-9.1%	-10.7%	-12.0%	-11.6%
(8) Future affordability uprating	-4.6%	-4.5%	-5.2%	-6.3%	-6.4%

Table 53: Modelled impacts of alternative approaches to uprating on mean alcohol consumption in year 20 by SIMD quintile

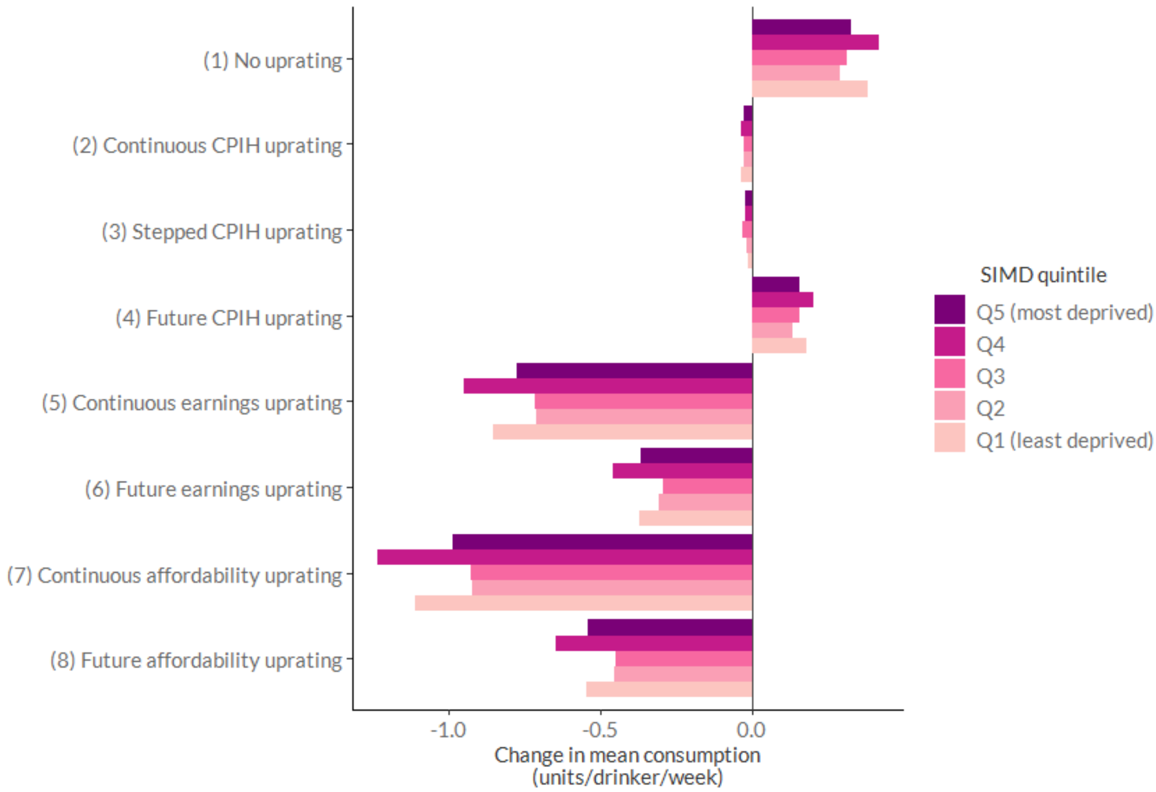

Figure 52: Modelled impacts of uprating scenarios on alcohol consumption in year 20 by SIMD quintile

The equivalent results for overall changes in consumer spending on alcohol over time under each of the uprating scenarios are shown in Figure 53 and Table 54. These follow a similar pattern to the changes in consumption shown in Figure 52, with spending increasing if the MUP threshold is not uprated at all (scenario 1), remaining generally steady if the threshold closely follows inflation (scenarios 2 and 3) and falling where the MUP threshold rises faster than inflation (scenarios 5-8).

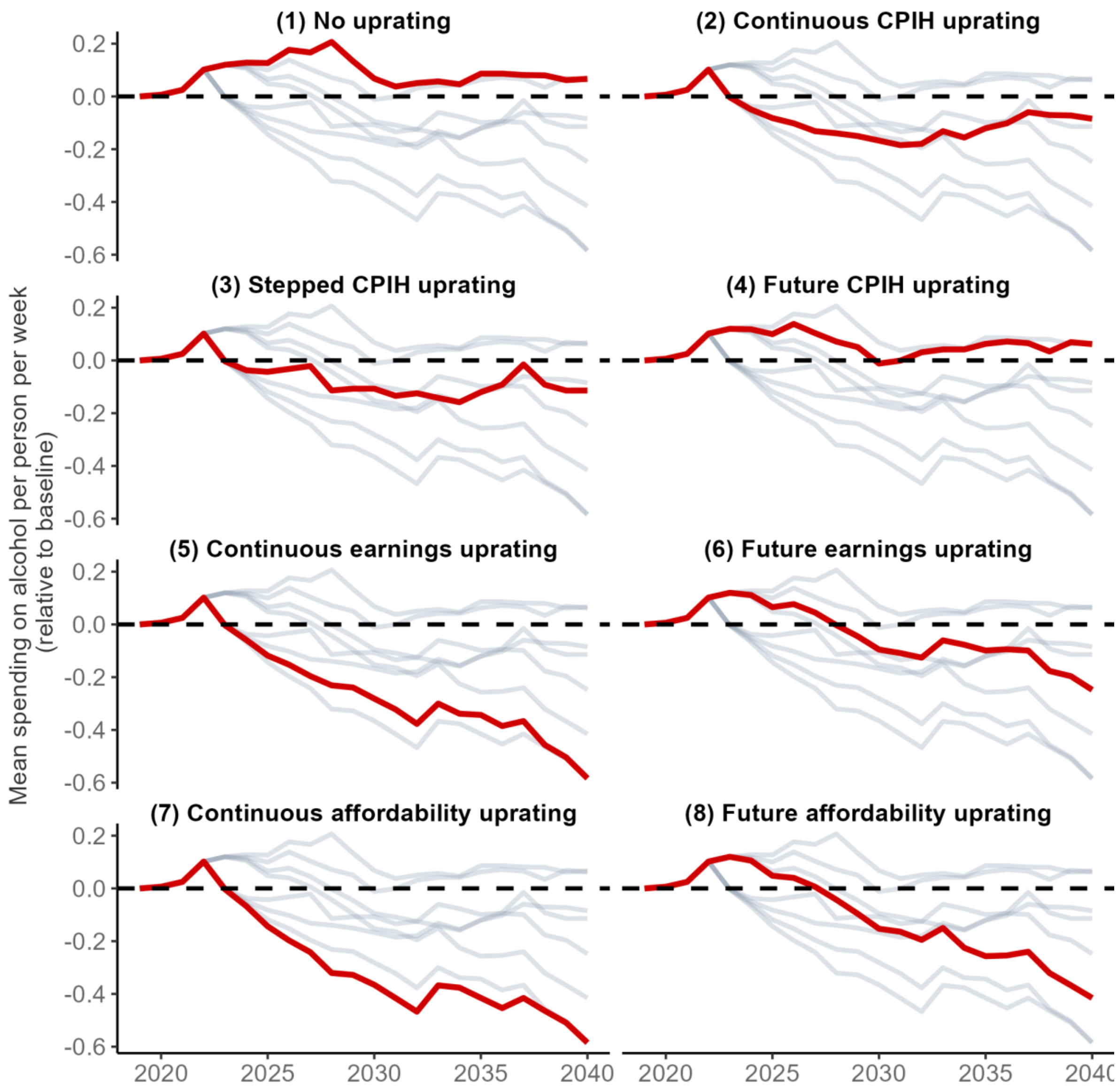

Figure 53: Modelled impacts of uprating scenarios on consumer spending on alcohol compared to control. Grey lines represent other modelled scenarios for comparison.

	Mean spending (£/drinker/week)	
	Absolute change	Relative change
(1) No uprating	£0.07	0.3%
(2) Continuous CPIH uprating	-£0.08	-0.3%
(3) Stepped CPIH uprating	-£0.11	-0.4%
(4) Future CPIH uprating	£0.06	0.2%
(5) Continuous earnings uprating	-£0.58	-2.2%
(6) Future earnings uprating	-£0.25	-0.9%
(7) Continuous affordability uprating	-£0.58	-2.2%
(8) Future affordability uprating	-£0.42	-1.6%

Table 54: Modelled impacts of alternative approaches to uprating on population spending on alcohol in year 20

Differences between SIMD quintiles in the impact of each uprating scenario on consumer spending on alcohol is shown in Table 55 and illustrated in Figure 54. These show a mixed picture, with different patterns across SIMD quintiles for different uprating approaches. Not uprating the MUP threshold leads to small impacts on spending in all but the most deprived group, who see a notable increase. Continuous and stepped CPIH uprating have limited differences in spending impacts between quintiles, while indexing the MUP threshold to earnings or affordability (scenarios 5-8) leads spending to fall across all SIMD groups, but not to the same extent.

	Q1 (least deprived)	Q2	Q3	Q4	Q5 (most deprived)
Absolute change vs. control					
(1) No uprating	-£0.16	£0.29	£0.05	-£0.21	£0.37
(2) Continuous CPIH uprating	£0.07	-£0.07	-£0.01	-£0.33	-£0.15
(3) Stepped CPIH uprating	-£0.23	£0.11	-£0.06	-£0.26	-£0.13
(4) Future CPIH uprating	£0.04	£0.17	£0.15	-£0.34	£0.26
(5) Continuous earnings uprating	-£0.66	-£0.39	-£0.27	-£0.78	-£0.84
(6) Future earnings uprating	-£0.39	-£0.08	-£0.10	-£0.55	-£0.13
(7) Continuous affordability uprating	-£0.43	-£0.51	-£0.37	-£0.87	-£0.82
(8) Future affordability uprating	-£0.72	-£0.11	-£0.13	-£0.66	-£0.45
Relative change vs. control					
(1) No uprating	-0.5%	1.1%	0.2%	-0.8%	1.6%
(2) Continuous CPIH uprating	0.2%	-0.2%	-0.0%	-1.3%	-0.7%
(3) Stepped CPIH uprating	-0.7%	0.4%	-0.3%	-1.0%	-0.6%
(4) Future CPIH uprating	0.1%	0.6%	0.7%	-1.3%	1.1%
(5) Continuous earnings uprating	-2.1%	-1.4%	-1.2%	-3.1%	-3.7%
(6) Future earnings uprating	-1.3%	-0.3%	-0.4%	-2.2%	-0.6%
(7) Continuous affordability uprating	-1.4%	-1.8%	-1.6%	-3.4%	-3.6%
(8) Future affordability uprating	-2.3%	-0.4%	-0.6%	-2.6%	-1.9%

Table 55: Modelled impacts of alternative approaches to uprating on population spending on alcohol in year 20 by SIMD quintile

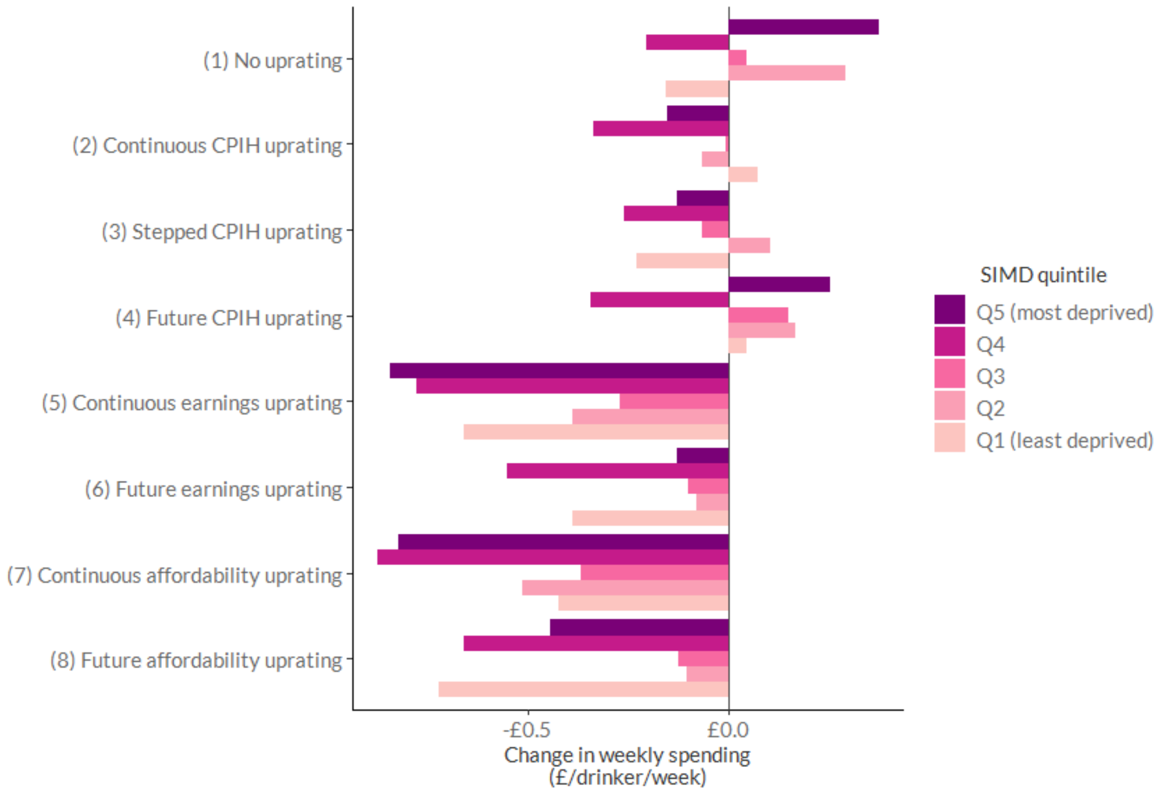

Figure 54: Modelled impacts of uprating scenarios on alcohol consumption in year 20 by SIMD quintile

Impacts of uprating policies on Exchequer and retailer revenue

The modelled impact of the 8 uprating scenarios on exchequer revenue from alcohol taxes, cumulatively over 20 years, is shown in Table 56 and Figure 55. These show that the no uprating and future CPIH uprating scenarios lead to the largest *increases* in revenue, while continuous uprating in line with earnings or affordability lead to the largest *decreases*.

	Off-trade	On-trade	Total
Absolute change vs. control			
(1) No uprating	£347	£28	£375
(2) Continuous CPIH uprating	-£78	-£46	-£125
(3) Stepped CPIH uprating	-£51	-£18	-£69
(4) Future CPIH uprating	£198	£34	£232
(5) Continuous earnings uprating	-£426	-£130	-£556
(6) Future earnings uprating	£11	-£12	-£1
(7) Continuous affordability uprating	-£562	-£172	-£734
(8) Future affordability uprating	-£77	-£67	-£144
Relative change vs. control			
(1) No uprating	2.02%	0.14%	1.01%
(2) Continuous CPIH uprating	-0.45%	-0.23%	-0.34%
(3) Stepped CPIH uprating	-0.29%	-0.09%	-0.19%
(4) Future CPIH uprating	1.15%	0.17%	0.63%
(5) Continuous earnings uprating	-2.48%	-0.66%	-1.50%
(6) Future earnings uprating	0.07%	-0.06%	-0.00%
(7) Continuous affordability uprating	-3.27%	-0.87%	-1.99%
(8) Future affordability uprating	-0.45%	-0.34%	-0.39%

Table 56: Modelled cumulative impact on exchequer revenue from alcohol taxes over 20 years compared to control

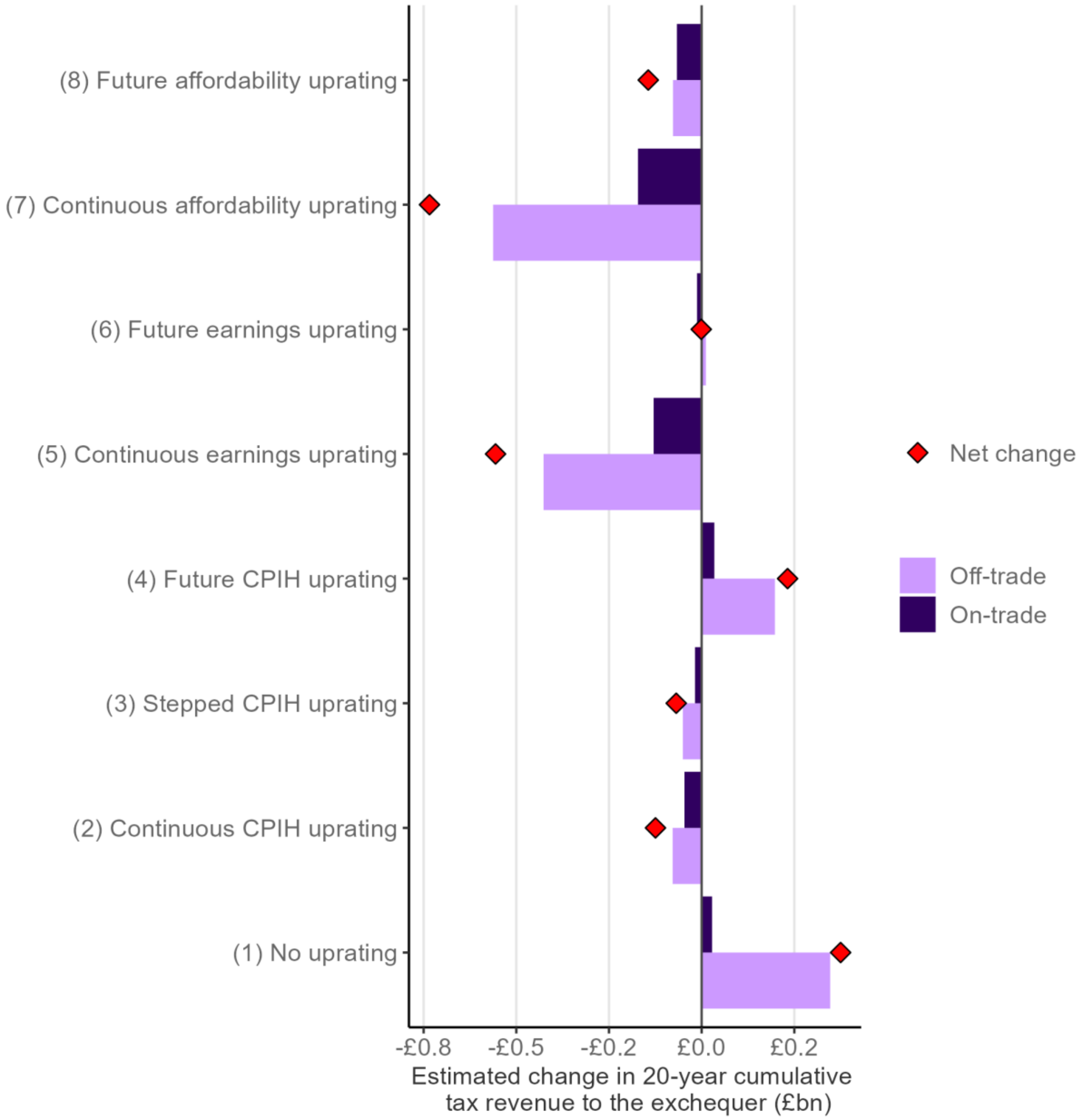

Figure 55: Modelled cumulative impact on exchequer revenue from alcohol taxes over 20 years compared to control

Table 57 and Figure 56 show the estimated impact on on- and off-trade retailer revenue from alcohol (excluding taxes). Again, this shows a mixed picture across the scenarios, although the pattern is different to that for changes in exchequer revenue. Almost all approaches to uprating, including not uprating at all, are estimated to increase retailer revenue, with the biggest revenue gains in the on-trade, while the off-trade is estimated to *lose* revenue under scenarios 1-4.

	Off-trade	On-trade	Total
Absolute change vs. control			
(1) No uprating	-£58	£60	£2
(2) Continuous CPIH uprating	-£114	-£138	-£252
(3) Stepped CPIH uprating	-£148	-£55	-£203
(4) Future CPIH uprating	-£75	£87	£12
(5) Continuous earnings uprating	£70	-£398	-£328
(6) Future earnings uprating	-£59	-£43	-£102
(7) Continuous affordability uprating	£173	-£513	-£340
(8) Future affordability uprating	-£24	-£199	-£223
Relative change vs. control			
(1) No uprating	-0.40%	0.10%	0.00%
(2) Continuous CPIH uprating	-0.79%	-0.24%	-0.35%
(3) Stepped CPIH uprating	-1.02%	-0.09%	-0.28%
(4) Future CPIH uprating	-0.51%	0.15%	0.02%
(5) Continuous earnings uprating	0.48%	-0.68%	-0.45%
(6) Future earnings uprating	-0.41%	-0.07%	-0.14%
(7) Continuous affordability uprating	1.19%	-0.88%	-0.46%
(8) Future affordability uprating	-0.17%	-0.34%	-0.30%

Table 57: Modelled cumulative impact on retailer revenue excluding taxes over 20 years compared to control

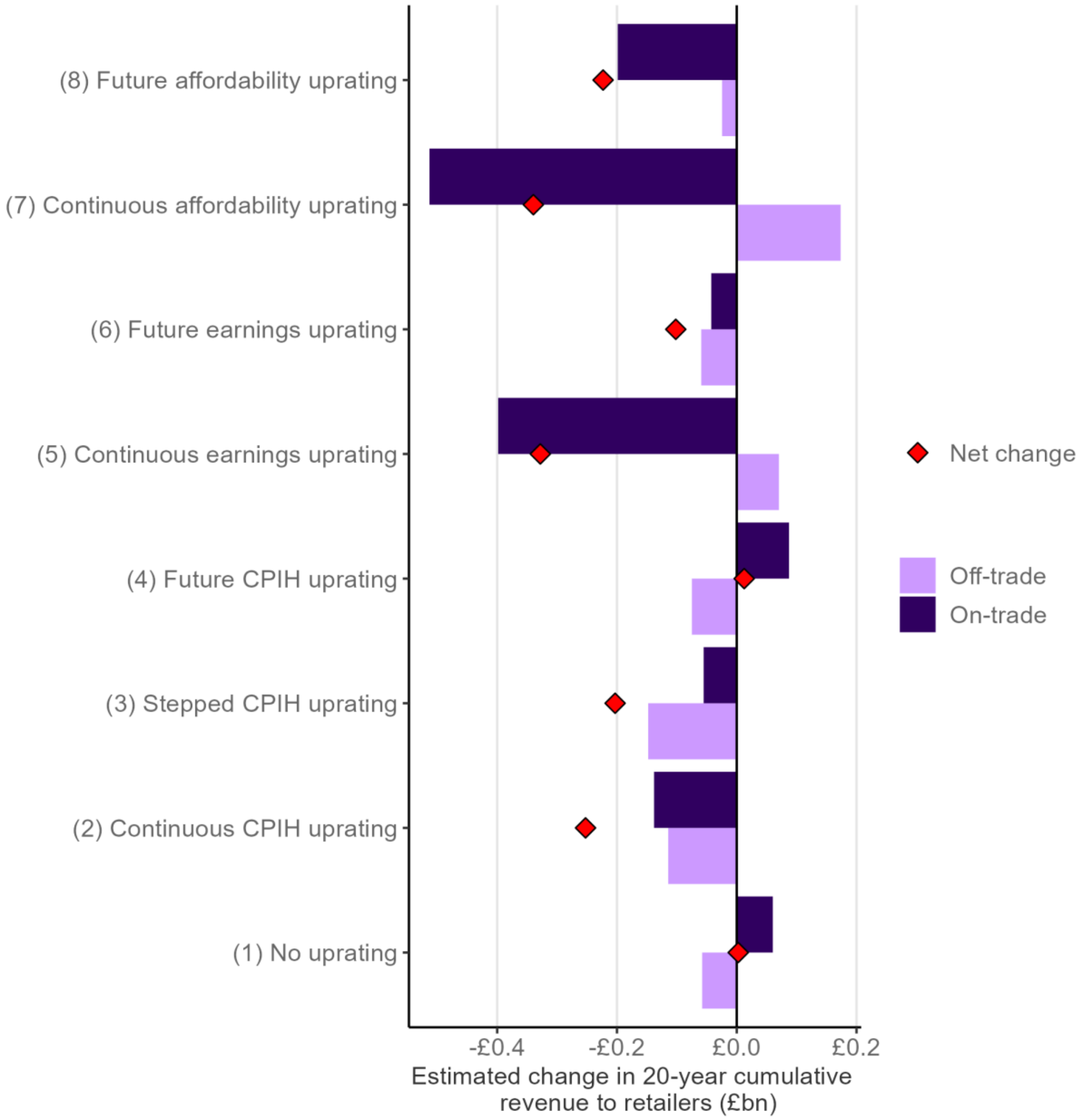

Figure 56: Modelled cumulative impact on retailer revenue excluding taxes over 20 years compared to control

Impacts of uprating policies on health outcomes

The modelled impacts of each of the 8 uprating scenarios on annual all-cause mortality are shown in Figure 57. As may be expected these follow very similar paths over time as the patterns of consumption illustrated in Figure 51. If the MUP threshold is not uprated, all-cause mortality increases and remains at elevated levels, whereas linking the MUP threshold to inflation leads to only small differences in mortality. In the scenario where there is no adjustment in the MUP level to reflect inflation over the period from 2018-2023, but the thresold is tied to inflation from 2023 onwards (scenario 4), mortality remains at a higher level than if the MUP threshold had been linked to inflation from 2018. The falls in consumption arising from both earnings and affordability rising faster than inflation lead to similar falls in mortality in scenarios 5-8.

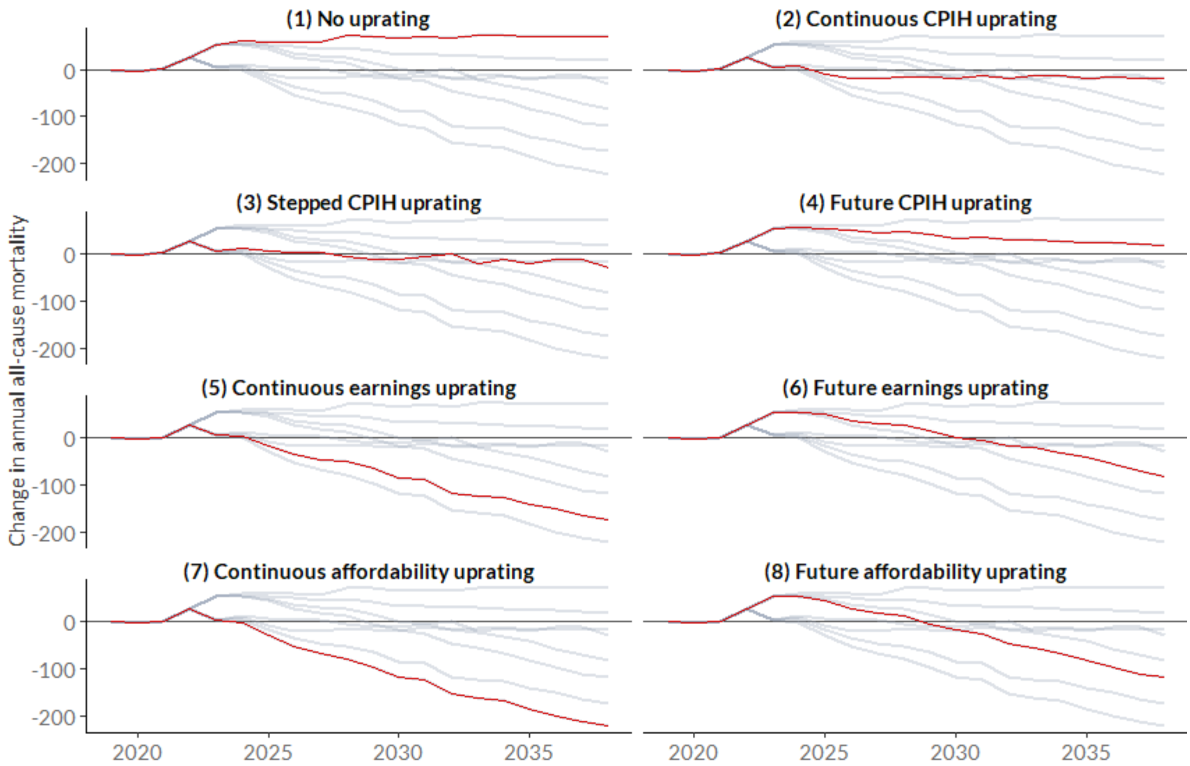

Figure 57: Modelled impact of alternative approaches to uprating on all-cause deaths over time. Grey lines represent other modelled approaches for comparison.

Cumulative differences over 20 years in all-cause mortality, hospital admissions, Years of Life Lost to premature mortality and NHS hospital costs for the overall population and by SIMD quintile are shown in Table 58. These illustrate that maintaining the MUP threshold at 50p in the long-term is estimated to lead to an additional 1,076 deaths, 14,532 hospital admissions, 37,728 YLLs and an increase of £17.4m in NHS costs. Adjusting the MUP threshold in 2023 for inflation since 2018 and then indexing it to CPIH (scenario 2) leads to a small overall reduction in all health harms compared to control, while a stepped approach (scenario 3), adjusting the threshold every 5 years leads to a reduction in deaths, but a small increase in hospital admissions and YLLs. Future CPIH uprating only (scenario 4) is estimated to lead to around 50-60% of the health impacts of not uprating at all, while continuously linking the MUP threshold to earnings (scenario 5) would see relatively large reductions in harms (1,366 fewer deaths and 14,274 fewer hospital admissions over 20 years, saving the NHS £17.4m).

	All	Q1 (least deprived)	Q2	Q3	Q4	Q5 (most deprived)
Cumulative difference in all-cause deaths						
(1) No uprating	1,076	136	91	209	335	306
(2) Continuous CPIH uprating	-197	-20	-39	-38	-61	-39
(3) Stepped CPIH uprating	-102	10	-27	-46	-23	-16
(4) Future CPIH uprating	598	101	31	119	206	141
(5) Continuous earnings uprating	-1,366	-153	-192	-283	-361	-377
(6) Future earnings uprating	-56	30	-56	-11	7	-25
(7) Continuous affordability uprating	-1,848	-212	-266	-378	-478	-513
(8) Future affordability uprating	-404	-12	-102	-67	-74	-148
Cumulative difference in hospital admissions						
(1) No uprating	14,532	1,891	1,540	2,535	4,074	4,492
(2) Continuous CPIH uprating	-1,174	-138	-185	-252	-335	-265
(3) Stepped CPIH uprating	319	158	-41	-117	143	175
(4) Future CPIH uprating	9,207	1,212	928	1,615	2,642	2,811
(5) Continuous earnings uprating	-14,274	-1,797	-1,849	-2,558	-3,754	-4,315
(6) Future earnings uprating	1,535	301	32	312	489	401
(7) Continuous affordability uprating	-19,771	-2,511	-2,593	-3,533	-5,137	-5,996
(8) Future affordability uprating	-2,214	-195	-439	-305	-456	-819
Cumulative difference in Years of Life Lost to premature death						
(1) No uprating	37,728	3,775	3,845	6,948	11,161	12,000
(2) Continuous CPIH uprating	-3,526	-305	-473	-921	-997	-830
(3) Stepped CPIH uprating	249	311	-90	-524	368	184
(4) Future CPIH uprating	23,818	2,447	2,268	4,387	7,208	7,508
(5) Continuous earnings uprating	-37,028	-3,491	-4,494	-7,204	-10,127	-11,711
(6) Future earnings uprating	3,882	706	23	758	1,377	1,018
(7) Continuous affordability uprating	-51,310	-4,876	-6,371	-9,779	-13,941	-16,342
(8) Future affordability uprating	-5,769	-302	-1,088	-963	-1,122	-2,294
Cumulative difference in NHS costs (£m)						
(1) No uprating	£17.4	£2.5	£1.9	£3.1	£4.8	£5.1
(2) Continuous CPIH uprating	-£1.5	-£0.2	-£0.2	-£0.3	-£0.4	-£0.3
(3) Stepped CPIH uprating	£0.3	£0.2	-£0.1	-£0.2	£0.1	£0.2
(4) Future CPIH uprating	£10.9	£1.6	£1.1	£2.0	£3.1	£3.2
(5) Continuous earnings uprating	-£17.4	-£2.4	-£2.4	-£3.2	-£4.5	-£4.9
(6) Future earnings uprating	£1.7	£0.4	£0.0	£0.3	£0.5	£0.4
(7) Continuous affordability uprating	-£24.1	-£3.3	-£3.3	-£4.4	-£6.1	-£6.9
(8) Future affordability uprating	-£2.8	-£0.3	-£0.6	-£0.4	-£0.6	-£1.0

Table 58: Modelled cumulative impact on deaths over 20 years by SIMD quintile

The patterns of changes in mortality by SIMD quintile under each uprating scenario are shown in Figure 58. Although there was little SIMD gradient in the impact of each scenario on alcohol consumption, there are clearer gradients in mortality impacts on display here, with more deprived groups seeing generally larger changes in all-cause mortality. This arises because of the fact that baseline harms are higher in more deprived groups, so if all drinkers change their consumption equally, the biggest impacts on harms are likely to be seen in the most deprived quintiles.

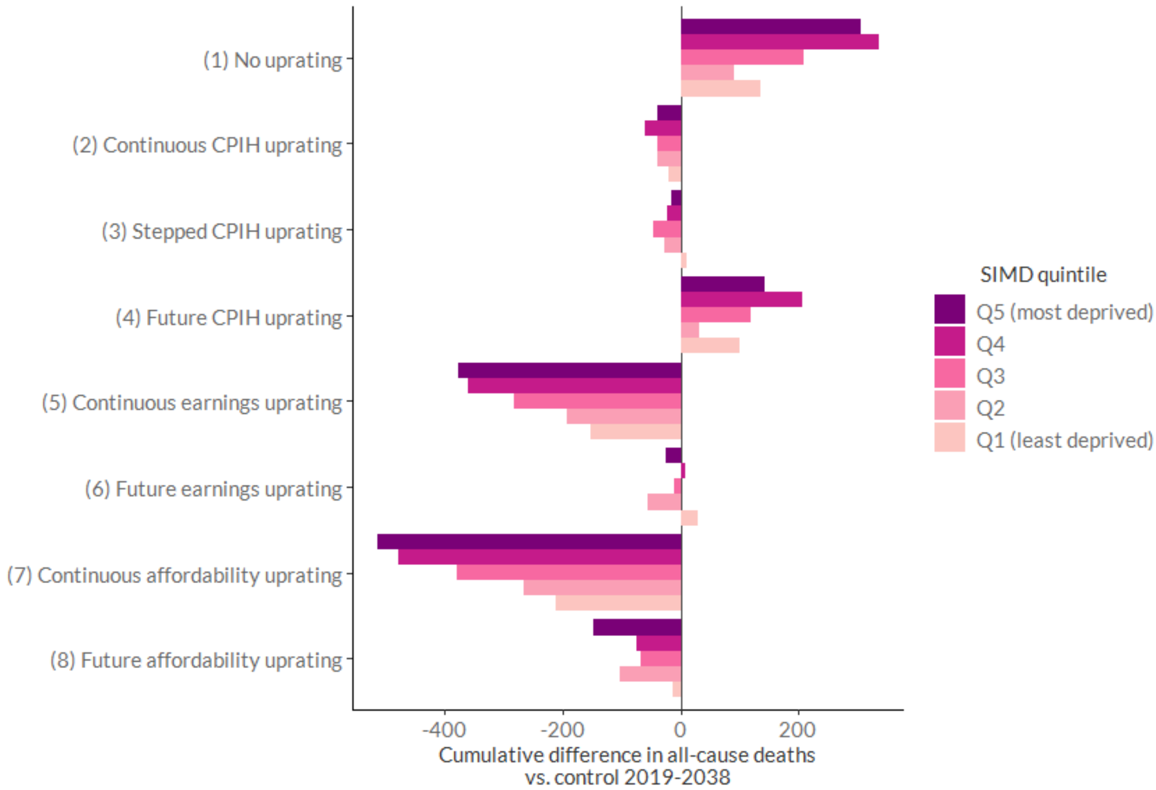

Figure 58: Modelled cumulative impact on deaths over 20 years by SIMD quintile

Finally, Table 59 shows the modelled impact of each scenario on cumulative alcohol-specific deaths over 20 years, showing similar patterns to the other health outcomes shown in Table 58.

	Relative to control	
	Absolute change	Relative change
(1) No uprating	914	5.4%
(2) Continuous CPIH uprating	-53	-0.3%
(3) Stepped CPIH uprating	37	0.2%
(4) Future CPIH uprating	589	3.5%
(5) Continuous earnings uprating	-893	-5.3%
(6) Future earnings uprating	87	0.5%
(7) Continuous affordability uprating	-1,239	-7.3%
(8) Future affordability uprating	-147	-0.9%

Table 59: Modelled cumulative impact on alcohol-specific deaths over 20 years

Discussion

The modelling in this chapter demonstrates the potential impacts of alternative approaches to uprating the MUP threshold in Scotland. The results suggest that not adjusting the current £0.50 MUP to account for inflation would lead to 1076 additional deaths over 20 years, compared to if the MUP threshold was indexed to inflation throughout. These effects are particularly large because of the present high rate of inflation. Based on the latest available forecasts of future inflation, not uprating the MUP threshold is estimated to lead to increased levels of alcohol consumption, particularly among harmful drinkers, resulting in additional deaths over 20 years, compared to if the MUP threshold was indexed to inflation throughout.

Our results also show that there are only small differences in effect between policies that increase the MUP threshold in line with inflation each year, and where this adjustment is made every 5 years instead, although the former leads to marginally lower levels of overall health harms. Linking the MUP threshold to inflation from 2023 onwards, but without addressing the real terms fall in the value of 50p/unit since 2018 leads to a smaller increase in deaths than not uprating at all (598). Finally, the results suggest that linking uprating to alternative measures such as earnings growth or affordability has the potential to lead to substantial improvements in health over and above indexing the MUP threshold to inflation, but these depend on how future changes in these indices compare to future levels of inflation, which may be sensitive to wider economic factors that are outside the scope of this project.

In this study we have explored a range of alternative approaches to uprating, following consultation with stakeholders, but other approaches to uprating could be used, for example linking the MUP threshold to the affordability of alcohol. There are also limitations to the modelling approach we have taken. These include the fact that we have not modelled the impact of changes in income or alcohol affordability separately from changes in price. As a result, if real incomes in the UK do indeed rise faster than inflation, as forecast, then disposable incomes are also likely to rise. We have not accounted for any resulting changes in consumption that might arise from these changes. We have also not accounted for the fact that price inflation may occur at different rates for different products. Our assumptions on the way that prices would change in response to changes in the MUP level are broadly in line with the changes that were observed when MUP was first introduced (73), but it is possible that producers and retailers may react differently if the MUP threshold was changed on a regular basis.

Overall, these results highlight that decisions on uprating the MUP in Scotland are important for the public health impact of the policy. The same is likely to be true in other jurisdictions such as Wales, the Republic of Ireland, Canada and several countries in Eastern Europe, which have Minimum Price policies in place, but no formal uprating mechanism. To our knowledge, the only jurisdiction to increase its MUP since implementation is Australia's Northern Territory, which introduced an MUP in October 2018 that is indexed annually to CPI inflation (74). A key recommendation from this report therefore is that policy makers in jurisdictions with MUP or that are considering introducting MUP establish policies for uprating that ensure the policy continues to achieve the intended outcomes.

References

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	All drinkers	Moderate	Hazardous	Harmful
Drinker population	3,568,079	2,546,719	877,934	143,426
Mean consumption per drinker per week (control)	12.0	4.8	24.5	63.8
Absolute change in weekly consumption vs. control				
Remove MUP	0.65	0.01	0.22	1.74
40p MUP	0.41	0.01	0.14	1.11
45p MUP	0.26	0.01	0.11	0.81
50p MUP (control)	0.00	0.00	0.00	0.00
55p MUP	-0.33	0.00	-0.10	-0.71
60p MUP	-0.80	-0.02	-0.28	-1.66
65p MUP	-1.29	-0.03	-0.48	-2.61
70p MUP	-1.84	-0.06	-0.85	-4.15
75p MUP	-2.39	-0.09	-1.14	-5.44
80p MUP	-2.96	-0.13	-1.50	-7.06
Relative change vs. control				
Remove MUP	5.4%	0.3%	0.9%	2.7%
40p MUP	3.4%	0.2%	0.6%	1.7%
45p MUP	2.2%	0.3%	0.4%	1.3%
50p MUP (control)	0.0%	0.0%	0.0%	0.0%
55p MUP	-2.7%	-0.1%	-0.4%	-1.1%
60p MUP	-6.7%	-0.3%	-1.1%	-2.6%
65p MUP	-10.7%	-0.7%	-2.0%	-4.1%
70p MUP	-15.3%	-1.3%	-3.5%	-6.5%
75p MUP	-19.9%	-1.9%	-4.6%	-8.5%
80p MUP	-24.6%	-2.7%	-6.1%	-11.1%

Table A1: Modelled impacts of removing or changing the MUP threshold on alcohol consumption in year 1

	All drinkers	Moderate	Hazardous	Harmful
Drinker population	3,568,079	2,546,719	877,934	143,426
Mean spending per drinker per week (control)	£27.92	£17.03	£48.87	£92.97
Absolute change in spending vs. control				
Remove MUP	£0.16	-£0.15	-£1.05	-£2.87
40p MUP	£0.11	-£0.07	-£0.66	-£1.95
45p MUP	£0.06	-£0.04	-£0.46	-£1.23
50p MUP (control)	£0.00	£0.00	£0.00	£0.00
55p MUP	-£0.12	£0.09	£0.57	£1.79
60p MUP	-£0.32	£0.21	£1.41	£4.18
65p MUP	-£0.57	£0.33	£2.28	£6.74
70p MUP	-£0.90	£0.45	£3.11	£9.08
75p MUP	-£1.29	£0.56	£4.08	£12.49
80p MUP	-£1.76	£0.66	£5.17	£14.85
Relative change vs. control				
Remove MUP	0.6%	-0.9%	-2.1%	-3.1%
40p MUP	0.4%	-0.4%	-1.4%	-2.1%
45p MUP	0.2%	-0.2%	-0.9%	-1.3%
50p MUP (control)	0.0%	0.0%	0.0%	0.0%
55p MUP	-0.4%	0.5%	1.2%	1.9%
60p MUP	-1.1%	1.2%	2.9%	4.5%
65p MUP	-2.0%	1.9%	4.7%	7.2%
70p MUP	-3.2%	2.6%	6.4%	9.8%
75p MUP	-4.6%	3.3%	8.3%	13.4%
80p MUP	-6.3%	3.9%	10.6%	16.0%

Table A2: Modelled impacts of removing or changing the MUP threshold on consumer spending on alcohol in year 1

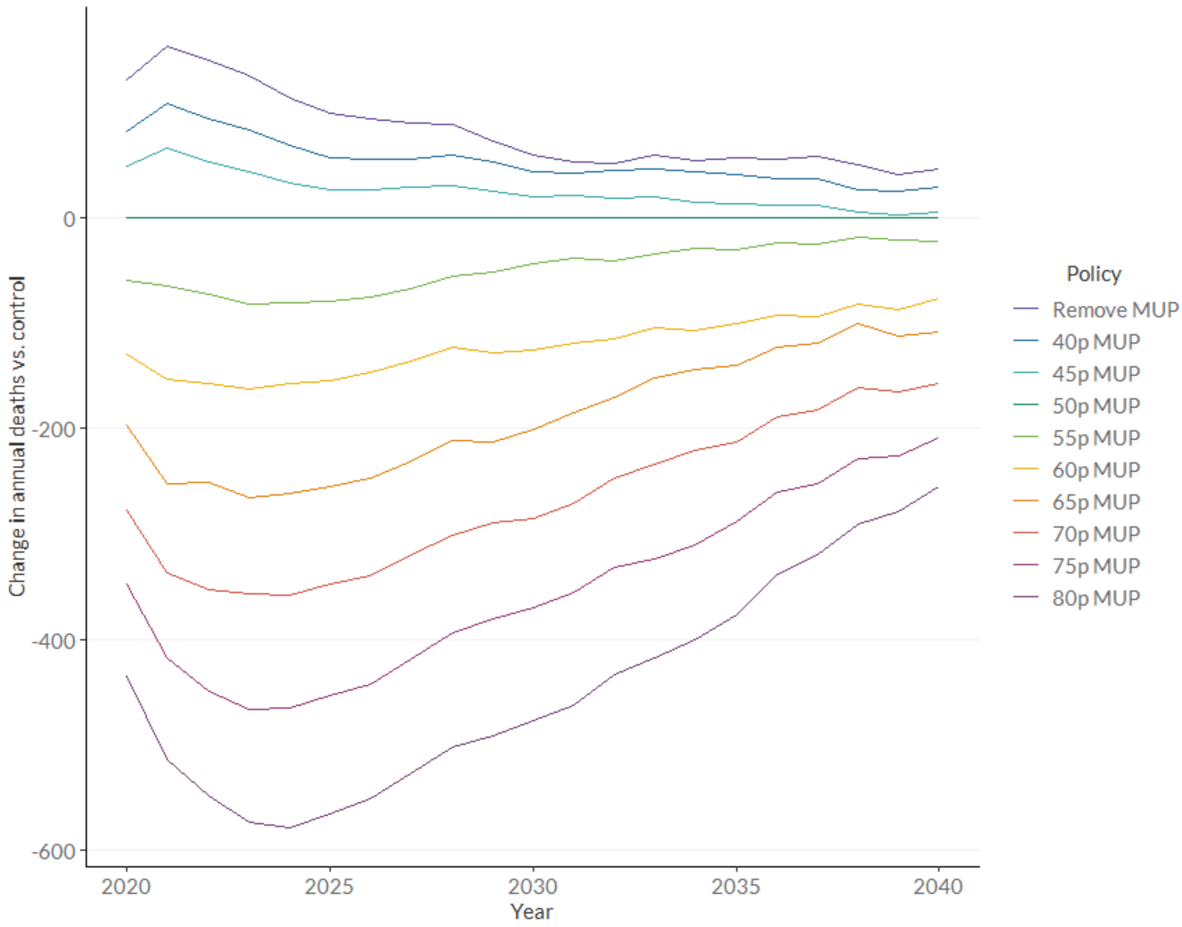

Figure A1: Modelled changes in all-cause mortality over time compared to control

Drinker group-specific mortality impacts, presented in Table A3, suggest that the largest reductions in mortality rates come from harmful drinkers, however, as discussed in the main report, these results should be interpreted with significant caution, particularly the finding that increasing the MUP threshold leads to an increase in mortality among moderate drinkers. There are four separate mechanisms which give rise to this increase. These are discussed in more detail in the SAPM-R technical report (1), but to summarise:

Firstly, as demonstrated by Table 10 in the report, increasing the MUP threshold leads to many hazardous drinkers reducing their consumption to moderate levels. This means the number of moderate drinkers consuming at the upper end of this band (i.e. close to 14 units/weeks) will increase and, in doing so, add to the overall risk of health harms in this group. This may limit or outweigh the reductions in health harms among moderate drinkers arising from an increase in the MUP. As a result, this movement of drinkers between drinker groups can serve to attenuate risk reductions among moderate drinkers overall, or even lead to the overall risk of health harms among moderate drinkers *increasing* even as the risks of all individuals reduces.

Secondly, the SAPM-R framework incorporates evidence that changes in alcohol consumption can take several years to feed through to changes in risks of some chronic harms (2). The individual nature of the simulation model means that hazardous drinkers who reduce their consumption to moderate levels will, as a result, still retain some of the risk associated with their previous higher levels of drinking, for up to 20 years as a result. Thus, even if a former hazardous drinker has the same level of alcohol consumption as a moderate drinker, they may still face greater risk of an alcohol-related chronic disease, such as cancer due to their drinking history.

Thirdly, a reduction in population alcohol consumption that moves drinkers from hazardous to moderate levels will, all else being equal, *increase* the number of people in the moderate drinker group and therefore increasing the expected number of deaths (although not the mortality rate, as this adjusts for the changing population size).

Finally, TAX-sim, in common with SAPM, assumes that evidence showing that moderate levels of alcohol consumption protects against several health conditions (i.e. reduces the risk of harm relative to abstention) is correct. This includes evidence relating to ischaemic heart disease (for both men and women) and type II diabetes (for women only). The nature of the modelled relationships between alcohol consumption levels and risk for these conditions (see (3) for details) means that policies that reduce consumption among moderate drinkers can lead to an increase in risk for some individuals as they move from the lowest point of the risk curve towards the higher risk level of non-drinkers. In turn, this can lead to an increase in harms within the moderate drinker group. As discussed in the main report, the epidemiological evidence underpinning these protective effects is contested, with standard observational epidemiology studies typically showing protective effects but more recent Mendelian Randomisation studies (4,5) and some meta-analyses that include only the highest quality standard observational studies showing little or no such effect (6,7). Overall, our decision to prefer evidence using traditional standard epidemiological approaches to the alternative evidence means that TAX-sim results are conservative in terms of the potential benefits of alcohol pricing policies , compared to the alternative decision of preferring evidence that excludes protective effects. However, our decision means that some estimates relating to moderate drinkers are more pessimistic about the public health impacts of alcohol price increases than if we excluded protective effects entirely.

In the context of these issues, it should be noted that the epidemiological evidence used in TAX-Sim, including around conditions with potential protective effects, is consistent with other large-scale alcohol modelling studies (8–10) and also the previous 2016 modelling using SAPM (11). This evidence base had not changed substantially since 2016 and therefore the differences in estimated impacts on moderate drinkers in Tables A3 and A4 compared to previous estimates are largely driven by the movement of drinkers between groups, as discussed above, rather than any change in the underlying assumptions about protective effects.

	Population	Moderate	Hazardous	Harmful
Absolute change in deaths vs. control				
Remove MUP	1,669	-5,588	2,603	4,653
40p MUP	1,098	-3,926	1,935	3,088
45p MUP	514	-2,118	1,030	1,602
50p MUP	0	0	0	0
55p MUP	-1,003	5,109	-3,503	-2,609
60p MUP	-2,483	12,060	-8,964	-5,579
65p MUP	-3,837	20,413	-15,487	-8,764
70p MUP	-5,454	30,231	-23,465	-12,220
75p MUP	-7,188	40,460	-32,081	-15,567
80p MUP	-9,088	51,578	-41,843	-18,823
Change in deaths per 100,000 vs. control				
Remove MUP	2	-12	14	153
40p MUP	1	-8	11	106
45p MUP	1	-4	6	57
50p MUP	0	0	0	0
55p MUP	-1	10	-20	-105
60p MUP	-3	24	-52	-245
65p MUP	-5	41	-93	-432
70p MUP	-6	59	-146	-687
75p MUP	-8	78	-208	-1,038
80p MUP	-11	97	-286	-1,554

Table A3: Modelled impacts of removing or changing the MUP threshold on cumulative all-cause mortality over 20 years by drinker group

	Population	Moderate	Hazardous	Harmful
Absolute change in hospital admissions vs. control				
Remove MUP	22,179	-27,137	12,923	36,393
40p MUP	15,057	-18,962	9,696	24,323
45p MUP	7,621	-9,934	4,997	12,558
50p MUP	0	0	0	0
55p MUP	-13,864	24,997	-18,560	-20,301
60p MUP	-30,484	59,330	-47,615	-42,199
65p MUP	-49,181	100,981	-82,593	-67,568
70p MUP	-70,018	150,188	-126,731	-93,474
75p MUP	-91,721	203,180	-174,859	-120,042
80p MUP	-115,310	261,527	-230,584	-146,253
Change in admissions per 100,000 vs. control				
Remove MUP	26	-57	72	1,200
40p MUP	18	-40	54	833
45p MUP	9	-21	28	448
50p MUP	0	0	0	0
55p MUP	-16	51	-105	-817
60p MUP	-36	120	-276	-1,852
65p MUP	-58	201	-493	-3,327
70p MUP	-82	294	-786	-5,259
75p MUP	-108	390	-1,133	-8,004
80p MUP	-135	492	-1,574	-12,071

Table A4: Modelled impacts of removing or changing the MUP threshold on cumulative hospital admissions over 20 years by drinker group

	Population	Moderate	Hazardous	Harmful
Absolute change in YLLs vs. control				
Remove MUP	58,348	-94,466	37,050	115,763
40p MUP	39,208	-66,829	28,371	77,666
45p MUP	19,965	-34,970	14,786	40,149
50p MUP	0	0	0	0
55p MUP	-35,111	88,809	-59,119	-64,801
60p MUP	-78,150	209,953	-152,175	-135,928
65p MUP	-125,485	358,074	-265,429	-218,130
70p MUP	-178,245	534,099	-411,570	-300,774
75p MUP	-233,539	722,724	-569,441	-386,821
80p MUP	-293,138	930,339	-752,172	-471,305
Change in YLLs per 100,000 vs. control				
Remove MUP	69	-197	206	3,818
40p MUP	46	-139	158	2,661
45p MUP	23	-73	82	1,432
50p MUP	0	0	0	0
55p MUP	-41	182	-335	-2,608
60p MUP	-92	425	-884	-5,964
65p MUP	-147	713	-1,586	-10,741
70p MUP	-209	1,045	-2,554	-16,921
75p MUP	-274	1,388	-3,689	-25,792
80p MUP	-344	1,750	-5,135	-38,899

Table A5: Modelled impacts of removing or changing the MUP threshold on cumulative YLLs over 20 years by drinker group

	Deaths	Alcohol-specific deaths	Hospital admissions	YLLs
Absolute change in outcome vs. control				
Remove MUP	41	47	738	1,785
40p MUP	24	33	515	1,193
45p MUP	3	15	221	476
50p MUP	0	0	0	0
55p MUP	-22	-35	-517	-1,225
60p MUP	-88	-81	-1,211	-3,033
65p MUP	-112	-134	-1,926	-4,807
70p MUP	-165	-192	-2,760	-6,870
75p MUP	-226	-253	-3,649	-9,123
80p MUP	-279	-319	-4,593	-11,433
Change in outcome per 100,000 person years vs. control				
Remove MUP	1.0	1.1	17.9	43.3
40p MUP	0.6	0.8	12.5	28.9
45p MUP	0.1	0.4	5.4	11.5
50p MUP	0.0	0.0	0.0	0.0
55p MUP	-0.5	-0.9	-12.5	-29.7
60p MUP	-2.1	-2.0	-29.4	-73.5
65p MUP	-2.7	-3.2	-46.7	-116.5
70p MUP	-4.0	-4.7	-66.8	-166.4
75p MUP	-5.5	-6.1	-88.3	-220.8
80p MUP	-6.7	-7.7	-111.1	-276.6

Table A6: Modelled impacts of removing or changing the MUP threshold on health outcomes in year 20

	Baseline consumption (units/drinker/week)	Modelled policy					
		60p MUP	24% tax rise	21% tax rise	25% tax rise	23% tax rise	29% tax rise
Absolute change vs. control							
All drinkers	12.03	-0.80	-0.64	-0.56	-0.69	-0.62	-0.80
Moderate	4.83	-0.02	-0.09	-0.08	-0.09	-0.08	-0.11
Hazardous	24.47	-0.28	-0.19	-0.17	-0.21	-0.19	-0.26
Harmful	63.83	-1.66	-0.48	-0.39	-0.55	-0.50	-0.68
Relative change vs. control							
All drinkers		-6.7%	-5.3%	-4.6%	-5.7%	-5.2%	-6.6%
Moderate		-0.3%	-1.8%	-1.6%	-1.9%	-1.8%	-2.2%
Hazardous		-1.1%	-0.8%	-0.7%	-0.9%	-0.8%	-1.1%
Harmful		-2.6%	-0.8%	-0.6%	-0.9%	-0.8%	-1.1%

Table A7: Modelled consumption impacts of different equivalised rates for a 60p MUP by drinker group

	Population	Moderate	Hazardous	Harmful
Absolute change vs. control				
60p MUP	-2,483	12,060	-8,964	-5,579
24% tax rise	-2,249	13,856	-10,701	-5,404
22% tax rise	-2,100	12,056	-9,270	-4,885
25% tax rise	-2,515	14,594	-11,365	-5,745
23% tax rise	-2,256	13,455	-10,326	-5,385
28% tax rise	-2,852	16,763	-13,052	-6,562
Relative change vs. control				
60p MUP	-0.2%	1.4%	-5.1%	-16.9%
24% tax rise	-0.2%	1.6%	-6.0%	-16.4%
22% tax rise	-0.2%	1.4%	-5.2%	-14.8%
25% tax rise	-0.2%	1.7%	-6.4%	-17.4%
23% tax rise	-0.2%	1.6%	-5.8%	-16.3%
28% tax rise	-0.3%	2.0%	-7.4%	-19.9%

Table A8: Modelled mortality impacts of different equivalised rates for a 60p MUP by drinker group

	All Drinkers	Moderate	Hazardous	Harmful
Consumption in 2023 (units per week per drinker - control)	12.09	5.08	24.35	61.74
Absolute change vs. control				
Duty Reform	-0.05	-0.01	-0.01	-0.01
60p MUP	-0.70	-0.01	-0.32	-1.76
Relative change vs. control				
Duty Reform	-0.4%	-0.2%	-0.0%	-0.0%
60p MUP	-5.8%	-0.2%	-1.3%	-2.9%

Table A9: Modelled impacts of alcohol duty reform on consumption by drinker group

	All Drinkers	Moderate	Hazardous	Harmful
Mean weekly spending in 2023 (per drinker - control)	£29.11	£17.91	£50.20	£98.40
Absolute change vs. control				
Duty Reform	£0.13	£0.08	£0.36	£1.04
60p MUP	-£0.17	£0.29	£1.26	£4.96
Relative change vs. control				
Duty Reform	0.4%	0.5%	0.7%	1.1%
60p MUP	-0.6%	1.6%	2.5%	5.0%

Table A10: Modelled impacts of alcohol duty reform on consumer spending by drinker group

Figure A2: Modelled impacts of alcohol duty reform and a 60p MUP on consumer spending over time by SIMD quintile

	All Drinkers	Moderate	Hazardous	Harmful
Cumulative deaths (2019-2038)	1,060,466	850,502	176,977	32,988
Absolute change vs. control				
Duty Reform	-220	985	-886	-318
60p MUP	-2,483	12,060	-8,964	-5,579
Relative change vs. control				
Duty Reform	-0.0%	0.1%	-0.5%	-1.0%
60p MUP	-0.2%	1.4%	-5.1%	-16.9%

Table A11: Modelled impacts of alcohol duty reform on mortality by drinker group

	All Drinkers	Moderate	Hazardous	Harmful
Cumulative hospitalisations (2019-2038)	16,914,372	12,498,984	3,596,614	818,774
Absolute change vs. control				
Duty Reform	-3,979	15,642	-13,654	-5,968
60p MUP	-78,150	209,953	-152,175	-135,928
Relative change vs. control				
Duty Reform	-0.0%	0.1%	-0.4%	-0.7%
60p MUP	-0.5%	1.7%	-4.2%	-16.6%

Table A12: Modelled impacts of alcohol duty reform on hospital admissions by drinker group

	All Drinkers	Moderate	Hazardous	Harmful
Cumulative YLLs (2019-2038)	5,393,872	4,025,521	1,108,484	259,867
Absolute change vs. control				
Duty Reform	-1,620	5,097	-4,579	-2,137
60p MUP	-30,484	59,330	-47,615	-42,199
Relative change vs. control				
Duty Reform	-0.0%	0.1%	-0.4%	-0.8%
60p MUP	-0.6%	1.5%	-4.3%	-16.2%

Table A13: Modelled impacts of alcohol duty reform on Years of Life Lost to premature death by drinker group

	Population	Abstainer	Moderate	Hazardous	Harmful
Cumulative change in deaths over 20 years					
Immediate rebound	663	-345	-3,502	3,113	1,397
No rebound	7,924	-279	-41,190	34,210	15,183
No heavy drinker rebound	3,523	-379	-15,568	12,980	6,490
Slow heavy drinker rebound	937	-285	-4,900	4,200	1,922
Change in rates per 100,000 person-years					
Immediate rebound	1	-2	-8	17	43
No rebound	10	-2	-98	169	376
No heavy drinker rebound	4	-3	-36	67	183
Slow heavy drinker rebound	1	-2	-11	23	59

Table A14: Modelled cumulative differences in mortality over 20 years by drinker group compared to control

	Population	Abstainer	Moderate	Hazardous	Harmful
Cumulative change in Admissions over 20 years					
Immediate rebound	8,653	-271	-9,210	10,567	7,567
No rebound	91,332	109	-107,217	118,385	80,056
No heavy drinker rebound	41,389	-204	-43,203	50,323	34,473
Slow heavy drinker rebound	11,817	-203	-12,863	14,670	10,212
Change in rates per 100,000 person-years					
Immediate rebound	11	-2	-21	57	234
No rebound	112	1	-256	583	1,984
No heavy drinker rebound	51	-1	-99	261	970
Slow heavy drinker rebound	15	-1	-29	79	313

Table A15: Modelled cumulative differences in hospital admissions over 20 years by drinker group compared to control

	Population	Abstainer	Moderate	Hazardous	Harmful
Cumulative change in YLLs over 20 years					
Immediate rebound	22,122	-2,438	-56,770	49,354	31,977
No rebound	239,002	-2,660	-644,141	555,742	330,062
No heavy drinker rebound	107,906	-3,060	-276,731	239,524	148,172
Slow heavy drinker rebound	30,603	-2,054	-81,243	69,949	43,951
Change in rates per 100,000 person-years					
Immediate rebound	27	-16	-127	267	989
No rebound	294	-18	-1,537	2,738	8,178
No heavy drinker rebound	133	-20	-636	1,244	4,171
Slow heavy drinker rebound	38	-14	-183	376	1,348

Table A16: Modelled cumulative differences in mortality over 20 years by drinker group compared to control

	Population	Moderate	Hazardous	Harmful
Absolute change in weekly consumption vs. control				
(1) No uprating	0.34	0.01	0.19	1.61
(2) Continuous CPIH uprating	-0.03	0.00	0.00	0.03
(3) Stepped CPIH uprating	-0.02	0.01	0.05	0.13
(4) Future CPIH uprating	0.16	0.01	0.11	0.84
(5) Continuous earnings uprating	-0.80	-0.06	-0.39	-3.01
(6) Future earnings uprating	-0.36	-0.02	-0.14	-1.43
(7) Continuous affordability uprating	-1.04	-0.09	-0.53	-4.01
(8) Future affordability uprating	-0.53	-0.04	-0.23	-2.12
Relative change vs. control				
(1) No uprating	3.4%	0.3%	0.8%	2.7%
(2) Continuous CPIH uprating	-0.3%	0.0%	0.0%	0.1%
(3) Stepped CPIH uprating	-0.2%	0.3%	0.2%	0.2%
(4) Future CPIH uprating	1.6%	0.2%	0.4%	1.4%
(5) Continuous earnings uprating	-8.0%	-1.2%	-1.6%	-5.1%
(6) Future earnings uprating	-3.6%	-0.4%	-0.6%	-2.4%
(7) Continuous affordability uprating	-10.3%	-1.6%	-2.2%	-6.7%
(8) Future affordability uprating	-5.3%	-0.7%	-1.0%	-3.6%

Table A17: Modelled impacts of alternative approaches to uprating on alcohol consumption in 2040 by drinker group

	Population	Moderate	Hazardous	Harmful
Absolute change in weekly spending on alcohol vs. control				
(1) No uprating	£0.07	-£0.22	-£0.89	-£2.37
(2) Continuous CPIH uprating	-£0.08	-£0.04	£0.07	-£0.33
(3) Stepped CPIH uprating	-£0.11	-£0.03	£0.13	-£1.20
(4) Future CPIH uprating	£0.06	-£0.12	-£0.45	£0.41
(5) Continuous earnings uprating	-£0.58	£0.28	£1.99	£1.67
(6) Future earnings uprating	-£0.25	£0.05	£0.78	£3.63
(7) Continuous affordability uprating	-£0.58	£0.42	£2.99	£5.29
(8) Future affordability uprating	-£0.42	£0.10	£1.08	£3.35
Relative change vs. control				
(1) No uprating	0.3%	-1.1%	-1.7%	-1.9%
(2) Continuous CPIH uprating	-0.3%	-0.2%	0.1%	-0.3%
(3) Stepped CPIH uprating	-0.4%	-0.1%	0.2%	-1.0%
(4) Future CPIH uprating	0.2%	-0.6%	-0.8%	0.3%
(5) Continuous earnings uprating	-2.2%	1.4%	3.7%	1.3%
(6) Future earnings uprating	-0.9%	0.2%	1.4%	2.9%
(7) Continuous affordability uprating	-2.2%	2.1%	5.5%	4.2%
(8) Future affordability uprating	-1.6%	0.5%	2.0%	2.7%

Table A18: Modelled impacts of alternative approaches to uprating on consumer spending on alcohol in 2040 by drinker group

	Population	Moderate	Hazardous	Harmful
Cumulative difference in all-cause deaths				
(1) No uprating	1,076	-3,925	1,897	3,105
(2) Continuous CPIH uprating	-197	625	-519	-303
(3) Stepped CPIH uprating	-102	475	-632	54
(4) Future CPIH uprating	598	-2,535	1,119	2,014
(5) Continuous earnings uprating	-1,366	5,161	-3,647	-2,880
(6) Future earnings uprating	-56	4	-451	391
(7) Continuous affordability uprating	-1,848	7,440	-5,427	-3,860
(8) Future affordability uprating	-404	1,186	-1,230	-359
Cumulative difference in hospital admissions				
(1) No uprating	14,532	-18,761	9,637	23,657
(2) Continuous CPIH uprating	-1,174	3,296	-3,157	-1,313
(3) Stepped CPIH uprating	319	2,361	-3,142	1,099
(4) Future CPIH uprating	9,207	-12,071	5,851	15,427
(5) Continuous earnings uprating	-14,274	25,441	-19,389	-20,326
(6) Future earnings uprating	1,535	-122	-2,003	3,659
(7) Continuous affordability uprating	-19,771	35,940	-27,991	-27,721
(8) Future affordability uprating	-2,214	5,820	-6,093	-1,941
Cumulative difference in Years of Life Lost to premature death				
(1) No uprating	37,728	-67,062	29,547	75,243
(2) Continuous CPIH uprating	-3,526	12,135	-10,468	-5,193
(3) Stepped CPIH uprating	249	9,033	-11,160	2,376
(4) Future CPIH uprating	23,818	-42,686	17,249	49,255
(5) Continuous earnings uprating	-37,028	90,763	-62,245	-65,545
(6) Future earnings uprating	3,882	144	-7,871	11,609
(7) Continuous affordability uprating	-51,310	128,135	-90,131	-89,314
(8) Future affordability uprating	-5,769	21,531	-20,916	-6,385
Cumulative difference in NHS costs (£m)				
(1) No uprating	£17.4	-£23.7	£12.3	£28.8
(2) Continuous CPIH uprating	-£1.5	£4.2	-£3.9	-£1.8
(3) Stepped CPIH uprating	£0.3	£3.0	-£4.0	£1.2
(4) Future CPIH uprating	£10.9	-£15.3	£7.5	£18.7
(5) Continuous earnings uprating	-£17.4	£32.3	-£24.6	-£25.1
(6) Future earnings uprating	£1.7	-£0.0	-£2.6	£4.3
(7) Continuous affordability uprating	-£24.1	£45.7	-£35.6	-£34.1
(8) Future affordability uprating	-£2.8	£7.5	-£7.8	-£2.5

Table A19: Modelled cumulative impact on health outcomes over 20 years by drinker group

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