Public Health Scotland

Evaluating the impact of Minimum Unit Pricing (MUP) on sales-based alcohol consumption in Scotland at three years post-implementation

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November 2022

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0908 11/2022

www.publichealthscotland.scot

Citation

This report should be cited as:

Giles L, Mackay D, Richardson E et al. Evaluating the impact of Minimum Unit Pricing on sales-based alcohol consumption in Scotland at three years post-implementation. Edinburgh: Public Health Scotland; 2022.

Acknowledgments

The authors would like to thank the Consumption and Health Harms Expert Advisory Group for their guidance on the study design and review of the report.

Contents

Key messages

- Three full years after implementation, the impact of MUP was a net reduction of 3.0% (−4.2% to −1.8%) in the total volume of pure alcohol sold per adult in Scotland, when using a method that accounts for sales in England & Wales (best available geographical control) and after adjustment for other potentially confounding factors. This reflects a 1.1% fall in Scotland in contrast to a 2.4% increase in England & Wales.

- The reduction in total alcohol sales was driven by a 3.6% (−4.8% to −2.5%) reduction in sales of alcohol through the off-trade. We found no evidence to suggest that MUP caused any changes in per-adult sales of alcohol through the on-trade.

- The overall reduction was driven by reduced per-adult sales of cider, perry, spirits and beer through the off-trade, although this was partially offset by increased off-trade sales of fortified wine and, to a lesser extent, wine.

- Our main finding was robust to a range of different conditions as tested through sensitivity analyses. Results from the sensitivity analyses suggested a reduction in total per-adult sales of pure alcohol in the range of 3−4%, and of 4−5% in per-adult sales through the off-trade.

- Our analytical method allowed us to take account of underlying trends in the data. We included adjustment for the best available geographical control and other external factors, including disposable household income and COVID-19 associated restrictions, as well as running a range of sensitivity analyses. The methods and measures we have used provide confidence that our findings are a result of the implementation of MUP.

- We conclude that MUP has been effective in reducing alcohol consumption at the population level in the first three years of implementation.

1. Introduction

1.1. Minimum unit pricing for alcohol in Scotland

There is strong and consistent evidence to show that reducing the affordability of alcohol by increasing its price is an effective approach to reducing population levels of alcohol consumption and related harms.[1] While taxes can be used to regulate the affordability of alcohol, another mechanism is to use minimum pricing policies, setting a minimum price below which alcoholic drinks cannot be sold. Included in the Scottish Government's 2009 Framework for Action,[2] minimum unit pricing (MUP) for alcohol was introduced in Scotland on 1 May 2018, setting a floor price, currently £0.50 per unit of pure alcohol, below which alcoholic drinks could not be sold by licensed retailers.

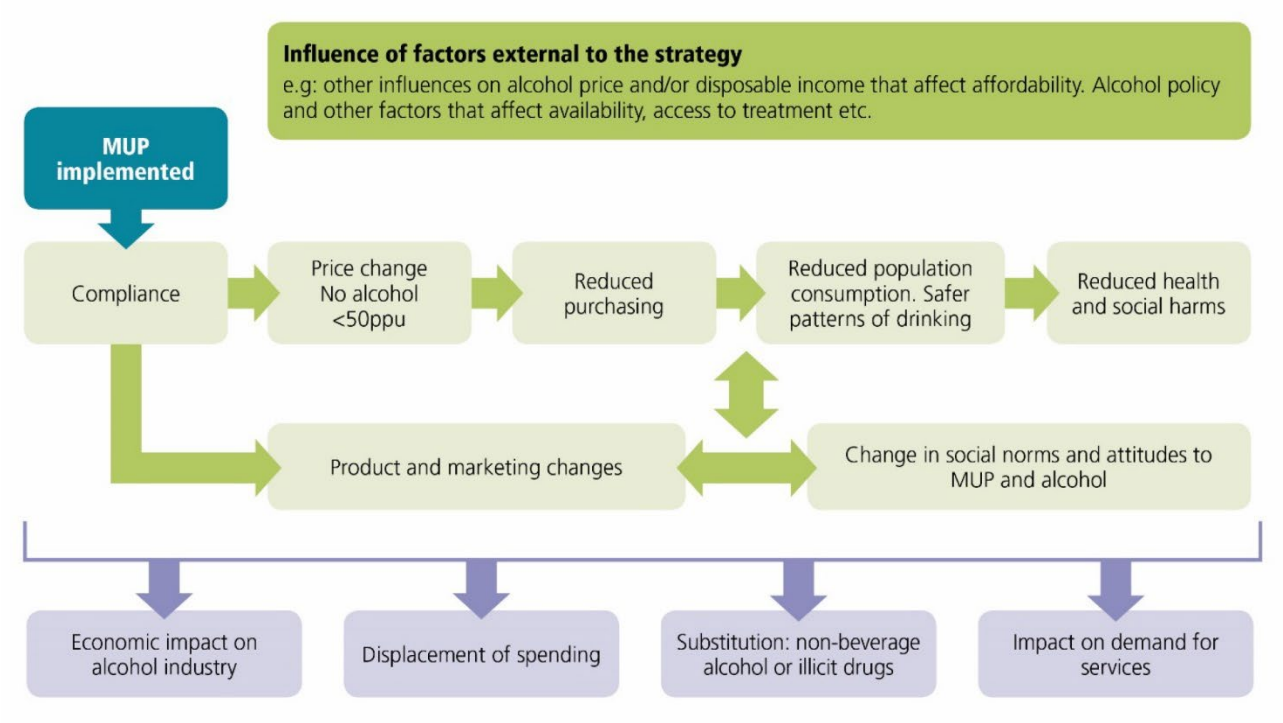
1.2. Minimum unit pricing for alcohol evaluation

The Alcohol (Minimum Pricing) (Scotland) Act 2012 (hereafter 'MUP Act') includes a sunset clause; this requires that either the legislation will expire at the end of the sixth year of implementation, or the Scottish Parliament must vote for it to continue. To help inform this decision, Public Health Scotland (formerly NHS Health Scotland) has been commissioned by the Scottish Government to lead an evaluation of the impact of MUP on a range of outcomes.[3] The evaluation is based on a theory of change (Figure 1), supported by the evidence base, suggesting that a reduction in the affordability of alcohol will reduce alcohol consumption and subsequently the health and social harms associated with alcohol use.

We have previously shown that MUP was associated with a 3.5% (95% confidence interval: 2.2% to 4.9%) net reduction of per-adult sales of pure alcohol through the off-trade after one full year of implementation.[4] The greatest net reductions were seen in spirits (-6.4% (-7.9% to -4.9%)), cider (-21.8% (-24.4% to -19.1%)) and perry (-41.9% (-44.5% to -39.3%))[4], which were also found to have the greatest increases in average price following the introduction of MUP.[5] We also found that there were increases in per-adult sales of fortified wine (9.2% (2.4% to 16.7%)) and

ready-to-drink beverages (RTDs; 15.5% (10.1% to 21.1%))[4] whose prices were less likely to be impacted by the policy.[5] This report is the final study in a package of work that uses alcohol retail sales data to examine the impact of MUP on alcohol consumption at a population level and will report the findings after three full years of implementation of the policy.

Figure 1: Theory of change for minimum unit pricing in Scotland



2. Aim and research questions

The aim of the study was to evaluate the impact of MUP on the volume of pure alcohol sold in Scotland using alcohol retail sales data.

The study addressed the following research questions:

1. What is the impact of the introduction of MUP on the volume of pure alcohol sold in Scotland?

2. What is the impact of the introduction of MUP on the volume of pure alcohol sold by off-trade retailers in Scotland?

3. What is the impact of the introduction of MUP on the volume of pure alcohol sold by on-trade retailers in Scotland?

4. To what extent did any impact of the introduction of MUP on the volume of pure alcohol sold in Scotland vary by drink type?

3. Methods

3.1. Study design

We used controlled interrupted time series methods to assess whether the introduction of MUP was associated with a change in the volume of pure alcohol sold per adult in Scotland in the three years after it was introduced, overall, by trade sector and by drink category. Our approach incorporated a number of methods to strengthen the interpretation of any detected impact of MUP, including:

- employing multiple approaches to incorporate data for England & Wales, our geographical control, into our analyses
- adjusting all statistical models for underlying seasonal and secular trends, the COVID-19 pandemic and related restrictions, and the introduction of MUP in Wales
- examining the impact of adjusting statistical models for the potential confounding effects of changes in disposable income and substitution between drink types and trade sectors
- performing a range of supplementary and sensitivity analyses, including using an alternative source of off-trade retail sales data, to test the robustness of our results to changes in the analytical approach deployed.

3.2. Outcome measures

The primary outcome measures for the study were:

- the total volume (litres, on- and off-trade combined) of pure alcohol sold per adult
- the volume (litres) of pure alcohol sold per adult in the off-trade.

A secondary outcome measure was:

- the volume (litres) of pure alcohol sold per adult in the on-trade.

3.3. Data

3.3.1. Off-trade alcohol retail sales

Off-trade alcohol sales are sales of alcohol from a premise to be consumed off the premises, such as from supermarkets and other shops.

3.3.1.1. Nielsen

Weekly off-trade alcohol sales data were obtained from market research specialists Nielsen for the period January 2013 to May 2021. Data were obtained for Scotland, England & Wales (combined), North East (NE) England and North West (NW) England. Nielsen estimates alcohol sales in Great Britain using electronic point of sales (EPOS) data from a census of large multiple retailers (retailers with 10 or more retail shops operating under common ownership, excluding the discount retailers) and from a weighted stratified random sample of smaller convenience retailers (retailers in which the consumer mainly uses the store for impulse or top-up purchases, i.e. not the main grocery shop). A detailed description of the methods used by Nielsen to produce alcohol retail sales estimates is provided in an earlier MESAS report.[6]

The natural volume* of alcohol sold (litres) was provided across eight alcoholic drink categories: spirits, wine, beer, cider, ready-to-drink beverages (RTDs), perry, fortified wine and 'other'. The volume sold in each drink category was converted into pure alcohol volume using a category-specific percentage alcohol by volume (ABV) provided by the data suppliers. The ABV used was based on the typical strength of drinks sold within subtypes of the category, except for wine where the same standard ABV was applied across all products due to the diversity of the wine market.

Alcohol sales through the discount retailers Aldi and Lidl are not included in Nielsen off-trade alcohol sales estimates. In sensitivity analyses, we adjusted for their exclusion by uplifting off-trade alcohol sales volumes using alcohol volume market share estimates for calendar years 2013 to 2021 provided by Kantar Worldpanel. Linear interpolation was used to calculate weekly alcohol market share estimates for Aldi and Lidl, by drink category, from the annualised data provided. Weekly Aldi and Lidl market share estimates were applied to weekly off-trade sales volume at drink category level. Annual alcohol market share estimates for Aldi and Lidl combined are provided in Appendix 1.

3.3.1.2. IRI

Weekly off-trade alcohol sales data were obtained from market research specialists IRI for the period January 2017 to May 2021. Data were obtained for 13 regions in England, Scotland and Wales synonymous with the Broadcasters' Audience Research Board (BARB) (Appendix 2). These are North Scotland, Central Scotland, Borders, NE England, NW England, Yorkshire, Wales, Midlands, East England, South West (SW) England, West England, London and South and South East (SE) England.

IRI estimates alcohol sales in the UK using a combination of EPOS and wholesale data. EPOS data are collected from a census of large multiple retailers (excluding the discount retailers) and some smaller convenience retailers. Where IRI is unable to

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* The natural volume is the volume of beverage rather than the volume of alcohol in the beverage, which is pure alcohol volume.

obtain census data, EPOS data are collected from a sample of retailers and modelled to represent the retailer group. IRI also uses wholesale data to supplement EPOS records from some parts of the convenience sector (namely some symbol* groups) where EPOS data are not available for all stores. Using a combination of EPOS data and wholesale shipments data for known stores within a group, IRI develops a ratio of wholesale to retail sales in those stores. The ratio can then be applied to stores where wholesale data are known but EPOS data are not, to derive a retail sales estimate for this part of the market. Finally, for some retailers where data cannot be collected, data from similar stores are modelled to represent these retailers.

The natural and pure volume (litres) of alcohol sold was provided across seven alcoholic drink categories: spirits, wine, beer, cider, flavoured alcoholic beverages (FABs; synonymous with RTDs in Nielsen data†), perry and fortified wine. IRI provided pure alcohol volume by drink category based on their own calculation using product-specific ABV data. Pure alcohol volume is calculated at product level by IRI and aggregated up to category level.

3.3.2. On-trade alcohol sales

On-trade alcohol sales are sales of alcohol to be consumed on the premises, such as those from pubs, clubs and restaurants.

On-trade alcohol sales data (litres of pure alcohol) were obtained for the period January 2013 to May 2021 from market research specialists CGA Strategy. On-trade alcohol sales estimates are based on a modelling process that uses product rate of sales derived from actual sales in distribution in a stratified sample of on-trade retailers, which is subsequently upweighted to represent total sales.[6] Data were obtained for the same drink categories and geographies as with Nielsen off-trade

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* A symbol group is a franchise of independent retailers operating under a common name, such as Spar.

† Throughout the remainder of the report, for simplicity, this category will be referred to as RTDs.

data. Linear interpolation was used to calculate weekly on-trade sales data per adult by drink category from the four-weekly data provided. Due to the impact of the COVID-19 pandemic on sales through the on-trade, there was insufficient data to perform adequate analyses for the on-trade beyond March 2020; the time series for on-trade models was therefore truncated to the end of February 2020.

3.3.3. Mid-year population estimates

Per-adult alcohol sales were calculated by dividing pure alcohol volume (litres of pure alcohol) by the total population aged 16 years and over. Mid-year population estimates and projections for Scotland were obtained from National Records of Scotland[7] and for England & Wales from the Office for National Statistics[8]. The NE and NW England regions used in this study were defined by the data providers based on postcode sectors and are not the same as official Government Office Regions. Population estimates for the local authorities containing the postcode sectors provided were aggregated to give estimates for the NE and NW England regions. Weekly population estimates were interpolated linearly from the mid-year estimates.

To calculate alcohol sales per adult drinker (for use in one of our specified sensitivity analyses), the total population was adjusted to account for the proportion reporting non-drinking in the Scottish Health Survey[9] or the Health Survey for England[10], as appropriate. The prevalence of non-drinking in Wales was assumed to be the same as in England, as a reliable estimate over time could not be obtained from the Welsh Health Survey or National Survey for Wales. The prevalence of non-drinking in 2020 was assumed to be the same as in 2019, as the Health Survey for England had not been published at the time of the analysis, and the 2020 Scottish Health Survey data were not comparable with previous years due to methodological issues associated with the COVID-19 pandemic.

3.3.4. Disposable household income

Quarterly gross disposable household income (GDHI) data were obtained for Scotland[11] and the United Kingdom[12] and expressed per adult aged 16 years and over. As equivalent quarterly data were not available for England & Wales combined, a proxy measure was created by estimating the contribution of England & Wales from

annual GDHI data[13] and applying that proportion to the UK quarterly GDHI data. Weekly GDHI estimates were interpolated linearly from the quarterly data.

3.3.5. Oxford COVID-19 Government Response Tracker

Physical distancing measures, including the closure of on-trade premises, were introduced in the UK in March 2020 in response to the evolving COVID-19 pandemic, and continued throughout the remainder of the study period. In order to account for the impact these measures had on alcohol sales through the on- and off-trade sectors,[14,15] we incorporated data on the level of those restrictions into our models. The Oxford COVID-19 Government Response Tracker (OxCGRT) provides a systematic way of tracking government responses to the COVID-19 pandemic across countries and over time.[16] A total of 23 indicators across five policy areas were collected and used to produce four different indices. Daily data for each of the UK devolved governments were available from January 2020 through to the end of the study period. We obtained data on the stringency index, as this focused primarily on indicators related to containment of the virus and closure of businesses and services (Appendix 3). We calculated the mean weekly value from the daily data for Scotland and England & Wales. We produced a single population-weighted average weekly value for England & Wales combined from separate indices for England and Wales.

3.4. Study period

We included on- and off-trade alcohol sales data from January 2013 to May 2021. This provided us with data for over five years before, and three years after, the implementation of MUP.

For analyses of on-trade sales, the post-intervention time period was truncated at 22 months (February 2020) due to the lack of sales through the on-trade following restrictions imposed in response to the COVID-19 pandemic. For some sensitivity analyses the study period differed. The sensitivity analysis using an alternative source of off-trade retail sales data had a shorter pre-intervention time period due to the availability of IRI data. Results using Nielsen data for the same time period were run to enable direct comparison.

3.5. Descriptive analysis

The volume of pure alcohol sold per adult per week was calculated for Scotland and England & Wales as already described and plotted for both total (on- and off-trade combined) and off-trade sales. The overall trend for both outcomes was further decomposed to differentiate the seasonal component from the underlying trend. This was repeated for each drink category. The relative market share of each drink category both pre- and post-intervention was calculated.

3.6. Statistical methods

We used controlled interrupted time series regression with seasonal autoregressive integrated moving average (SARIMA) errors as our main statistical method to assess the impact of MUP on alcohol sales in Scotland. This enabled us to identify underlying trends in data and whether those trends changed in Scotland compared to England & Wales following the introduction of MUP. Our analytical strategy consisted of initially modelling the alcohol sales data time series to obtain an adequate preliminary model and then modelling and testing the effect of the intervention with and without adjustment for covariates. This approach is based on that used in our earlier work[4,17] and is in line with guidance produced by Beard et al[18].

A full description of our statistical methods is provided in Appendix 4.

3.6.1. Comparison with a geographical control

In line with Lopez-Bernal et al's[19] guidance, we used a two-step approach of incorporating the geographical control time series in the analysis. First, we fitted separate models to the intervention and control series to assess if there was a change in the level or slope (underlying upward or downward trend in sales) of the intervention series (Scotland data) that was not seen in the control series (England & Wales data). Second, we entered the geographical control time series data as a covariate in the SARIMA models for Scotland to produce a 'controlled' model.

3.6.2. Adjusting the model for covariates

Models were fitted to alcohol sales data with and without estimated adjustment for covariates that could plausibly explain part of any identified relationship between MUP and alcohol sales. We included data for the following covariates in adjusted models:

- Disposable household income
- On-trade alcohol sales (Scotland only)
- Sales of other alcoholic drink categories (in models of specific drink categories for Scotland only)

All models included adjustment for the impact of the COVID-19 pandemic and related restrictions and, in controlled models, for the introduction of MUP in Wales.

3.6.3. Supplementary and sensitivity analyses

We performed a number of additional analyses to test the robustness of our results. These additional analyses were carried out for the primary outcome measures (total (on- and off-trade combined) and off-trade sales) only. The analyses were performed for all alcohol sales and by drink category in both unadjusted and adjusted models for Scotland, unless specified otherwise.

- We re-ran our fully controlled and adjusted Scottish off-trade model without adjustment for on-trade sales as this was potentially a source of over-adjustment, as on-trade and off-trade sales may affect each other.
- We repeated our analyses using a shorter post-intervention time series to eliminate the potential effect of both changes in on- and off-trade alcohol sales due to the introduction of restrictions associated with the COVID-19 pandemic and the introduction of MUP in Wales, part of the geographical control area, on 1 March 2020. The post-intervention time series was truncated at the last week of February 2020, providing 22 months of post-MUP outcome data.

- We repeated our analyses using the difference between Scotland and England & Wales (Scotland minus England & Wales) at each time point as the outcome time series.

- We assessed the impact of applying volume market share uplift factors to off-trade alcohol sales data to account for not having data on sales by Aldi and Lidl.

- We repeated our analyses expressing alcohol sales per adult drinker as the outcome measure, instead of per adult (i.e. excluding non-drinkers from the denominator).

- It has been suggested that Northern England is a more appropriate control group for Scotland than England & Wales due to a more similar socio-demographic make-up and alcohol culture.[20] We therefore repeated our analyses using NW and NE England as geographical controls. This was performed using separate unadjusted models for each region and in an adjusted, controlled model that incorporated the region as a covariate in the model for Scotland. This was not performed by drink category.

- We assessed the impact of using a different source of off-trade alcohol retail sales data. Specifically, we obtained off-trade alcohol retail sales from market research company IRI and repeated our analyses of both off-trade and total alcohol sales. The pre-intervention time series began in January 2017 due to the availability of IRI data. Results using Nielsen data were reproduced using the same pre-intervention time period for comparability.

- We repeated our analyses using two different false intervention dates in order to test the plausibility of attributing any effect to the intervention. We moved the intervention to both six months before and six months after the true intervention date. Not finding an effect in these models would make it more likely that any effect observed in the models with the correct intervention date are due to MUP. This was not performed by drink category.

- We assessed the impact of MUP on off-trade alcohol sales using an alternative analytical approach. Specifically, we used an Unobserved Components Model

(UCM), a form of structural time series method, across the entire outcome series. UCM presents an alternative to SARIMA as it does not assume the data are 'stationary' (i.e. that statistical properties of the data series, such as the mean and variance, are constant over time)[21]. In addition, model output is typically presented as a series of plots of the trend, seasonal and cyclical components making the analysis easier to comprehend compared to the regression output format of a SARIMA model. This was performed in unadjusted models for Scotland and England & Wales, and was not performed by drink category.

- We also tested whether MUP had an impact on the variability in weekly alcohol sales. In other words, did MUP affect the frequency and magnitude of peaks and troughs in the data series after it was introduced compared with the pre-intervention period? This was performed in an adjusted model for Scotland and was not performed by drink category.

3.6.4. Reporting and presentation of results

In the main report, we graphically present the estimated impact of MUP from our primary analyses based on:

1. separate unadjusted, uncontrolled models for Scotland and England & Wales
2. unadjusted, controlled models (in which the England & Wales series is incorporated in the model for Scotland)
3. adjusted, controlled models (as above but also including as covariates trends in household disposable income, on-trade sales and, for analyses of specific drink categories, off-trade alcohol sales of other drink categories).

To allow visual presentation of results on a consistent scale of model estimates of the impact of MUP (displayed as percentage changes), we present separate figures for the following groups of drink categories:

- all alcohol, wine, spirits and beer
- cider, perry, fortified wine and RTDs.

We provide an indication of uncertainty around our estimates of the impact of MUP using 95% confidence intervals. Where the confidence interval crosses zero this indicates a greater degree of uncertainty in the observed effect estimate. Reporting this uncertainty is in line with STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidance[22] and the guidelines produced by Beard et al (2019)[18] for using time series analyses in addiction research. We report results from both uncontrolled and controlled analyses as recommended by Lopez-Bernal et al.[19] Throughout the report we refer to the fully adjusted and controlled model as our main model; this is the model on which our primary findings are based.

3.6.5. Changes to our published protocol

We published our pre-planned methodological approach and detailed analysis plan in our study protocol[23] and statistical analysis plan[24] respectively. We made the following changes to the sensitivity analyses pre-specified in our statistical analysis plan. We did not carry out a sensitivity analysis with balanced pre- and post-intervention data points as this would have reduced our total number of pre-intervention time points and subsequently reduced statistical power. We limited our falsification of the intervention dates to six months pre- and post-intervention, rather than three and six months pre- and post-intervention as specified.

In addition, we added sensitivity analyses with a shorter post-intervention period (to exclude the impact of COVID-19 restrictions and MUP in Wales), using an alternative source of retail sales data and re-running our main model without including adjustment for Scottish on-trade sales.

4. Results

4.1. Descriptive trends

Descriptive trends for all alcohol (total and off-trade) are presented here. Time series charts by drink category are presented in Appendix 5.

The volume of pure alcohol sold per adult both in total (on- and off-trade combined) (Figure 2a) and through the off-trade (Figure 3a) remained relatively stable in both Scotland and England & Wales throughout the pre-intervention time period. Per-adult sales were consistently higher in Scotland than in England & Wales with the difference between the two remaining broadly consistent throughout the pre-intervention period. Following the implementation of MUP in May 2018, and throughout the remainder of the time series, a decline in total alcohol sales was observed and the gap between the time series for Scotland and England & Wales narrows over the same period (Figure 2a). In the off-trade, a decline in per-adult sales in Scotland and a narrowing of the gap with England & Wales was observed following the implementation of MUP and up to early 2020 (Figure 3a). From early 2020 onwards, off-trade sales in both Scotland and England & Wales increased, associated with the onset of the COVID-19 pandemic and indicating a shift towards consumption of alcohol sold through the off-trade as a result of restrictions to the on-trade. The difference between the level of per-adult off-trade sales in Scotland and England & Wales remained smaller than that observed in the pre-intervention period (Figure 3a).

Seasonality was clear in both Scotland and in England & Wales (Figures 2b and 3b), with the most notable peaks being seen in the fortnight over Christmas and New Year each year, and smaller peaks associated with public holidays and weekends throughout the year, particularly over the summer. Similarly, a substantial drop in sales can be observed in January of each year. The contribution of seasonality to the overall time series was relatively stable throughout the full study period.

There was an overall downward trend in total sales in Scotland (Figure 2c) over the whole study period, which appeared more pronounced both in the period from May

2018 to April 2020, after the implementation of MUP, and again between April 2020 and April 2021 during the COVID-19 pandemic. While a downward trend was observed in England & Wales over the whole time series (Figure 2c), the trend was relatively flat between January 2013 and the summer of 2019. At this point a decline in total sales was discernible and appeared to accelerate around the time of the COVID-19 pandemic and associated restrictions.

For off-trade sales the pattern was somewhat different (Figure 3c). In Scotland the trend was relatively flat between January 2013 and May 2018. Following the implementation of MUP in May 2018 a decline in per-adult sales of alcohol through the off-trade was discernible. This was followed by a relatively sharp incline in off-trade sales associated with the onset of the COVID-19 pandemic, indicating a shift towards consumption of alcohol sold through the off-trade as a result of restrictions to the on-trade. In England & Wales the trend in per-adult off-trade sales was relatively flat throughout the majority of the time series, with the exception of the increase observed from early 2020 onwards, associated with the onset of the COVID-19 pandemic.

Sales of alcohol are not evenly distributed across the seven categories examined in this report. Sales of beer, wine and spirits make up the majority of total sales collectively contributing approximately 90% of total sales in both Scotland and England & Wales (Tables 1 and 2, respectively). Beer is the most popular category in England & Wales (Table 2) and typically per-adult sales are greater than in Scotland, while sales of spirits are greater in Scotland (Table 1). Prior to the implementation of MUP, cider sales were generally around 7–8% in both areas, but this has fallen in Scotland in the years following (Table 1). Fortified wine, RTDs and perry make up the remainder, typically around 3–4% of total per-adult sales of pure alcohol (Table 1).

Figure 2: Total volume of pure alcohol sold (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

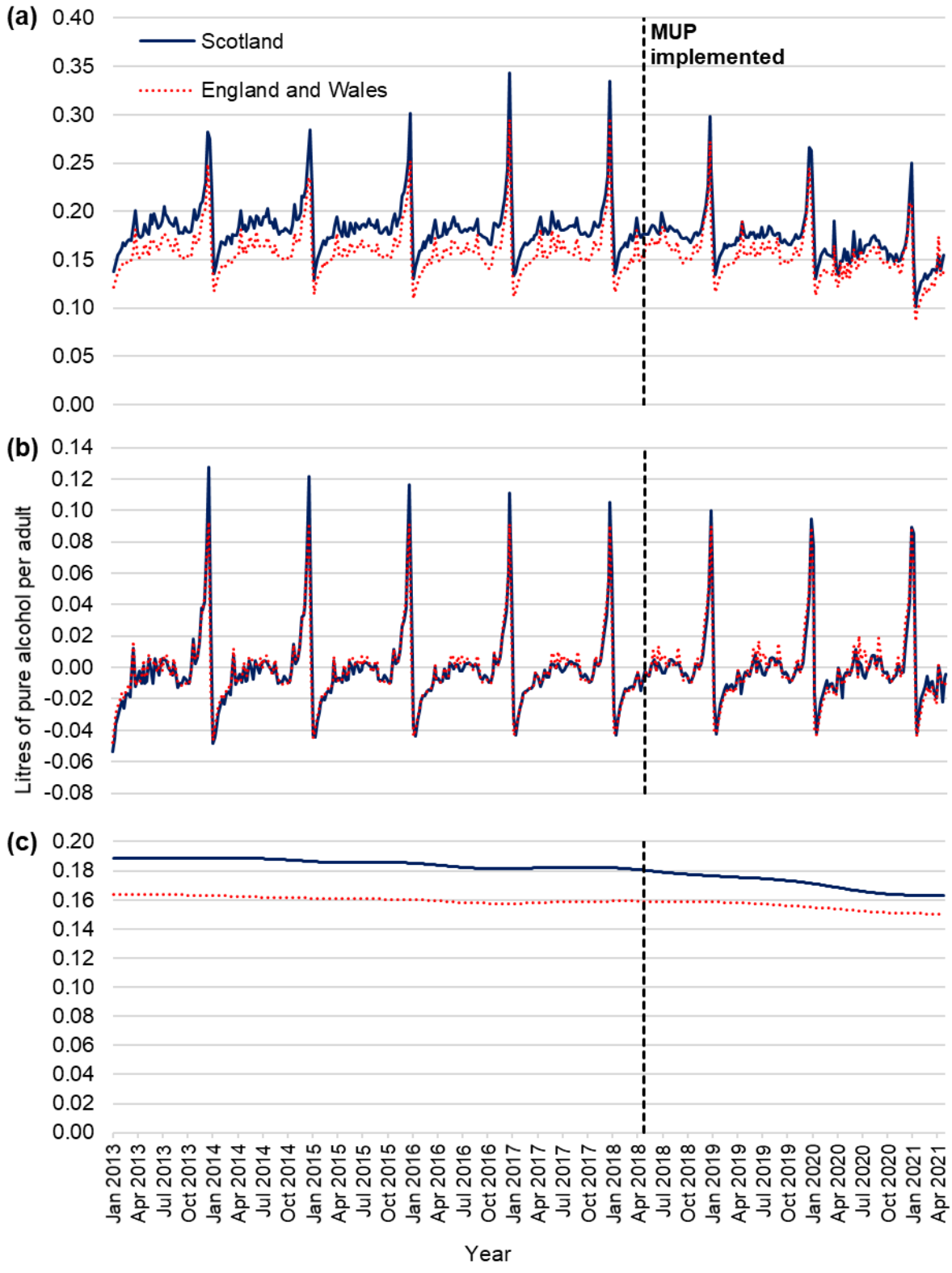


Figure 3: Volume of pure alcohol sold through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

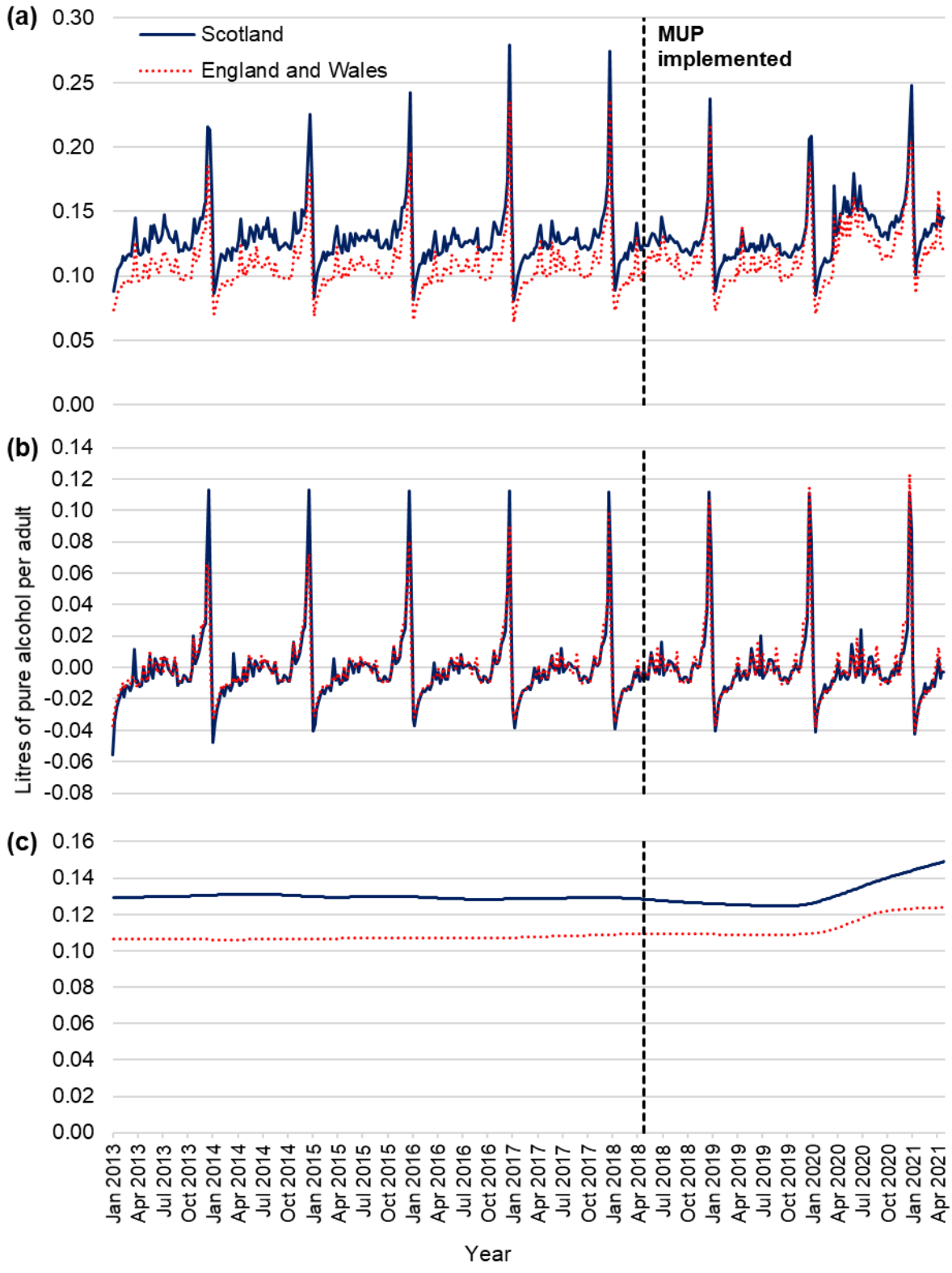


Table 1: Total volume of pure alcohol sold (on- and off-trade combined) in Scotland, litres per adult (percentage of total sales), annual, May 2013 to April 2021

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
All	9.79	9.73	9.64	9.51	9.56	9.35	8.99	8.06
Beer	3.12 (31.8%)	3.13 (32.2%)	3.08 (31.9%)	3.06 (32.1%)	3.07 (32.1%)	3.05 (32.6%)	2.86 (31.8%)	2.19 (27.1%)
Spirits	2.84 (29.0%)	2.82 (29.0%)	2.81 (29.1%)	2.76 (29.0%)	2.78 (29.1%)	2.74 (29.3%)	2.68 (29.8%)	2.56 (31.7%)
Wine	2.80 (28.6%)	2.76 (28.4%)	2.72 (28.2%)	2.66 (28.0%)	2.61 (27.3%)	2.52 (27.0%)	2.48 (27.5%)	2.42 (30%)
Cider	0.71 (7.3%)	0.71 (7.3%)	0.70 (7.2%)	0.71 (7.4%)	0.73 (7.7%)	0.63 (6.7%)	0.58 (6.4%)	0.48 (6.0%)
FW	0.17 (1.7%)	0.17 (1.7%)	0.19 (2.0%)	0.19 (2.0%)	0.21 (2.2%)	0.27 (2.9%)	0.26 (2.9%)	0.25 (3.2%)
RTD	0.10 (1.0%)	0.10 (1.0%)	0.09 (1.0%)	0.09 (0.9%)	0.10 (1.0%)	0.10 (1.1%)	0.11 (1.2%)	0.12 (1.6%)
Perry	0.04 (0.5%)	0.04 (0.4%)	0.04 (0.4%)	0.04 (0.5%)	0.04 (0.4%)	0.02 (0.3%)	0.02 (0.2%)	0.02 (0.2%)

Note: FW = Fortified wine. RTD = ready-to-drink beverages. Each year runs from May to April inclusive.

Table 2: Total volume of pure alcohol sold (on- and off-trade combined) in England & Wales, litres per adult (percentage of total sales), annual, May 2013 to April 2021

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
All	8.48	8.42	8.32	8.27	8.31	8.42	8.06	7.44
Beer	3.29 (38.7%)	3.27 (38.9%)	3.21 (38.6%)	3.17 (38.3%)	3.16 (38.1%)	3.27 (38.8%)	3.07 (38.1%)	2.47 (33.2%)
Spirits	1.70 (20.1%)	1.71 (20.3%)	1.74 (20.9%)	1.76 (21.3%)	1.83 (22%)	1.90 (22.6%)	1.88 (23.4%)	1.90 (25.5%)
Wine	2.52 (29.7%)	2.50 (29.7%)	2.47 (29.7%)	2.44 (29.5%)	2.42 (29.1%)	2.31 (27.4%)	2.24 (27.9%)	2.30 (30.9%)
Cider	0.72 (8.4%)	0.71 (8.4%)	0.69 (8.2%)	0.69 (8.3%)	0.69 (8.4%)	0.72 (8.6%)	0.65 (8.1%)	0.56 (7.6%)
FW	0.12 (1.4%)	0.11 (1.3%)	0.10 (1.2%)	0.10 (1.2%)	0.09 (1%)	0.08 (1%)	0.08 (1.0%)	0.09 (1.2%)
RTD	0.07 (0.8%)	0.06 (0.8%)	0.06 (0.7%)	0.06 (0.7%)	0.06 (0.7%)	0.06 (0.8%)	0.07 (0.8%)	0.07 (0.9%)
Perry	0.06 (0.7%)	0.05 (0.6%)	0.05 (0.6%)	0.05 (0.6%)	0.05 (0.5%)	0.05 (0.5%)	0.04 (0.5%)	0.03 (0.5%)

Note: FW = Fortified wine. RTD = ready-to-drink beverages. Each year runs from May to April inclusive.

Table 3: Volume of pure alcohol sold through the off-trade in Scotland, litres per adult (percentage of off-trade sales), annual, May 2013 to April 2021

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
All	6.79	6.79	6.74	6.69	6.74	6.60	6.59	7.61
Beer	1.56 (23.0%)	1.59 (23.4%)	1.57 (23.3%)	1.57 (23.5%)	1.57 (23.3%)	1.59 (24.0%)	1.59 (24.2%)	1.95 (25.6%)
Spirits	2.21 (32.5%)	2.22 (32.7%)	2.22 (32.9%)	2.19 (32.7%)	2.20 (32.7%)	2.14 (32.5%)	2.14 (32.5%)	2.46 (32.3%)
Wine	2.22 (32.7%)	2.19 (32.2%)	2.16 (32.0%)	2.13 (31.9%)	2.12 (31.5%)	2.07 (31.3%)	2.08 (31.6%)	2.35 (30.8%)
Cider	0.52 (7.6%)	0.52 (7.6%)	0.49 (7.3%)	0.50 (7.5%)	0.52 (7.7%)	0.42 (6.3%)	0.39 (6.0%)	0.45 (5.9%)
FW	0.17 (2.5%)	0.16 (2.4%)	0.19 (2.8%)	0.19 (2.8%)	0.21 (3.1%)	0.26 (4.0%)	0.26 (3.9%)	0.25 (3.3%)
RTD	0.07 (1.0%)	0.07 (1.0%)	0.06 (0.9%)	0.06 (0.9%)	0.07 (1.0%)	0.08 (1.2%)	0.09 (1.4%)	0.12 (1.6%)
Perry	0.04 (0.7%)	0.04 (0.6%)	0.04 (0.6%)	0.04 (0.6%)	0.04 (0.6%)	0.02 (0.4%)	0.02 (0.3%)	0.02 (0.2%)

Note: FW = Fortified wine. RTD = ready-to-drink beverages. Each year runs from May to April inclusive.

Table 4: Volume of pure alcohol sold through the off-trade in England & Wales, litres per adult (percentage of off-trade sales), annual, May 2013 to April 2021

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
All	5.57	5.58	5.55	5.59	5.63	5.76	5.77	6.82
Beer	1.5 (27%)	1.53 (27.4%)	1.52 (27.4%)	1.54 (27.5%)	1.54 (27.3%)	1.64 (28.4%)	1.66 (28.8%)	2.08 (30.4%)
Spirits	1.33 (23.8%)	1.35 (24.2%)	1.37 (24.7%)	1.40 (25.0%)	1.45 (25.8%)	1.52 (26.4%)	1.54 (26.7%)	1.81 (26.5%)
Wine	2.06 (37.0%)	2.05 (36.7%)	2.03 (36.6%)	2.02 (36.2%)	2.02 (35.9%)	1.95 (33.8%)	1.94 (33.6%)	2.22 (32.6%)
Cider	0.46 (8.3%)	0.45 (8.1%)	0.43 (7.7%)	0.43 (7.7%)	0.43 (7.7%)	0.46 (8.0%)	0.43 (7.5%)	0.50 (7.4%)
FW	0.11 (2.0%)	0.10 (1.9%)	0.10 (1.8%)	0.09 (1.6%)	0.08 (1.5%)	0.08 (1.4%)	0.08 (1.3%)	0.09 (1.3%)
RTD	0.04 (0.8%)	0.04 (0.7%)	0.04 (0.7%)	0.04 (0.7%)	0.04 (0.7%)	0.05 (0.9%)	0.05 (0.9%)	0.07 (1.0%)
Perry	0.05 (0.9%)	0.05 (0.9%)	0.05 (0.8%)	0.05 (0.8%)	0.04 (0.8%)	0.05 (0.8%)	0.04 (0.7%)	0.03 (0.5%)

Note: FW = Fortified wine. RTD = ready-to-drink beverages. Each year runs from May to April inclusive.

Table 5: Volume of pure alcohol sold through the on-trade in Scotland, litres per adult (percentage of on-trade sales), annual, May 2013 to April 2021

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
All	3.00	2.94	2.91	2.82	2.82	2.75	2.40	0.45
Beer	1.55 (51.9%)	1.54 (52.3%)	1.51 (52.0%)	1.49 (52.6%)	1.50 (53.3%)	1.46 (53.2%)	1.27 (52.9%)	0.24 (53.8%)
Spirits	0.63 (21.1%)	0.60 (20.4%)	0.59 (20.4%)	0.57 (20.2%)	0.58 (20.5%)	0.60 (21.7%)	0.53 (22.2%)	0.09 (21.2%)
Wine	0.57 (19.2%)	0.57 (19.6%)	0.56 (19.4%)	0.53 (18.7%)	0.49 (17.4%)	0.46 (16.6%)	0.39 (16.4%)	0.08 (16.9%)
Cider	0.20 (6.6%)	0.19 (6.5%)	0.20 (7.0%)	0.21 (7.3%)	0.22 (7.6%)	0.21 (7.6%)	0.18 (7.5%)	0.03 (7.4%)
FW	<0.01 (0.1%)	<0.01 (0.2%)	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (0.1%)
RTD	0.03 (1.0%)	0.03 (1.1%)	0.03 (1.1%)	0.03 (1.0%)	0.03 (1.0%)	0.02 (0.7%)	0.02 (0.8%)	<0.01 (0.6%)
Perry	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)

Note: FW = Fortified wine. RTD = ready-to-drink beverages. Each year runs from May to April inclusive.

Table 6: Volume of pure alcohol sold through the on-trade in England & Wales, litres per adult (percentage of off-trade sales), annual, May 2013 to April 2021

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
All	2.91	2.83	2.77	2.68	2.68	2.66	2.29	0.62
Beer	1.78 (61.3%)	1.74 (61.4%)	1.69 (60.9%)	1.63 (60.7%)	1.63 (60.8%)	1.63 (61.3%)	1.40 (61.5%)	0.39 (63.4%)
Spirits	0.37 (12.9%)	0.36 (12.8%)	0.37 (13.2%)	0.36 (13.5%)	0.37 (14.0%)	0.39 (14.5%)	0.34 (15.0%)	0.09 (14.2%)
Wine	0.46 (15.8%)	0.45 (15.8%)	0.44 (15.8%)	0.41 (15.4%)	0.40 (14.8%)	0.36 (13.6%)	0.30 (13.3%)	0.08 (12.4%)
Cider	0.25 (8.8%)	0.25 (9.0%)	0.26 (9.3%)	0.26 (9.6%)	0.26 (9.7%)	0.26 (9.9%)	0.22 (9.6%)	0.06 (9.6%)
FW	<0.01 (0.2%)	<0.01 (0.2%)	<0.01 (0.1%)	<0.01 (0.2%)	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (0.1%)
RTD	0.03 (1.0%)	0.02 (0.8%)	0.02 (0.7%)	0.02 (0.7%)	0.02 (0.6%)	0.02 (0.6%)	0.01 (0.6%)	<0.01 (0.3%)
Perry	<0.01 (0.1%)	<0.01 (0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)	<0.01 (<0.1%)

Note: FW = Fortified wine. RTD = ready-to-drink beverages. Each year runs from May to April inclusive.

4.2. Interrupted time series

A summary of the results from the main models for total (on- and off-trade combined) and off-trade alcohol sales, for all alcohol and drink category, is presented first. The pre-specified main model is the Scottish model that incorporates sales data for England & Wales as a geographical control, and adjusts for household disposable income, on-trade sales and, for analyses of specific drink categories, off-trade alcohol sales of other drink categories. The results from these models form the basis of our conclusions about the impact of MUP.

Following the summary, the results for all models (Scotland (uncontrolled, unadjusted), England & Wales (uncontrolled, unadjusted), Scotland (controlled, unadjusted) and Scotland (controlled, adjusted)) are presented in sequential order for each type of sales (total, off-trade and on-trade) and for all alcohol and by drink category. This is in line with recommended best practice.[19]

4.2.1. Summary of main results

The findings below summarise the results from the main Scottish model (controlled and adjusted) for total (on- and off-trade combined) and off-trade alcohol sales, for all alcohol and by drink category.

In the first three years of implementation, MUP was associated with:

- a **net reduction** of 3.0% (95% confidence interval (CI): −4.2% to −1.8%) in the volume of pure alcohol sold in Scotland, and a **net reduction** of 3.6% (−4.8% to −2.5%) in the volume of pure alcohol sold through the off-trade

- a **net reduction** of 2.3% (−3.9% to −0.7%) in the volume of pure alcohol sold as beer in Scotland, and a **net reduction** of 1.6% (−3.7% to 0.5%) in the volume of pure alcohol sold as beer through the off-trade

- a **net reduction** of 4.9% (−6.6% to −3.1%) in the volume of pure alcohol sold as spirits in Scotland, and a **net reduction** of 5.5% (−7.5% to −3.4%) in the volume of pure alcohol sold as spirits through the off-trade

- **no change** (0.6% (−0.6% to 1.7%) in the volume of pure alcohol sold as wine in Scotland, and a **net increase** of 1.8% (0.8% to 2.8%) in the volume of pure alcohol sold as wine through the off-trade

- a **net reduction** of 13.5% (−16.9% to −10.0%) in the volume of pure alcohol sold as cider in Scotland, and a **net reduction** of 21.5% (-24.6% to -18.3%) in the volume of pure alcohol sold as cider through the off-trade

- a **net increase** of 13.5% (7.5% to 19.8%) in the volume of pure alcohol sold as fortified wine in Scotland, and a **net increase** of 13.8% (8.7% to 19.3%) in the volume of pure alcohol sold as fortified wine through the off-trade

- **no change** (−0.5% (−6.9% to 6.3%) in the volume of pure alcohol sold as ready-to-drink beverages in Scotland, and a **net increase** of 3.6% (−3.4% to 11.1%) in the volume of pure alcohol sold as ready-to-drink beverages through the off-trade

- a **net reduction** of 31.6% (−38.4% to −24.1%) in the volume of pure alcohol sold as perry in Scotland, and a **net reduction** of 31.3% (−37.7% to −24.2%) in the volume of pure alcohol sold as perry through the off-trade.

4.2.2. Total (on- and off-trade combined) alcohol sales

The results for all models are presented here and in Figure 4 (all alcohol, beer, spirits and wine), Figure 5 (cider, fortified wine, RTDs and perry) and in Tables A1 to A4 in Appendix 6.

4.2.2.1. All alcohol

In uncontrolled analysis, the volume of pure alcohol sold per adult in Scotland fell by 1.1% (−2.9% to 0.8%) in the three-year period after the implementation of MUP. In England & Wales, there was a 2.4% (−0.0% to 4.9%) increase in per-adult sales over the same time period. When controlling for alcohol sales in England & Wales, MUP implementation was associated with a 2.9% (−4.0% to −1.9%) net reduction in Scotland. When both controlling for alcohol sales in England & Wales, and adjusting

for potential confounders, we found MUP implementation to be associated with a 3.0% (−4.2% to −1.8%) net reduction in total per-adult alcohol sales in Scotland.

4.2.2.2. Beer

In uncontrolled analysis, there was little evidence to suggest any change (0.3% (−3.5% to 4.2%)) in the volume of pure alcohol sold per adult as beer in Scotland in the three-year period following the implementation of MUP. In England & Wales, there was a 5.6% (0.8% to 10.5%) increase in total per-adult beer sales over the same time period. In the controlled, unadjusted model, MUP was associated with a 3.0% (−4.4% to −1.7%) net reduction in per-adult beer sales in Scotland. When both controlling for alcohol sales in England & Wales, and adjusting for potential confounders, we found MUP implementation to be associated with a 2.3% (−3.9% to −0.7%) net reduction in per-adult sales of beer in Scotland.

4.2.2.3. Spirits

In uncontrolled analysis, there was little evidence to suggest any change (−0.7% (−3.0% to 1.6%)) in the volume of pure alcohol sold per adult as spirits in Scotland following the implementation of MUP. In England & Wales, there was a 3.1% (−0.7% to 7.1%) increase in total per-adult spirits sales over the same time period. In the controlled, unadjusted model, MUP was associated with a 4.8% (−6.5% to −3.2%) net reduction in per-adult spirits sales in Scotland. In the fully controlled and adjusted model a net reduction of 4.9% (−6.6% to −3.1%) in per-adult sales of spirits was associated with the implementation of MUP in Scotland.

4.2.2.4. Wine

In uncontrolled analysis, the total volume of pure alcohol sold per adult in Scotland as wine fell by 1.5% (−3.0% to −0.0%) in the three-year period following the implementation of MUP. In England & Wales, there was a 3.4% (−5.0% to −1.7%) reduction over the same time period. There was little evidence that the implementation of MUP was associated with any net change in per-adult sales of wine in Scotland either when controlling for wine sales in England & Wales (0.2% (−0.6% to 1.1%)) or with the further adjustment for potential confounders (0.6% (−0.6% to 1.7%)).

4.2.2.5. Cider

In uncontrolled analysis, the total volume of pure alcohol sold per adult in Scotland as cider fell by 6.5% (−13.2% to 0.8%) in the three-year period following the implementation of MUP. In England & Wales, there was an 11.7% (6.2% to 17.6%) increase over the same time period. In the controlled, unadjusted model, the implementation of MUP was associated with a 15.0% (−18.5% to −11.3%) net reduction in per-adult cider sales in Scotland. In the fully controlled and adjusted model a net reduction of 13.5% (−16.9% to −10.0%) in per-adult sales of cider was associated with the implementation of MUP in Scotland.

4.2.2.6. Fortified wine

In uncontrolled analysis, the total volume of pure alcohol sold per adult in Scotland as fortified wine increased by 15.1% (7.0% to 23.8%) in the three-year period following the implementation of MUP. In England & Wales, there was little evidence of any change (−2.1% (−9.2% to 5.5%)) in per-adult sales of fortified wine over the same time period. In the controlled, unadjusted model, MUP was associated with a 15.3% (9.8% to 21.2%) net increase in per-adult sales of fortified wine in Scotland. In the fully controlled and adjusted model, MUP was associated with a 13.5% (7.5% to 19.8%) net increase in per-adult sales of fortified wine in Scotland.

4.2.2.7. Ready-to-drink beverages (RTDs)

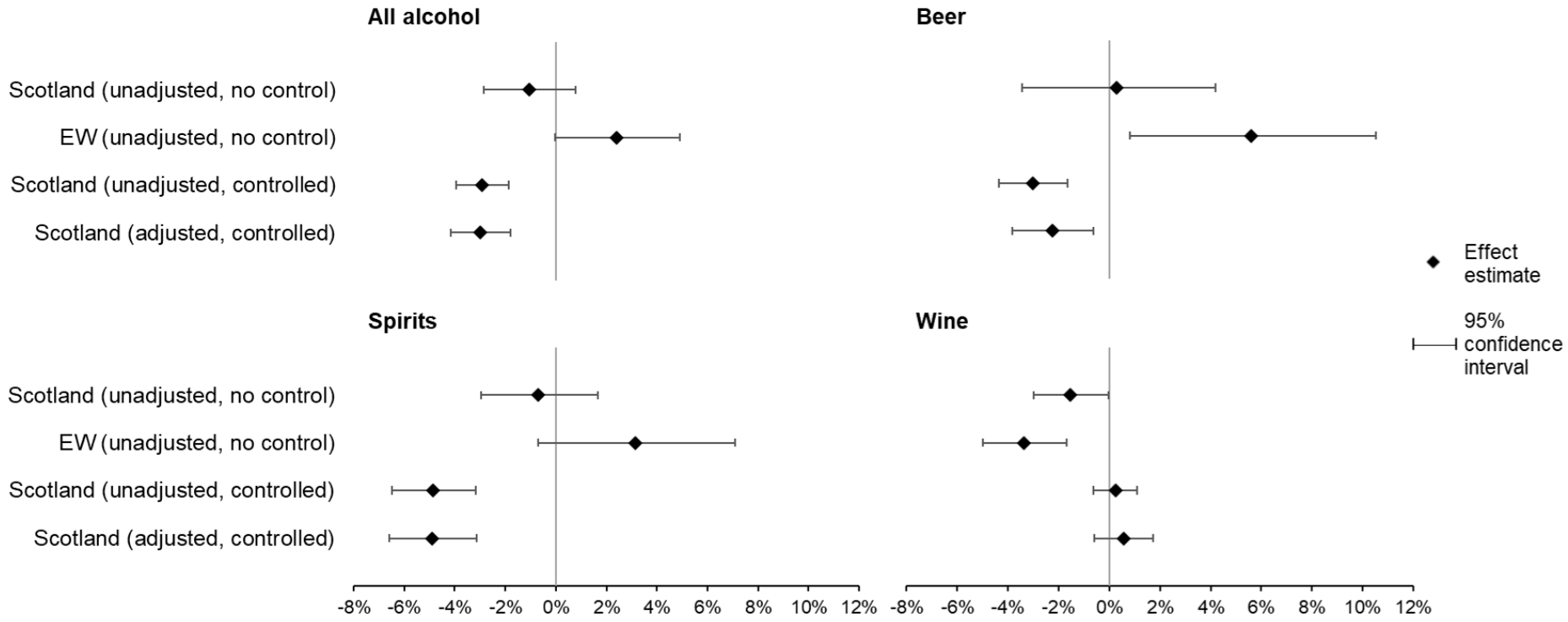
In uncontrolled analysis, the total volume of pure alcohol sold per adult in Scotland as RTDs increased by 11.0% (−0.7% to 24.0%) in the three-year period following the implementation of MUP. In England & Wales, a similar increase (9.7% (0.6% to 19.7%)) was observed over the same time period. There was little evidence that the implementation of MUP was associated with any net change in per-adult sales of RTDs in Scotland either when controlling for RTD sales in England & Wales (−2.8% (−9.2% to 4.2%) or with the further adjustment for potential confounders (−0.5% (−6.9% to 6.3%)).

4.2.2.8. Perry

In uncontrolled analysis, the total volume of pure alcohol sold per adult in Scotland as perry fell by 33.2% (−38.5% to −27.5%) in the three-year period following the

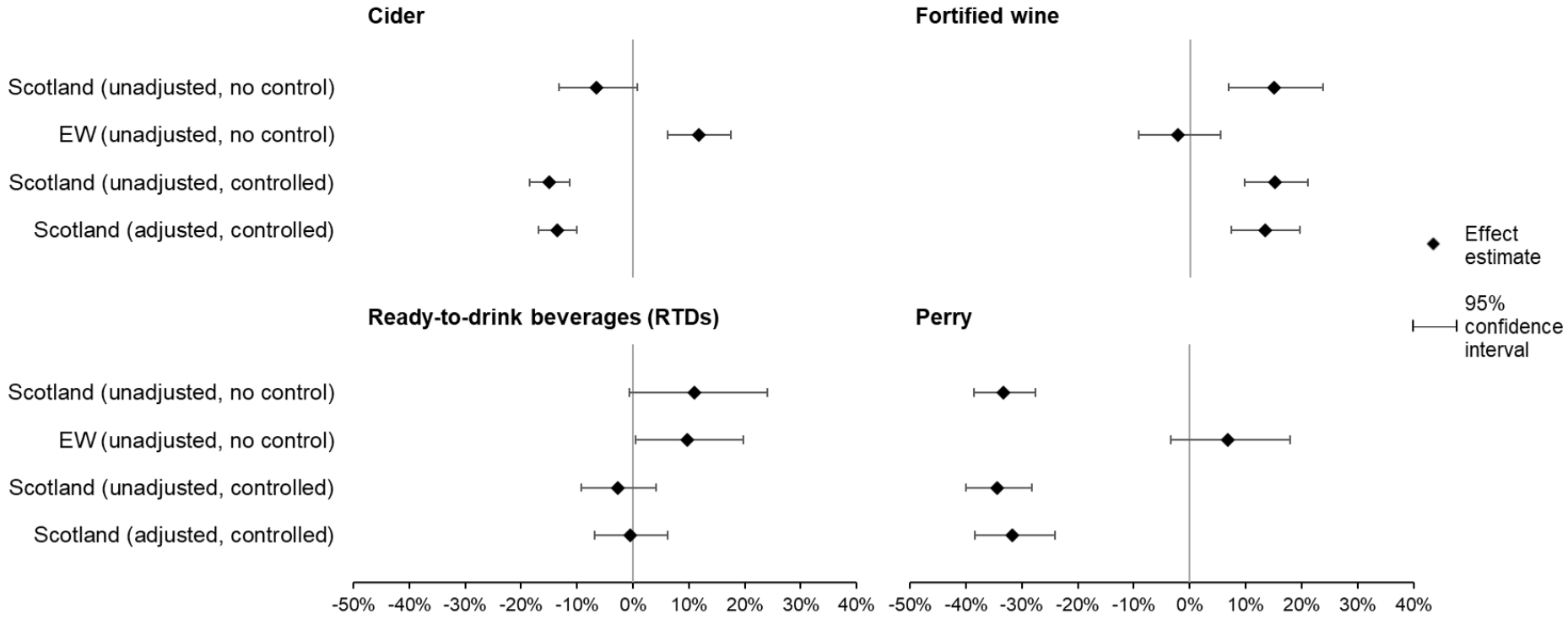
implementation of MUP. In England & Wales, there was a 6.7% (−3.3% to 17.9%) increase over the same time period. In the controlled, unadjusted model, MUP was associated with a 34.4% (−40.0% to −28.1%) net reduction in per-adult sales of perry in Scotland. In the fully controlled and adjusted model, MUP was associated with a 31.6% (−38.4% to −24.1%) net reduction in per-adult sales of perry in Scotland.

Figure 4: Change (%) in total (on- and off-trade combined) alcohol sales in the three years after MUP was implemented in Scotland – all alcohol, beer, spirits and wine



Note: EW = England & Wales. Controlled models include trends in alcohol sales in England & Wales as a covariate. Adjusted models include trends in household disposable income and, for analyses of specific drink categories, total sales of the other drink categories as covariates. All models are adjusted for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions and MUP in Wales. Effect estimates are statistically significant to the 95% level where the confidence limits (bars) do not cross zero.

Figure 5: Change (%) in total (on- and off-trade combined) alcohol sales in the three years after MUP was implemented in Scotland – cider, fortified wine, RTDs and perry



Note: EW = England & Wales. Controlled models include trends in alcohol sales in England & Wales as a covariate. Adjusted models include trends in household disposable income and, for analyses of specific drink categories, total sales of the other drink categories as covariates. All models are adjusted for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions and MUP in Wales. Effect estimates are statistically significant to the 95% level where the confidence limits (bars) do not cross zero.

4.2.3. Off-trade alcohol sales

The results for all models are presented here and in Figure 6 (all alcohol, beer, spirits and wine) and in Figure 7 (cider, fortified wine, RTDs and perry) and in Tables A5 to A8 in Appendix 6.

4.2.3.1. All alcohol

In uncontrolled analysis, the total volume of pure alcohol sold per adult through the off-trade in Scotland fell by 1.3% (−3.2% to 0.6%) in the three-year period following the implementation of MUP. In England & Wales, there was a 2.5% (0.2% to 4.9%) increase over the same time period. In the controlled, unadjusted model, MUP was associated with a 3.2% (−4.3% to −2.2%) net reduction in total per-adult off-trade alcohol sales in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with a 3.6% (−4.8% to −2.5%) net reduction in per-adult sales of alcohol through the off-trade in Scotland.

4.2.3.2. Beer

In uncontrolled analysis, there was little evidence to suggest any change (0.7% (−1.9% to 3.2%) in the volume of pure alcohol sold per adult as beer through the off-trade in Scotland in the three-year period following the implementation of MUP. In England & Wales, there was a 5.2% (2.2% to 8.2%) increase over the same time period. In the controlled, unadjusted model, MUP was associated with a 3.1% (−4.8% to −1.3%) net reduction in off-trade per-adult beer sales in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with a 1.6% (−3.7% to 0.5%) net reduction in per-adult sales of beer through the off-trade in Scotland.

4.2.3.3. Spirits

In uncontrolled analysis, the volume of pure alcohol sold per adult as spirits through the off-trade in Scotland fell by 2.0% (−4.7% to 0.8%) in the three-year period following MUP implementation. In England & Wales, there was a 3.3% (0.8% to 5.8%) increase in off-trade per-adult spirits sales over the same time period. In the controlled, unadjusted model, MUP was associated with a 5.6% (−6.9% to −4.2%)

net reduction in off-trade per-adult spirits sales in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with a 5.5% (−7.5% to −3.4%) net reduction in per-adult spirits sales through the off-trade in Scotland.

4.2.3.4. Wine

In uncontrolled analysis, there was little evidence to suggest any change (−0.7% (−1.9% to 0.5%)) in the volume of pure alcohol sold per adult as wine through the off-trade in Scotland in the three-year period following MUP implementation. In England & Wales, there was a 3.0% (−4.2% to −1.7%) reduction over the same time period. In the controlled, unadjusted model there was a 1.0% (0.3% to 1.7%) net increase in the volume of pure alcohol sold per adult as wine through the off-trade in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with a 1.8% (0.8% to 2.8%) net increase in per-adult sales of wine through the off-trade in Scotland.

4.2.3.5. Cider

In uncontrolled analysis, the volume of pure alcohol sold per adult as cider through the off-trade in Scotland fell 10.5% (−17.7% to −2.8%) in the three-year period following MUP implementation. In England & Wales, there was a 14.7% (7.1% to 22.9%) increase over the same time period. In the controlled, unadjusted model, MUP was associated with a 23.9% (−25.8% to −21.9%) net reduction in per-adult off-trade cider sales in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with a 21.5% (−24.6% to −18.3%) net reduction in per-adult sales of cider through the off-trade in Scotland.

4.2.3.6. Fortified wine

In uncontrolled analysis, the volume of pure alcohol sold per adult as fortified wine through the off-trade in Scotland increased by 15.2% (6.9% to 24.1%) in the three-year period following the implementation of MUP. In England & Wales, there was little evidence of any change over the same time period (−1.9% (−9.2% to 6.0%)). In the controlled, unadjusted model, MUP was associated with a 15.4% (9.8% to 21.4%) net increase in off-trade per-adult sales of fortified wine in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with

a 13.8% (8.7% to 19.3%) net increase in per-adult fortified wine sales through the off-trade in Scotland.

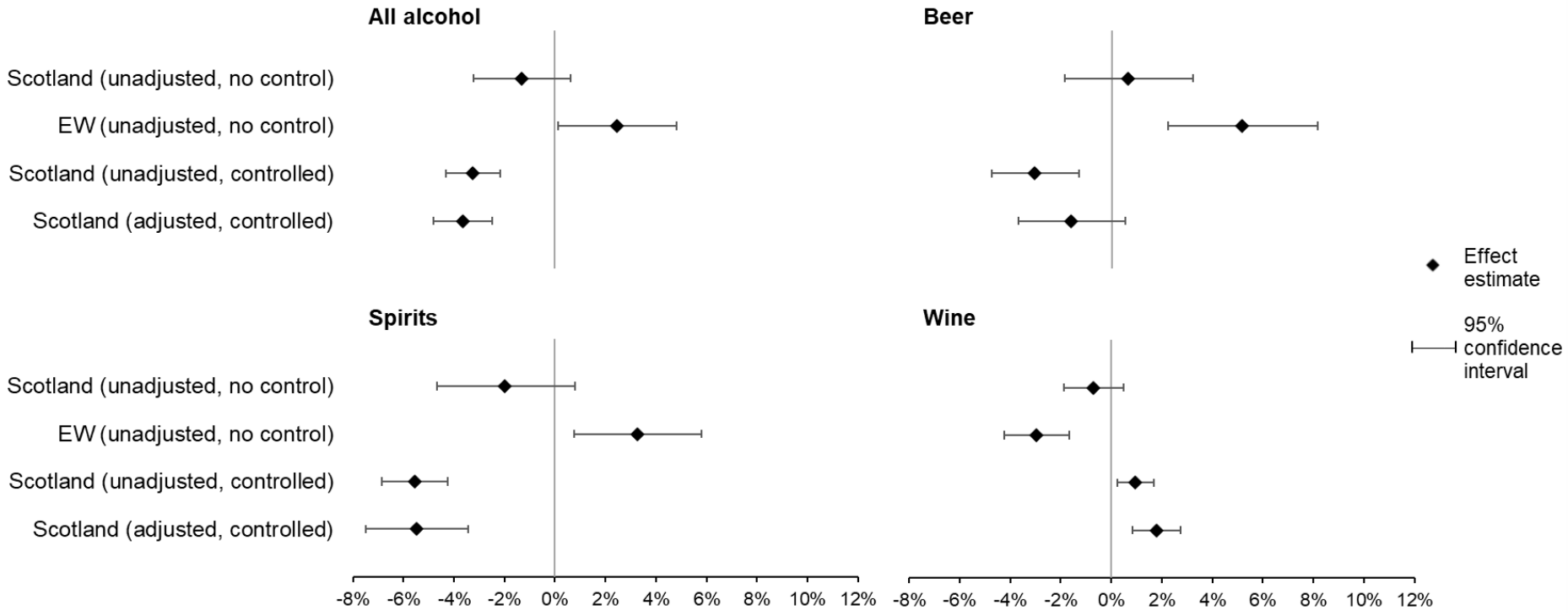
4.2.3.7. Ready-to-drink beverages (RTDs)

In uncontrolled analysis, the volume of pure alcohol sold per adult as RTDs through the off-trade in Scotland increased by 17.9% (4.3% to 33.3%) in the three-year period following MUP implementation. In England & Wales, a similar increase was observed (19.0% (4.2% to 35.9%)) over the same time period. In the controlled, unadjusted model, there was little evidence of any net change (2.2% (−5.3% to 10.3%)) in per-adult sales of RTDs through the off-trade in Scotland. In the fully controlled and adjusted model there was some evidence of a 3.6% (−3.4% to 11.1%) net increase in per-adult sales of RTDs through the off-trade in Scotland.

4.2.3.8. Perry

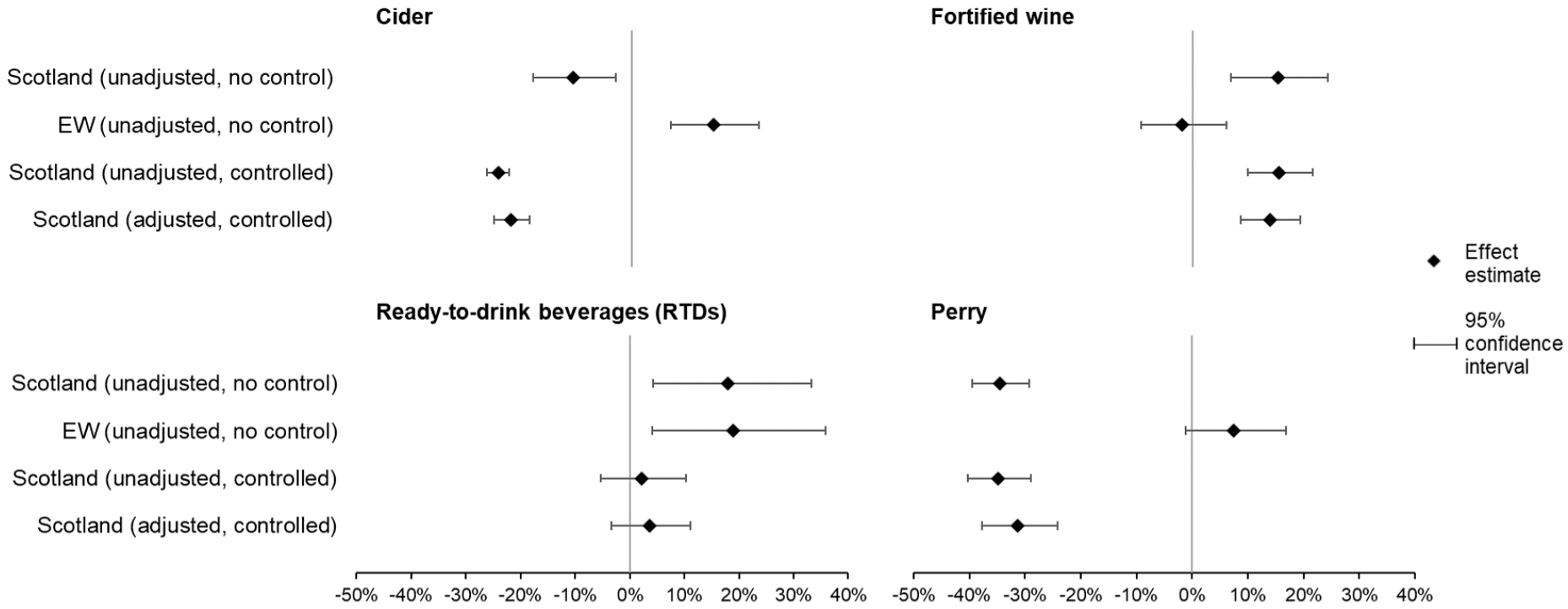
In uncontrolled analysis, the introduction of MUP was associated with a 34.5% (−39.4% to −29.2%) reduction in the total volume of pure alcohol sold per adult as perry through the off-trade in Scotland. In England & Wales, there was a 7.5% (−1.1% to 16.8%) increase over the same time period. In the controlled, unadjusted model, MUP was associated with a 34.9% (−40.3% to −28.9%) reduction in per-adult off-trade sales of perry in Scotland. In the fully controlled and adjusted model, MUP implementation was associated with a 31.3% (−37.7% to −24.2%) reduction in per-adult sales of perry through the off-trade in Scotland.

Figure 6: Change (%) in off-trade alcohol sales in the three years after MUP was implemented in Scotland – all alcohol, beer, spirits and wine



Note: EW = England & Wales. Controlled models include trends in off-trade alcohol sales in England & Wales as a covariate. Adjusted models include trends in household disposable income, on-trade sales and, for analyses of specific drink categories, total off-trade sales of the other drink categories as covariates. All models are adjusted for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions and MUP in Wales. Effect estimates are statistically significant to the 95% level where the confidence interval (bars) does not cross zero.

Figure 7: Change (%) in off-trade alcohol sales in the three years after MUP was implemented in Scotland – cider, fortified wine, RTDs and perry



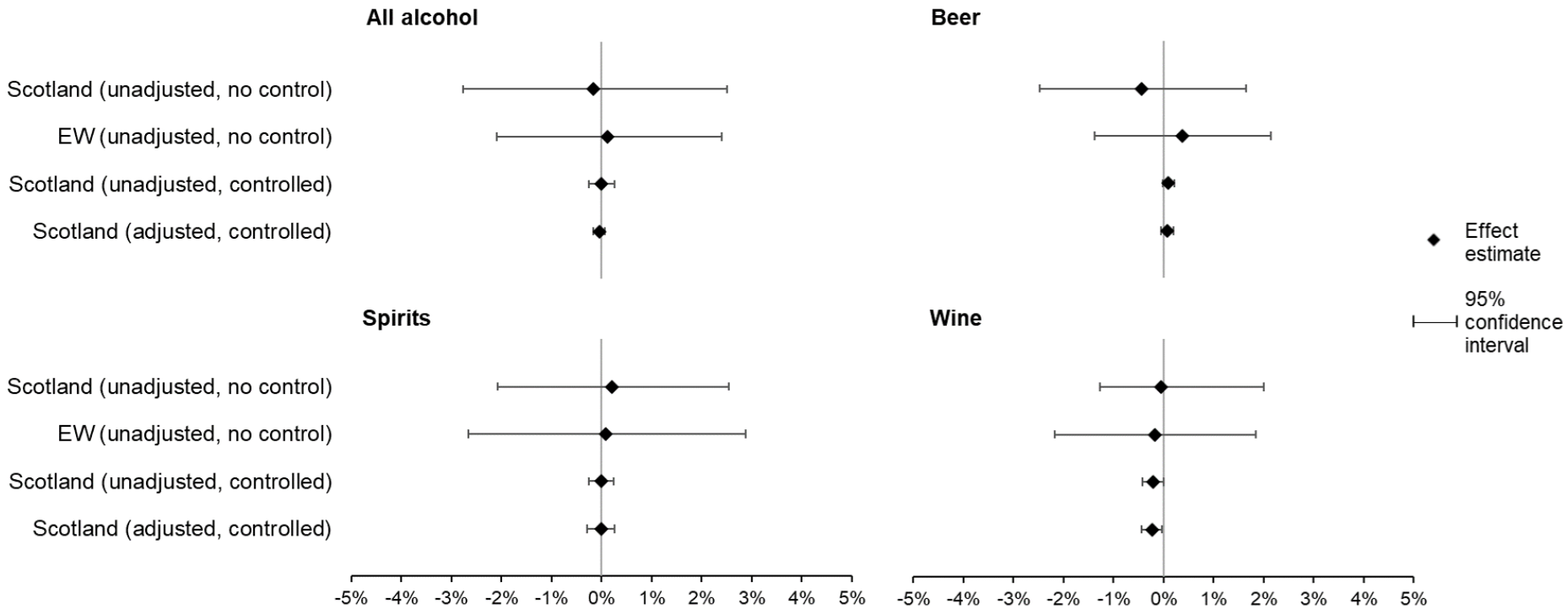
Note: EW = England & Wales. Controlled models include trends in off-trade alcohol sales in England & Wales as a covariate. Adjusted models include trends in household disposable income, on-trade sales and, for analyses of specific drink categories, total off-trade sales of the other drink categories as covariates. All models are adjusted for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions and MUP in Wales. Effect estimates are statistically significant to the 95% level where the confidence interval (bars) does not cross zero.

4.2.4. On-trade alcohol sales

The results for all models are presented in Figure 8 (all alcohol, beer, spirits and wine) and in Figure 9 (cider, fortified wine, RTDs and perry) and in Tables A9 to A12 in Appendix 6.

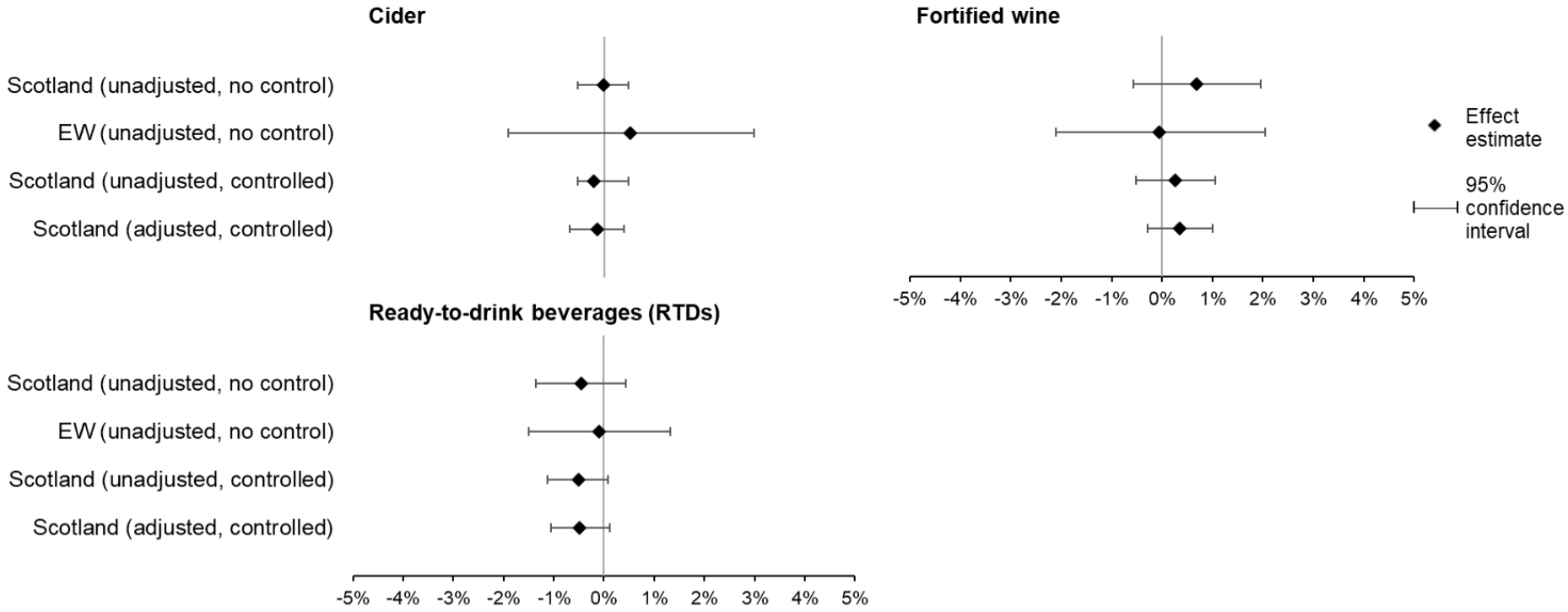
There was very little evidence of any change in per-adult sales of pure alcohol through the on-trade in Scotland following the implementation of MUP either for all alcohol or for any of the drink categories. No results could be produced for perry due to very low levels of on-trade perry sales in some weeks in Scotland.

Figure 8: Change (%) in on-trade alcohol sales in the three years after MUP was implemented in Scotland – all alcohol, beer, spirits and wine



Note: EW = England & Wales. Controlled models include trends in on-trade alcohol sales in England & Wales. Adjusted models include trends in household disposable income. All models are adjusted for underlying seasonal and secular trends. On-trade analyses are truncated to 22 months post-MUP (February 2020) due to incomplete data following the introduction of COVID-related restrictions. Effect estimates are statistically significant to the 95% level where the confidence limits (bars) do not cross zero.

Figure 9: Change (%) in on-trade alcohol sales in the three years after MUP was implemented in Scotland – cider, fortified wine and RTDs



Note: EW = England & Wales. Controlled models include trends in on-trade alcohol sales in England & Wales. Adjusted models include trends in household disposable income. All models are adjusted for underlying seasonal and secular trends. On-trade analyses are truncated to 22 months post-MUP (February 2020) due to incomplete data following the introduction of COVID-related restrictions. No results for perry are presented due to there being very low levels of on-trade perry sales recorded in Scotland in some weeks. Effect estimates are statistically significant to the 95% level where the confidence limits (bars) do not cross zero.

4.2.5. Sensitivity analyses

Sensitivity analyses were carried out for the primary outcomes only, namely total (on- and off-trade combined) and off-trade alcohol sales. The results from the fully controlled and adjusted models for all alcohol are presented here (Figures 10 and 11), unless otherwise stated. Full results by drink category and for different model conditions, where they were carried out, are presented in Appendix 6.

4.2.5.1. Excluding on-trade adjustment (off-trade only)

When excluding adjustment for on-trade alcohol sales from the fully adjusted and controlled Scottish model, MUP implementation was associated with a 3.6% (−4.8% to −2.5%) reduction in per-adult sales of alcohol through the off-trade (Table A13).

4.2.5.2. Using a shorter post-intervention time period

When using a shorter post-intervention time period, in order to exclude potential effects resulting from the COVID-19 pandemic and the introduction of MUP in Wales, MUP implementation was associated with a 3.5% (−4.4% to −2.6%) reduction in total per-adult alcohol sales in Scotland (Table A15). Repeating the analysis for per-adult sales of alcohol through the off-trade, MUP implementation was associated with a 4.0% (−5.2% to −2.8%) reduction (Table A17).

4.2.5.3. Net difference in alcohol sales (Scotland minus England & Wales)

When using the net difference in total per-adult alcohol sales between Scotland and England & Wales as the outcome measure, MUP was associated with a 3.2% (−4.5% to −1.9%) reduction in the three years following implementation (Table A19). Repeating the analysis for per-adult sales of alcohol through the off-trade, MUP was associated with 4.3% (−5.6% to −3.1%) reduction (Table A21).

4.2.5.4. Adjusting for alcohol sales in Aldi and Lidl

When uplifting off-trade alcohol sales data to account for the share sold through Aldi and Lidl, MUP implementation was associated with a 3.6% (−4.9% to −2.3%) reduction in total per-adult alcohol sales in Scotland (Table A23). Repeating the analysis for per-adult sales of alcohol through the off-trade in Scotland found that

MUP was associated with a 4.4% (−5.7% to −3.1%) reduction after three years of implementation (Table A25).

4.2.5.5. Litres of pure alcohol per adult drinker

When using adult drinkers, rather than all adults, as the population denominator, MUP was associated with a 3.7% (−5.2% to −2.3%) reduction in total per-adult alcohol sales in Scotland (Table A27). Repeating the analysis for per-adult sales through the off-trade, MUP was associated with a 4.4% (−5.7% to −3.1%) reduction (Table A29).

4.2.5.6. Alternative geographical control

When using alcohol sales in the NE of England as the geographical control, MUP was associated with a 4.3% (−5.5% to −3.2%) reduction in total per-adult sales (Table A30). Repeating the analysis for per-adult sales through the off-trade, MUP was associated with a 5.2% (−6.7% to −3.7%) reduction (Table A31).

Using alcohol sales in the NW of England as the geographical control, MUP was associated with a 4.2% (−5.6% to −2.7%) reduction in total per-adult sales (Table A30). Repeating the analysis using per-adult sales through the off-trade as the outcome measure a 4.3% (−5.8% to −2.7%) reduction was observed (Table A31).

4.2.5.7. Using a different source of off-trade alcohol retail sales data

Due to a difference in the pre-intervention period for which data were available from the two off-trade alcohol sales sources, the results using IRI data presented here are not directly comparable to the main results (using Nielsen data) presented earlier in this section (see Methods for more detail). Results from the full set of models for Scotland and England & Wales, and by drink category, for both Nielsen and IRI using the same pre-intervention period are presented in Appendix 6. The results presented here are a summary of the main models (total and off-trade) using IRI data.

When using IRI data as the source of off-trade alcohol retail sales in a fully adjusted and controlled model for Scotland, MUP was associated with a 3.4% (−4.8% to −2.0%) reduction in total per-adult alcohol sales (Table A35). Repeating the analysis

for per-adult sales of alcohol through the off-trade found that MUP was associated with a 2.8% (−4.6% to −1.0%) reduction in Scotland (Table A39).

4.2.5.8. Falsification of intervention date

Using a false intervention date six months prior to the implementation of MUP found no significant change to either total per-adult alcohol sales (−1.1% (−2.5% to 0.3%); Table A40) or to per-adult sales through the off-trade (−0.0% (−1.8% to 1.8%); Table A42).

Using a false intervention date six months after the implementation of MUP found no significant change in total per-adult sales (−1.0% (−2.4% to 0.5%); Table A41) and a 1.7% (−3.2% to −0.2%) reduction in per-adult sales through the off-trade (Table A43).

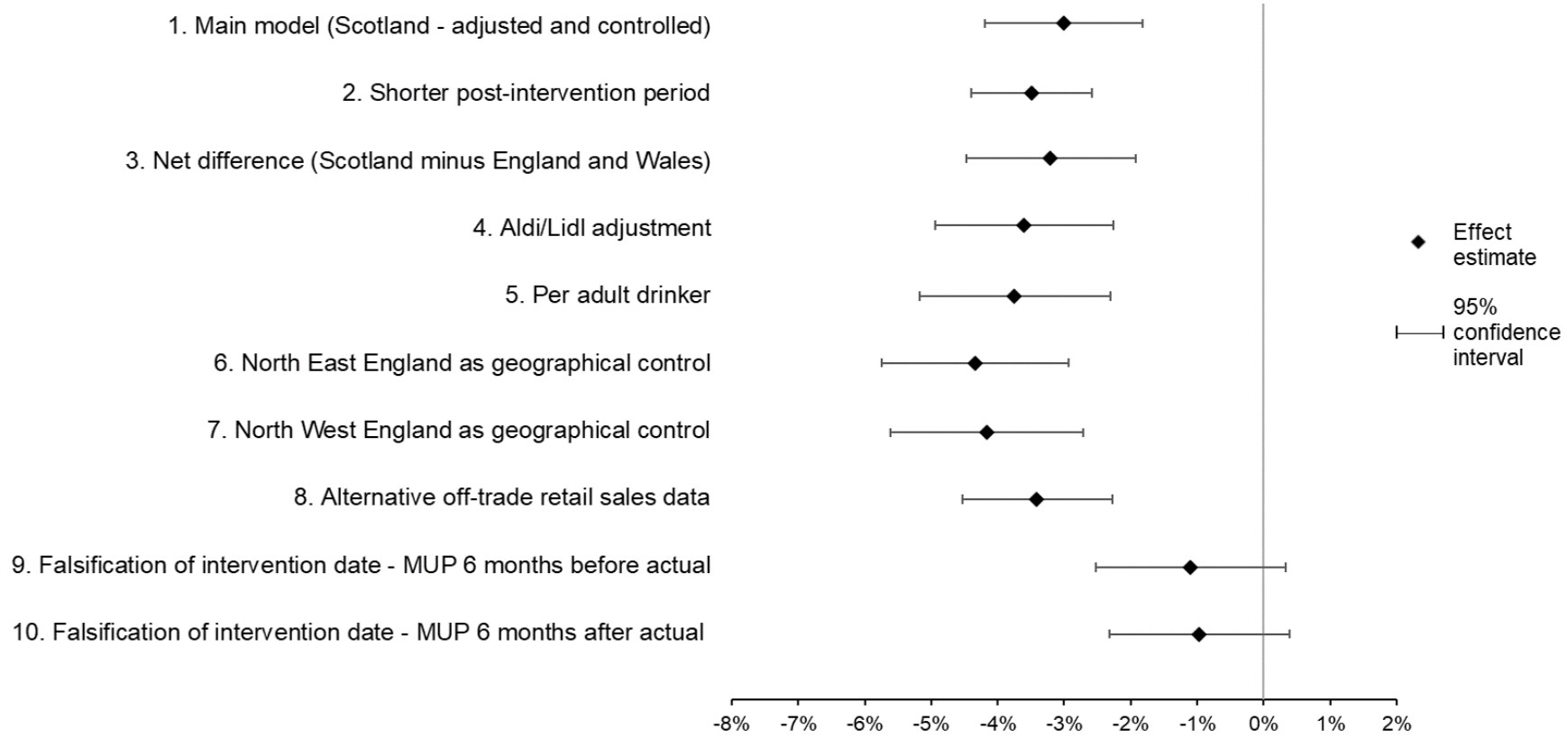
4.2.5.9. Using a different analytical approach

Fitting an unobserved components model (UCM) to the data, instead of a SARIMA model, produced broadly similar estimates in uncontrolled models for Scotland and England & Wales, although the estimated increase in sales in England & Wales was generally greater, particularly in total sales (Tables A44 and A45).

4.2.5.10. Test of change in variability

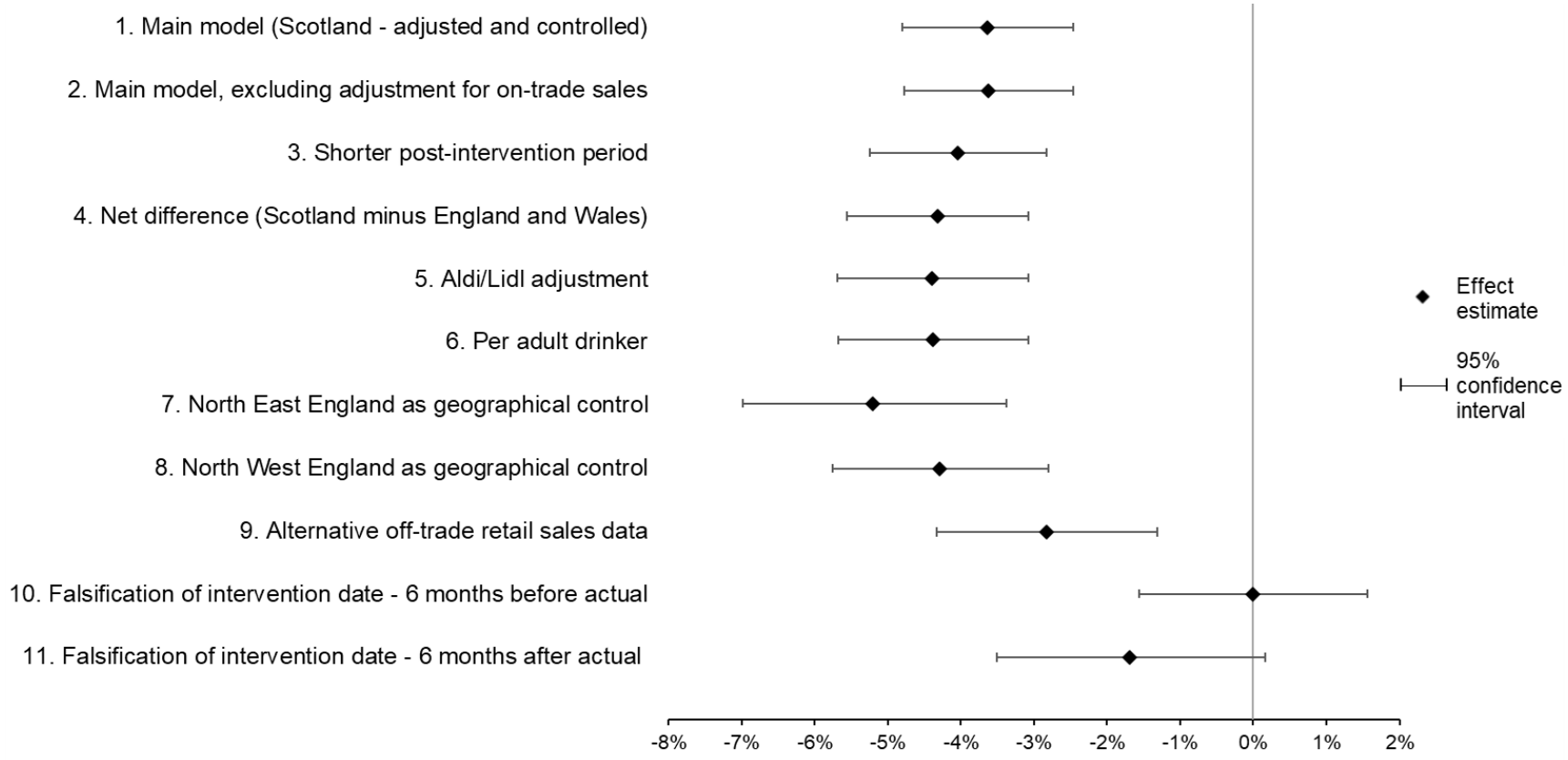
Our test of whether MUP had an impact on the variability of weekly total (on- and off-trade combined) or off-trade sales in Scotland did not suggest a statistical difference in the frequency and magnitude of peaks and troughs in the post-MUP period (Tables A46 and A47). This analysis did not incorporate data for England & Wales.

Figure 10: Change (%) in total (on- and off-trade combined) alcohol sales in the three years after MUP was implemented in Scotland – results from each of the supplementary analyses



Note: The estimate for the main model is given first (model 1) to allow ease of comparison with the subsequent estimates from each of the supplementary analyses. Models 1, 2, 4, 5, 8, 9 and 10 include trends in alcohol sales in England & Wales as a covariate (control). All models include trends in household disposable income. All models are adjusted for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions and MUP in Wales. Effect estimates are statistically significant to the 95% level where the confidence limits (bars) do not cross zero.

Figure 11: Change (%) in off-trade alcohol sales in the three years after MUP was implemented in Scotland – results from each of the supplementary analyses



Note: The estimate for the main model is given first (model 1) to allow ease of comparison with the subsequent estimates from each of the supplementary analyses. Models 1, 2, 3, 5, 6, 9, 10 and 11 include trends in alcohol sales in England & Wales as a covariate (control). All models include trends in household disposable income and (excluding model 2) on-trade sales. All models are adjusted for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions and MUP in Wales. Effect estimates are statistically significant to the 95% level where the confidence limits (bars) do not cross zero.

5. Discussion

5.1. Principal findings

This study finds that the introduction of MUP in Scotland on 1 May 2018 was associated with a net reduction in the total volume of pure alcohol sold, when controlling for sales in the best available geographical control area and other external factors. Using our main model (controlled and adjusted) we found MUP to be associated with a net reduction of 3.0% in total per-adult sales in the three years following implementation; this was driven by a 3.6% reduction in sales through the off-trade. The uncontrolled effect in Scotland (i.e. before adjustment for the best available geographical control and other factors) showed a reduction of 1.1% in total alcohol sales, and 1.3% in off-trade sales. Over the same time period there was a 2.4% increase in total sales, and a 2.5% increase in off-trade sales, in England & Wales. No change to per-adult sales of pure alcohol through the on-trade was observed over the study period.

The largest net reductions in per-adult alcohol sales were observed for cider and perry. Smaller net reductions were observed for spirits and beer. Given the relatively large proportion that spirits and beer add to the volume of pure alcohol sold in Scotland, these smaller relative reductions make an important contribution to the reduction overall. An increase in the volume of pure alcohol sold per adult as fortified wine, and of wine through the off-trade, was observed over the same time period, which partly offset the overall reduction.

The results from the main models for both total and off-trade sales were robust to a range of different conditions as tested through our supplementary and sensitivity analyses. For total alcohol sales the supplementary analyses suggested a reduction in per-adult sales of pure alcohol in the range of 3−4%, and a reduction of 4−5% in sales through the off-trade, following the implementation of MUP.

5.2. Strengths

We used alcohol retail sales data, converted to pure alcohol volume and expressed per adult, as our proxy for alcohol consumption at a population level. This is considered the most reliable and objective approach for monitoring and evaluating the impact of alcohol-related interventions at a population level.[25] We have provided an initial assessment,[6] and two subsequent updates,[26,27] on the validity and reliability of using alcohol retail sales data to monitor alcohol consumption at a population level and have found that they provide one of the best available data sources for that purpose. Both Nielsen and CGA, providers of off-trade and on-trade alcohol sales data respectively, continually review and improve their methodology to make their data as representative of alcohol sales in the constituent GB countries as possible.

We incorporated outcome data for the best available geographical control, England & Wales, into our models. By comparing with and controlling for any change in alcohol sales in England & Wales over the three-year post-implementation time period, we can be more confident that any observed changes in Scotland are due to MUP rather than another external factor that might affect alcohol consumption in both Scotland and England & Wales. Given that the COVID-19 pandemic hit the UK during the three-year post-implementation period, affecting where people were able to purchase and consume alcohol, including a geographical control area with similar purchasing and consumption habits to Scotland was of particular importance.

Interrupted time series analysis is a well-established method used to evaluate interventions that are implemented across a whole population.[28] Using this method allowed us to objectively account for existing underlying trends in the pre-intervention time series and to more robustly identify any changes in Scotland as being associated with the implementation of MUP.

We included adjustment for the physical distancing conditions imposed on the UK in response to the COVID-19 pandemic. We did that separately for Scotland and England & Wales so as to account for differences in how and when restrictions were introduced by the devolved governments.

We included adjustment for the introduction of MUP in Wales on 1 March 2020. Given that Wales makes up a relatively small proportion of the overall population of England & Wales, it is likely that this will have had a minimal impact on alcohol sales in our control area and could therefore represent over-adjustment.

We ran a series of supplementary and sensitivity analyses to test the robustness of the results from our primary model and obtained largely similar results, substantiating the interpretation of these results. Of note, we performed an additional analysis using an alternative source of off-trade alcohol retail sales data, and a further analysis using a truncated post-intervention time period so as to eliminate the impacts of COVID-19 restrictions and the implementation of MUP in Wales, which were not specified in our analysis plan.

5.3. Limitations

We were unable to disaggregate retail sales data to assess how alcohol sales, and the impact of MUP, may differ across population groups. However, this has been addressed across the range of studies within the evaluation of MUP[3] and by others in the academic literature.[29,30]

The retail sales data used in this study do not allow disaggregation below the on- and off-trade. Within the off-trade, where we have shown the impact of MUP to have occurred, the data cannot be further broken down into sales through different channels. Nielsen's 'grocery multiple' data constitutes most of the major supermarkets, which account for approximately 80% of the off-trade alcohol market; sales estimates for this channel are likely to be highly accurate as they are based on census data. The 'impulse' data accounting for the remaining alcohol sold through the off-trade constitutes symbol groups (e.g. Spar, Londis) and independent convenience stores and off-licences. Sales estimates for this channel are based on a sample of retailers, thereby increasing uncertainty. We have, however, examined the impact on sales through those different channels in our prices and products study[31] and examined the impact of MUP on small retailers specifically.[32]

5.4. Interpretation

The findings reported here – a 3.0% net reduction in per-adult sales of pure alcohol and a 3.6% net reduction in off-trade sales – are in line with those we reported at one year after MUP implementation (a 3.5% net reduction in per-adult off-trade sales).[4] As with the earlier study, the largest relative reductions were observed for cider and perry, with smaller reductions being observed for spirits and beer.

The observed reductions in sales are consistent with the expected mechanism for the policy, namely an increase in the price of products sold below the minimum unit price before the policy was implemented. Those drink categories with the greatest reduction in sales demonstrated here are typically those that are most impacted by an increase in price.[5,31,33] Similarly, where little or no change in price per unit occurred as a result of the policy[5,31,33] then either no change or an increase in per-adult sales was seen, as for fortified wine.

The observed changes were entirely driven by changes to sales through the off-trade with no discernible impact to on-trade sales. This indicates that the implementation of MUP did not cause a substantial shift towards on-trade alcohol consumption.

As noted earlier, the results from our main model at three years post-implementation are very similar to the results from our study looking at the impact of MUP at one year post-implementation, suggesting a step change in the volume of pure alcohol sold per adult in Scotland following the implementation of MUP in May 2018. This can be explained by a relatively rapid industry and consumer response to the introduction of MUP, resulting in a reduction in total alcohol sales that was then maintained throughout the remainder of the post-implementation study period. We have shown that the retail industry responded to the introduction of MUP in a variety of ways, primarily targeted at those products impacted by the policy and aimed at pricing those products at a more attractive price point to the consumer.[31] Our findings are largely consistent with those reported in research led by the University of Newcastle where an initial reduction of 7.6% (9.5g of alcohol per adult per household per week) in off-trade alcohol purchases was found[29] and that a reduction in alcohol purchasing in Scotland, relative to Northern England, was maintained during the first half of 2020.[30]

Restrictions designed to limit the spread of COVID-19 were introduced in the UK in March 2020 and continued in various forms throughout the remainder of the post-intervention study period. We have shown that the first 'lockdown' (23 March to early July 2020) in the UK was associated with a 6% reduction in total per-adult alcohol sales in both Scotland and England & Wales, primarily through physical distancing restrictions that required on-trade premises to close.[14] While there was a corresponding increase in sales of alcohol through the off-trade, the increase was not sufficient to fully compensate for lost on-trade sales. In further descriptive work we have shown that this skew towards sales through the off-trade and an overall reduction in alcohol sales continued throughout the remainder of the study period (to May 2021).[15] There are two direct mechanisms whereby the COVID-19 pandemic may impact on the findings of the current study. Firstly, through the impact on alcohol sales already described, and secondly by affecting whether England & Wales remains a satisfactory geographical control due to the devolved UK governments introducing different measures, both nationally and locally, at different times. We assessed whether the level of restrictions introduced in Scotland and England & Wales throughout the post-intervention period was similar by visually examining the stringency index (Appendix 3); we found that the level of restrictions in each area was similar. We have also shown that the impact on alcohol sales has been broadly similar in both areas[14] and therefore conclude that England & Wales remained a viable geographical control and the best available for Scotland in this study.

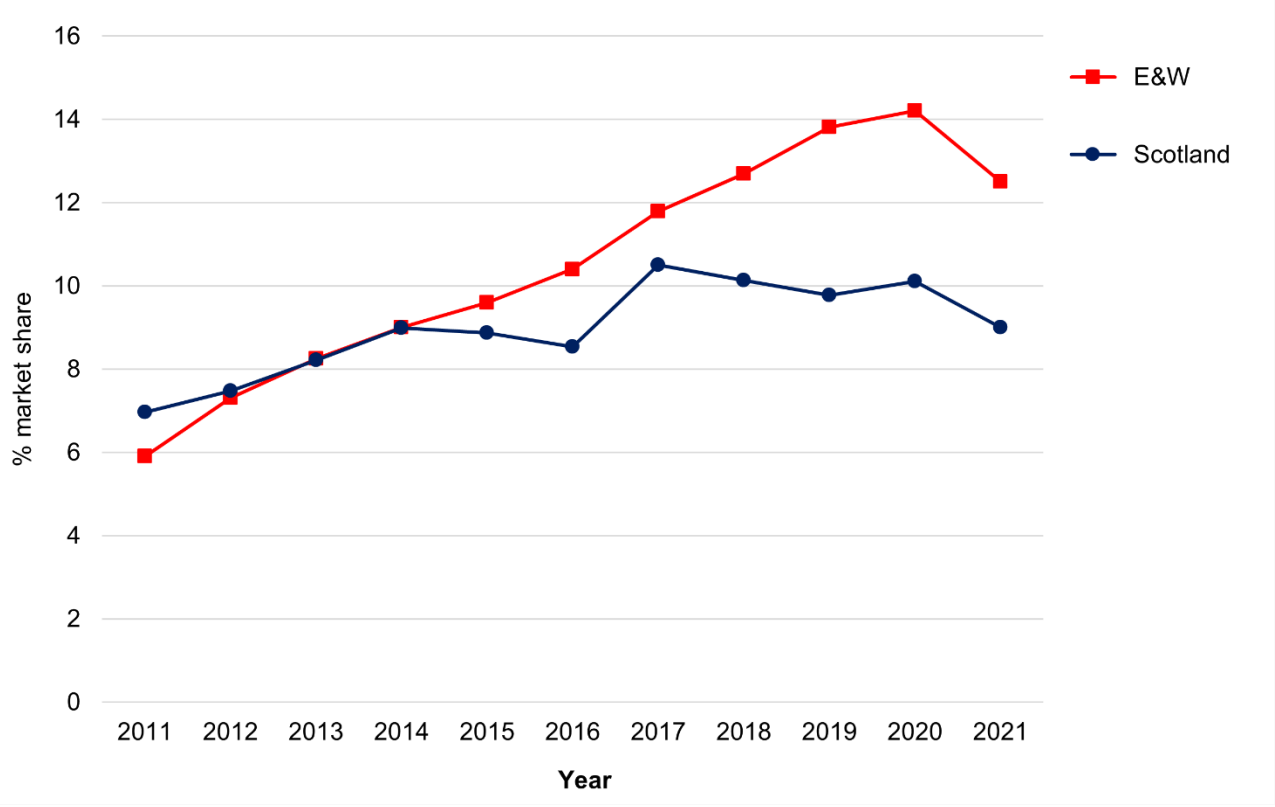
6. Conclusion

MUP has been effective in reducing per-adult sales of pure alcohol in Scotland, when adjusting for the best available geographical control and other external factors. The observed reduction was largely driven by a decrease in sales of cider, perry, spirits and beer through the off-trade, and was partially offset by increased sales of fortified wine and, to a lesser extent, wine. We found little evidence to suggest that MUP was associated with changes in per-adult sales of alcohol through the on-trade. Our main finding was robust to a range of different conditions, as tested through sensitivity analyses. The sensitivity analyses suggested a reduction in total per-adult sales of pure alcohol in the range of 3−4%. We conclude that MUP has been effective in reducing alcohol consumption at the population level in the first three years of implementation.

Appendix 1: Aldi and Lidl alcohol market share

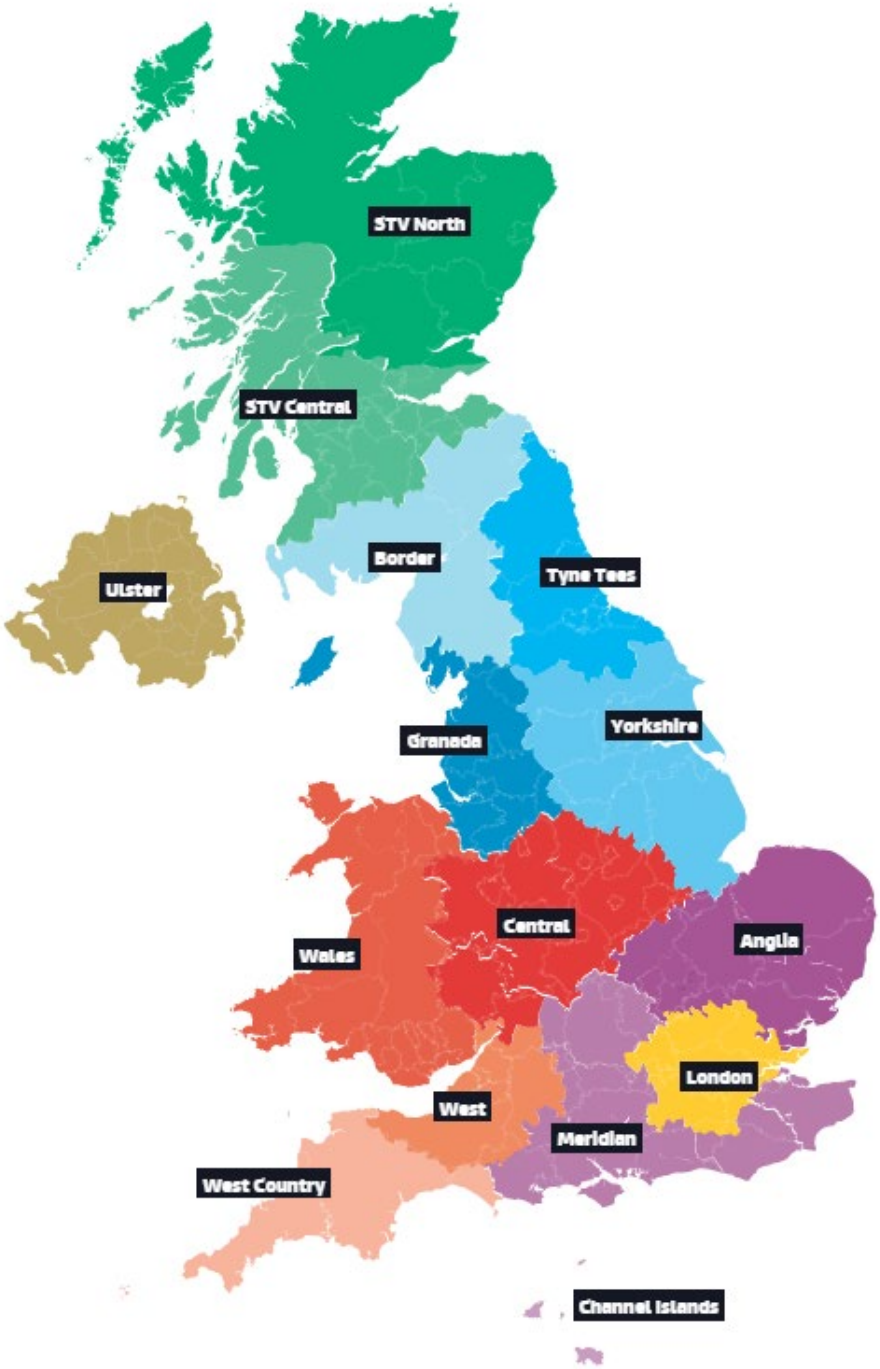
Nielsen off-trade alcohol sales data do not include data for the discount stores Aldi and Lidl. In order to account for the proportion of alcohol sold within the discount retail sector in sensitivity analysis, adjustment factors have been applied to Nielsen off-trade sales estimates. Adjustment factors are based on the market share of Aldi and Lidl sales volumes drawn from Kantar Worldpanel consumer panel data, which were provided for Scotland and England & Wales for calendar years 2011 to 2020 and for the first 20 weeks (to mid-May) of 2021.

Figure A1: Aldi and Lidl market share estimates in Scotland and England & Wales for all alcohol, 2011–2021



Source: Kantar Worldpanel

Appendix 2: Broadcasters' Audience Research Board (BARB) regions



Source: **www.itvmedia.co.uk/advertising-on-itv/regional-advertising**

Appendix 3: The Oxford COVID-19 Government Response Tracker

The Oxford COVID-19 Government Response Tracker (OxCGRT)[16] provides a systematic way of tracking government responses to COVID-19 across countries and over time. Data for several indicators are gathered from a variety of sources and aggregated to produce several indices of government response. The dataset contains 23 indicators plus a miscellaneous notes field. The indicators are organised into the following groups:

C – containment and closure policies

E – economic policies

H – health system policies

V – vaccination policies

M – miscellaneous policies

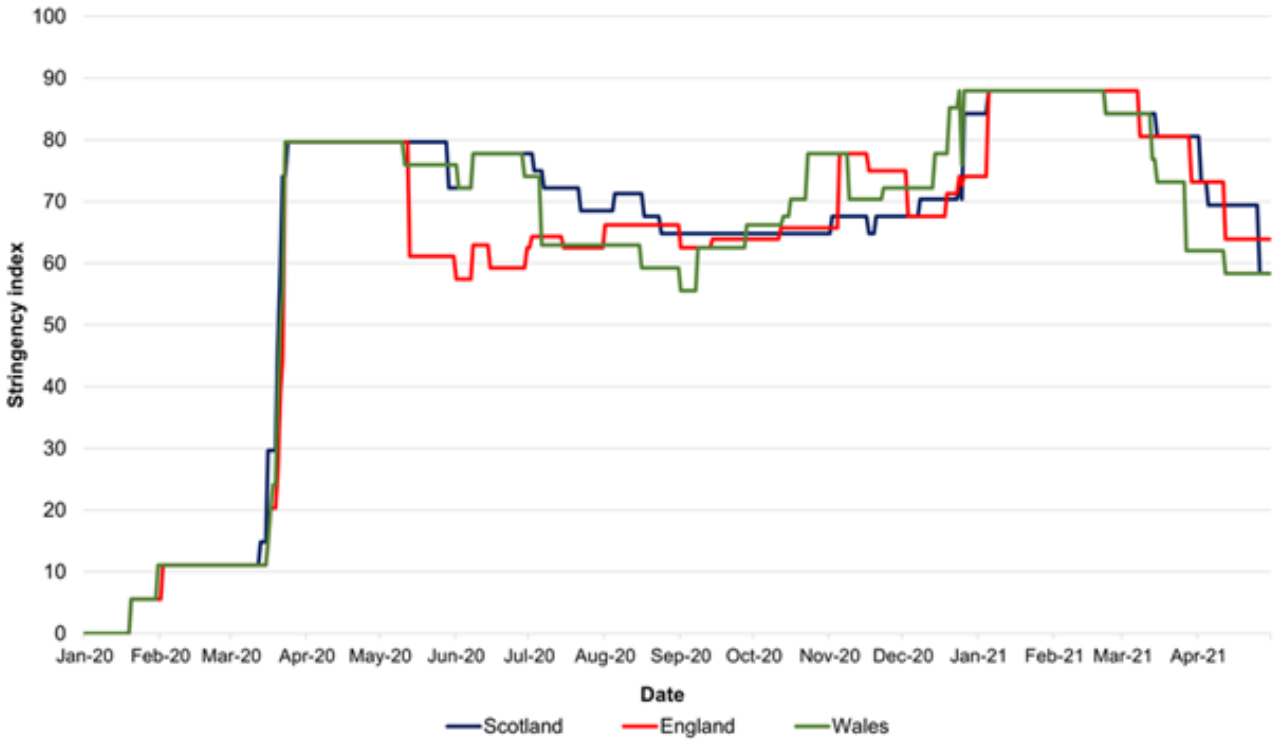
From these indicators a number of indices have been produced. The indices are produced from the average of the indicator scores on any given day, weighted according to whether the policy was national or targeted. The indices produced are:

- overall government response index (all indicators)
- containment and health index (all C and H indicators)
- stringency index (all C indicators, plus H1 which records public information campaigns)
- economic support index (all E indicators)

The indices provide a measure of which policies a government has implemented and how strict or wide reaching that policy is. The indices cannot provide a measure of whether the policy was implemented effectively.

The measure used in this study was the stringency index and was chosen as it is the measure most likely to include factors likely to influence alcohol consumption. The chart below shows the daily calculated index for each of the three devolved UK governments included in this study.

Figure A2: Daily stringency index data for Scotland, England and Wales, from 1 January 2020 to 31 April 2021



Source: Oxford COVID-19 Government Response Tracker

Appendix 4: Detailed description of statistical methods

Preparing the data

We assessed whether the outcome measures have a normal distribution using Kernel Density plots. As our primary outcome measures were not normally distributed, these data were transformed using the natural logarithm. This is often an important step for meeting the assumption of a normal distribution when performing SARIMA modelling.

Diagnosing autocorrelation and non-stationarity

The presence of serial and seasonal autocorrelation and non-stationarity was diagnosed using autocorrelation (AC) and partial autocorrelation functions (PAC). These enabled any significant correlation between error terms at different lag periods and the number of autoregressive (AR) and moving average (MA) terms to be identified and accounted for. Inclusion of deterministic terms was sufficient to address non-stationarity in the mean and variance of the sales series meaning that differencing was not required.

Selecting the baseline model

Candidate SARIMA models were investigated using plots and AC/PAC plots of the stationary data series. The most appropriate and parsimonious model was selected using the Akaike Information Criterion (AIC) and Bayesian Information Criteria (BIC) statistics.[34] Lagged effects of MUP were not explored in light of findings from other studies in the MUP evaluation portfolio which have shown that the legislation has been complied with and implemented effectively.[35] Similarly, our preliminary analysis of data on the average sales price of off-trade alcohol did not suggest that there was an anticipatory effect prior to MUP being introduced in Scotland compared with England & Wales.[5]

Testing the effect of the intervention

We estimated the magnitude and uncertainty of the effect of MUP implementation on alcohol sales by including a binary explanatory variable in our SARIMA models, with the value of zero for the time before MUP was introduced (January 2013 to April 2018) and the value of one after the introduction of MUP (May 2018 to April 2021). Models were all fitted assuming a change in level. This was based on a comparison of AIC and BIC statistics of separate models testing for either: a change in level only; a change in trend only; a change in level and trend.

Assessment of model fit

For all models, standard diagnostic tests were performed to ensure that the residuals of the fitted models were not significantly different from those expected from white noise or a random series.[36] In addition, AIC and BIC statistics were obtained and compared, and R^2 values were obtained by performing linear regression analyses using predicted values as the explanatory series and observed values as the outcome series.

Software

Analyses were performed using the following statistical software:

- MATLAB (Version 9.7 update 1) for all SARIMA modelling
- Python 3.7 for Unobserved Components Model analysis (using the UCM procedure in the ‘statsmodels’ package).

Appendix 5: Descriptive trends by drink category

Beer

Figure A3: Total volume of pure alcohol sold as beer (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

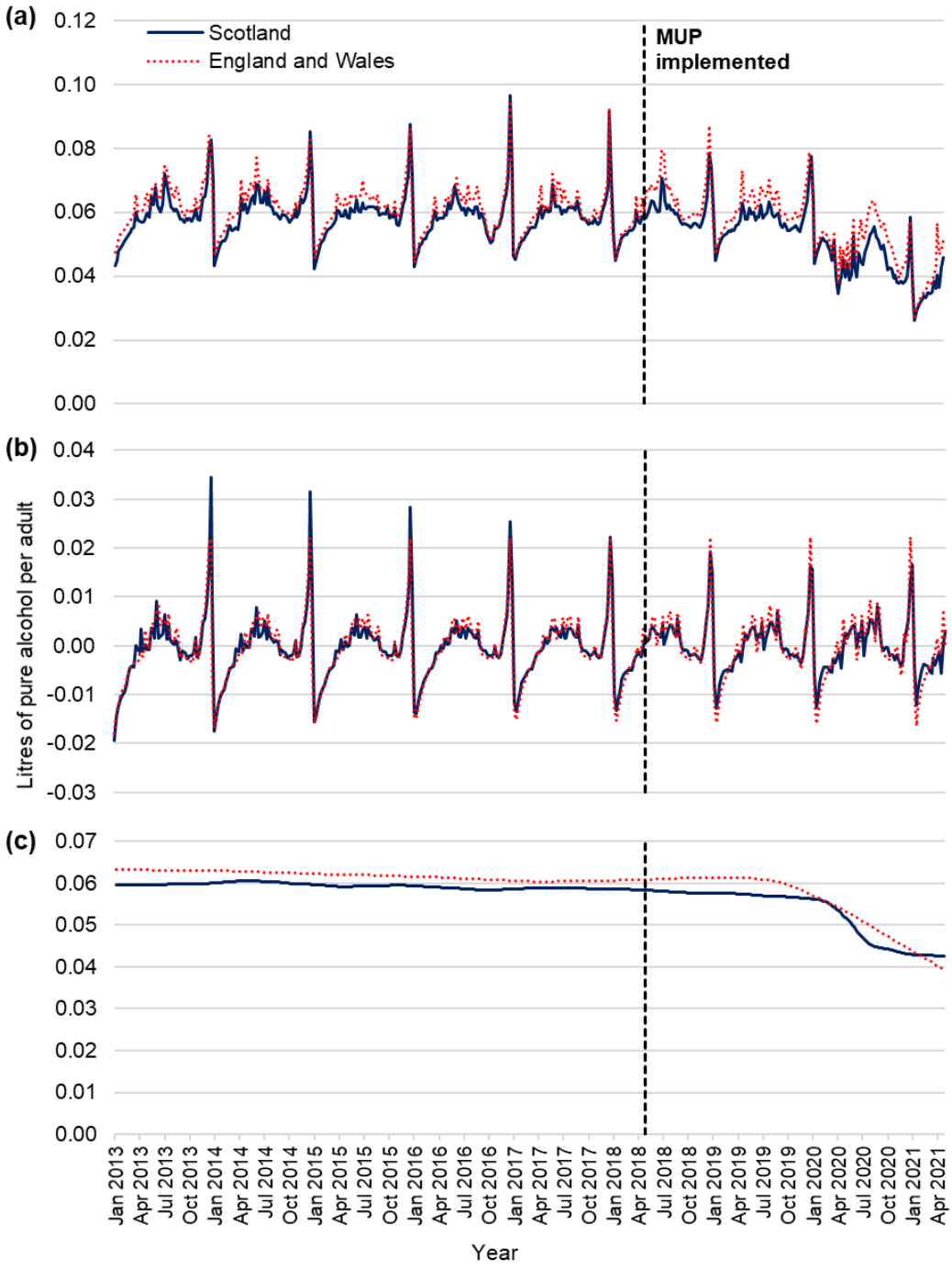
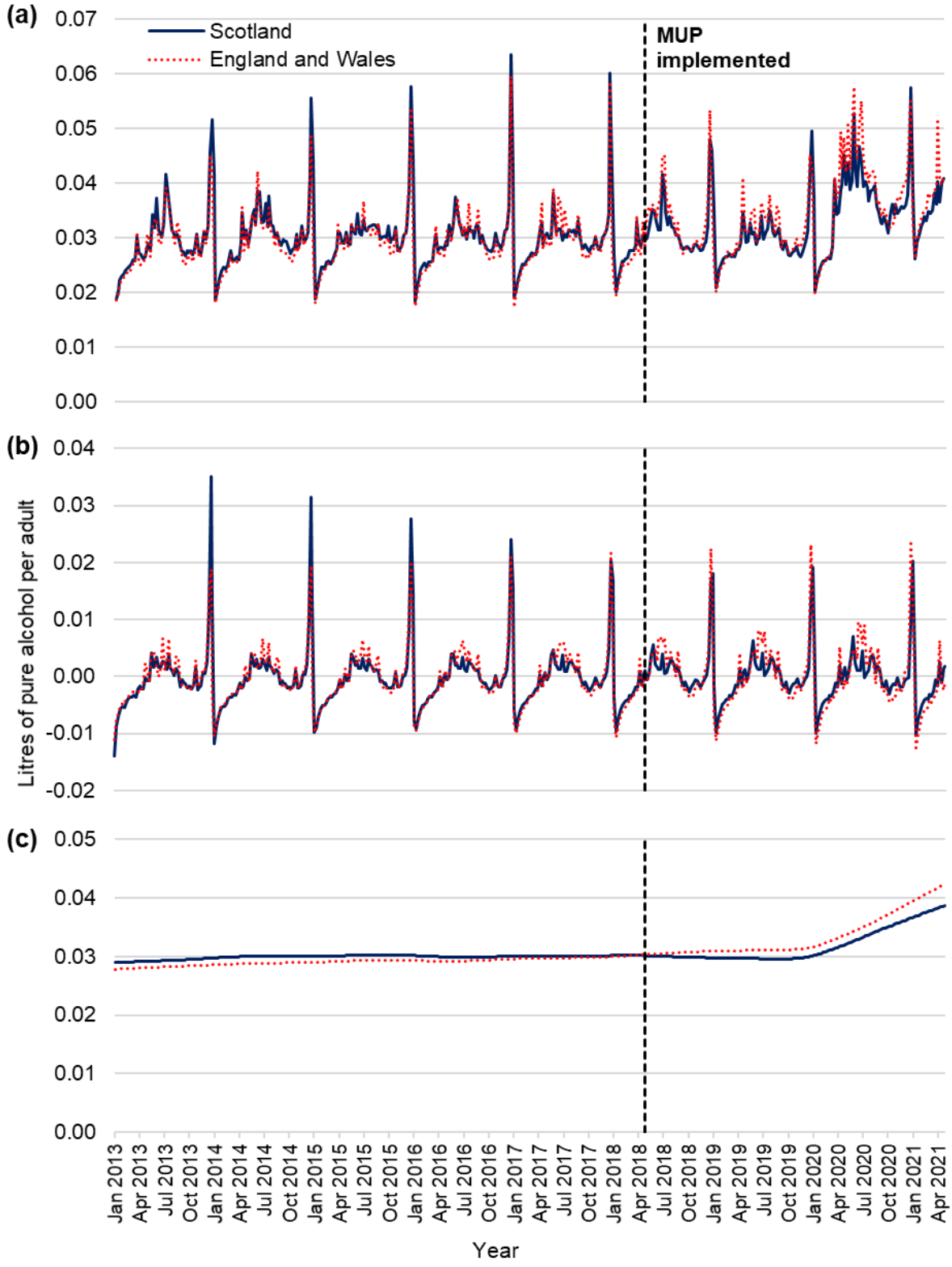


Figure A4: Volume of pure alcohol sold as beer through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Spirits

Figure A5: Total volume of pure alcohol sold as spirits (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

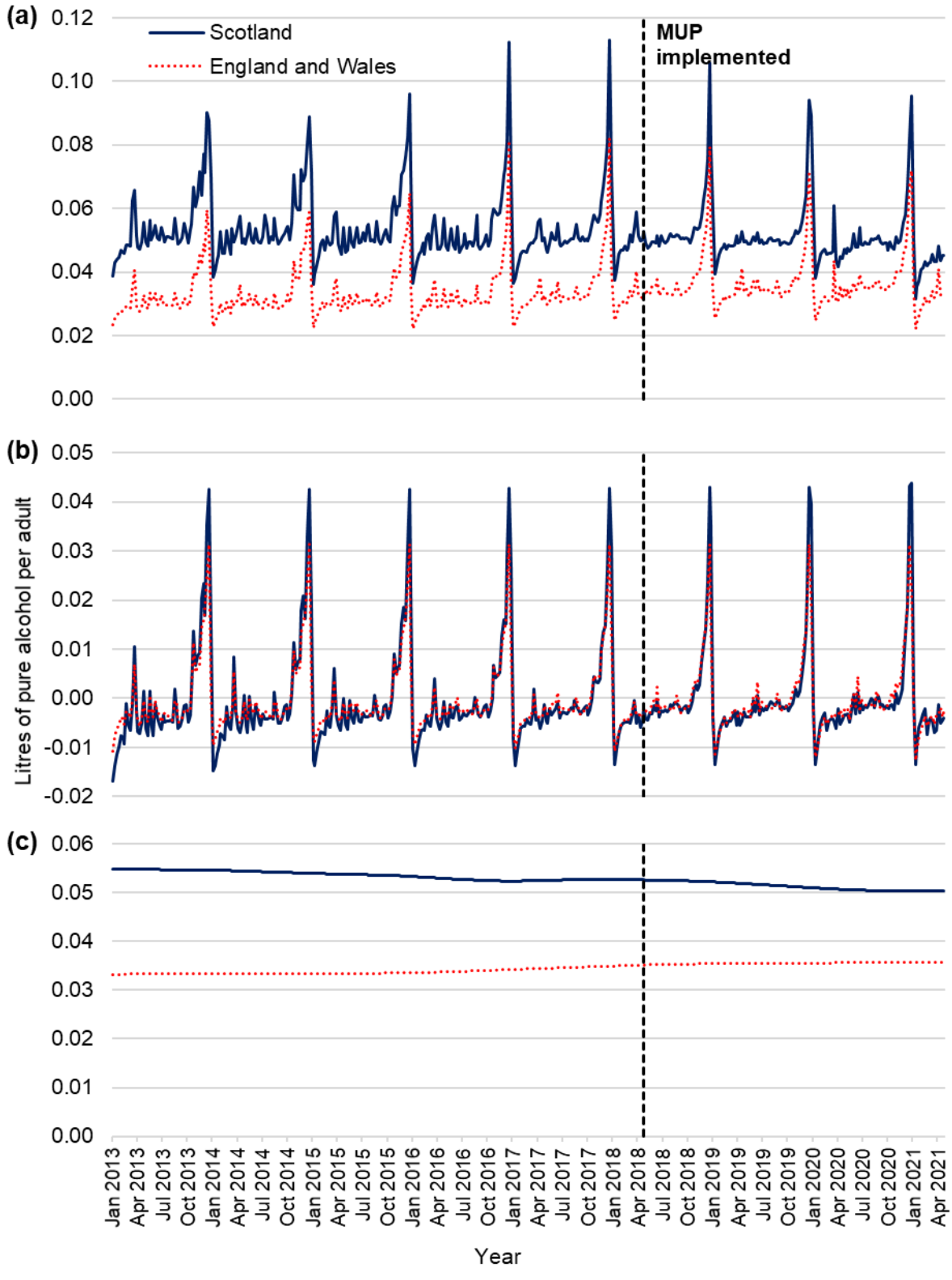
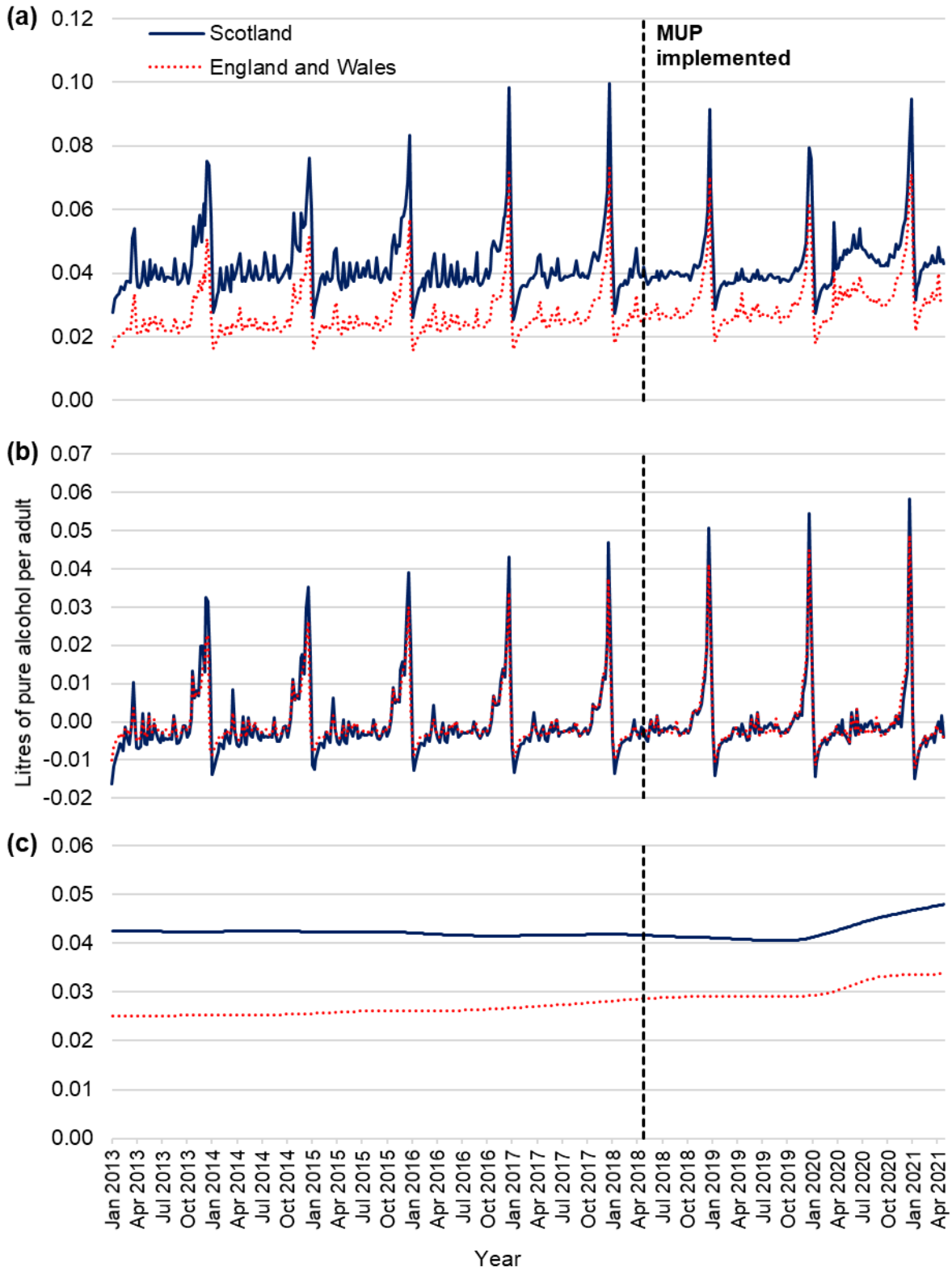


Figure A6: Volume of pure alcohol sold as spirits through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Wine

Figure A7: Total volume of pure alcohol sold as wine (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

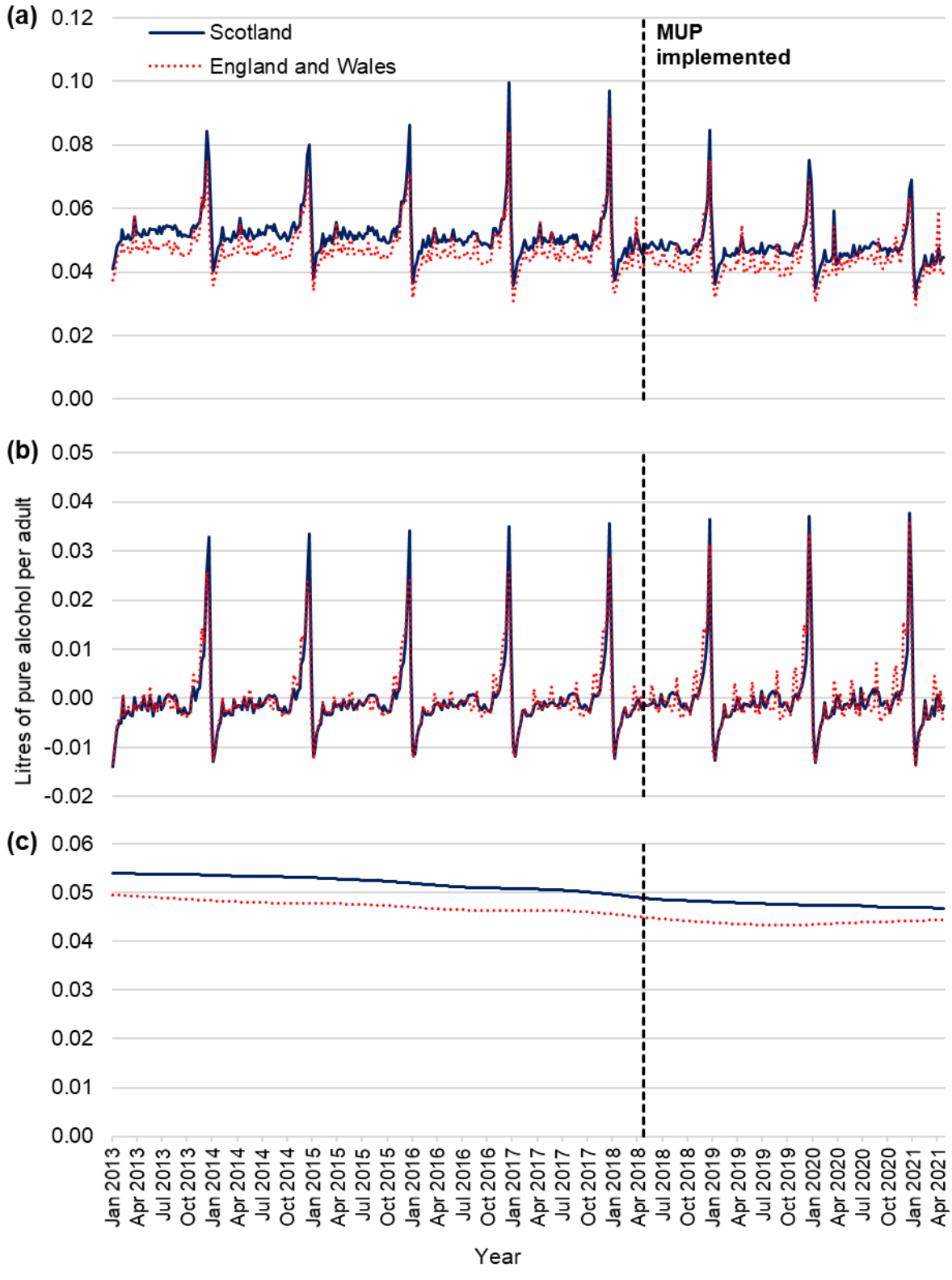
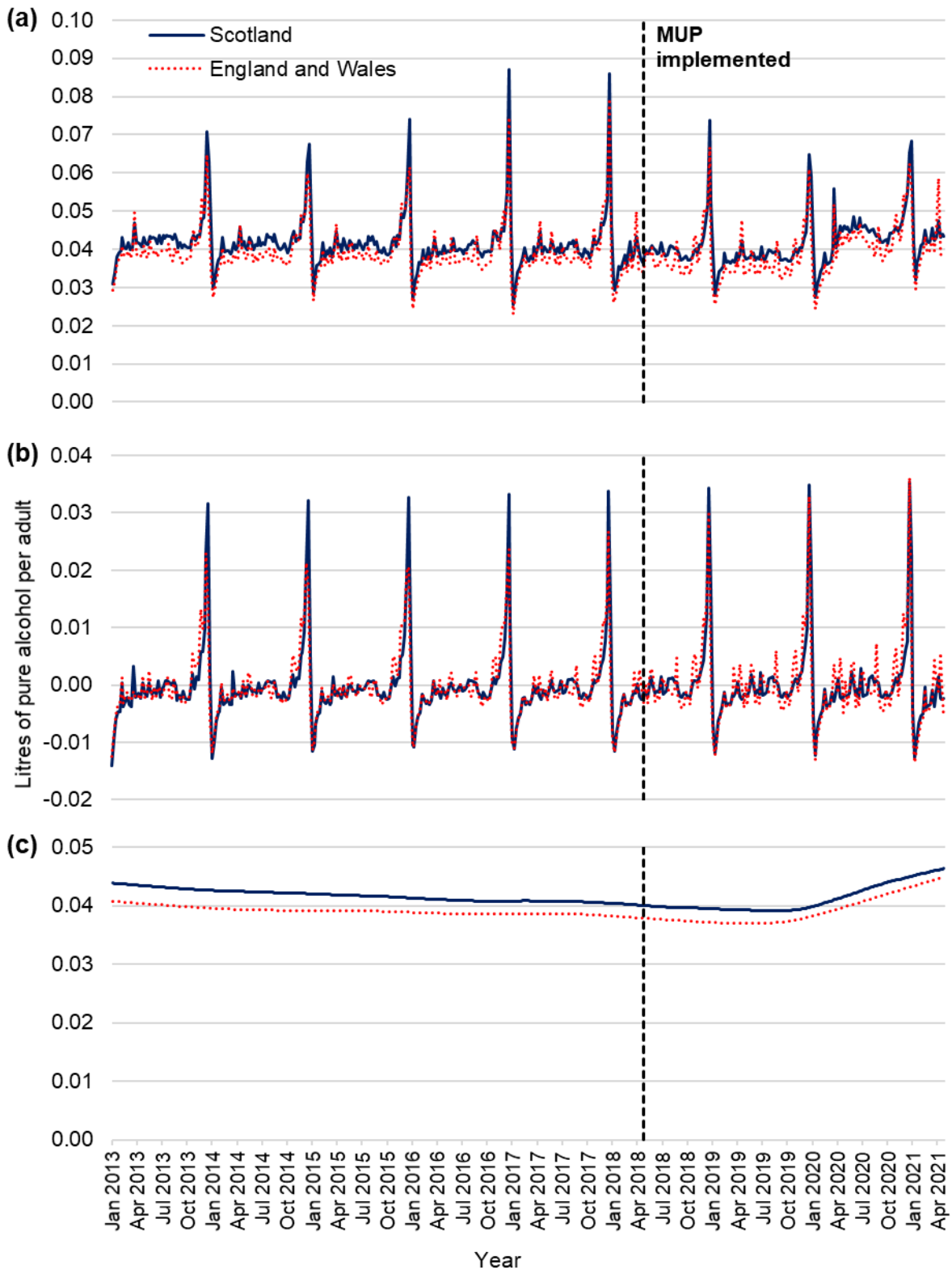


Figure A8: Volume of pure alcohol sold as wine through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Cider

Figure A9: Total volume of pure alcohol sold as cider (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

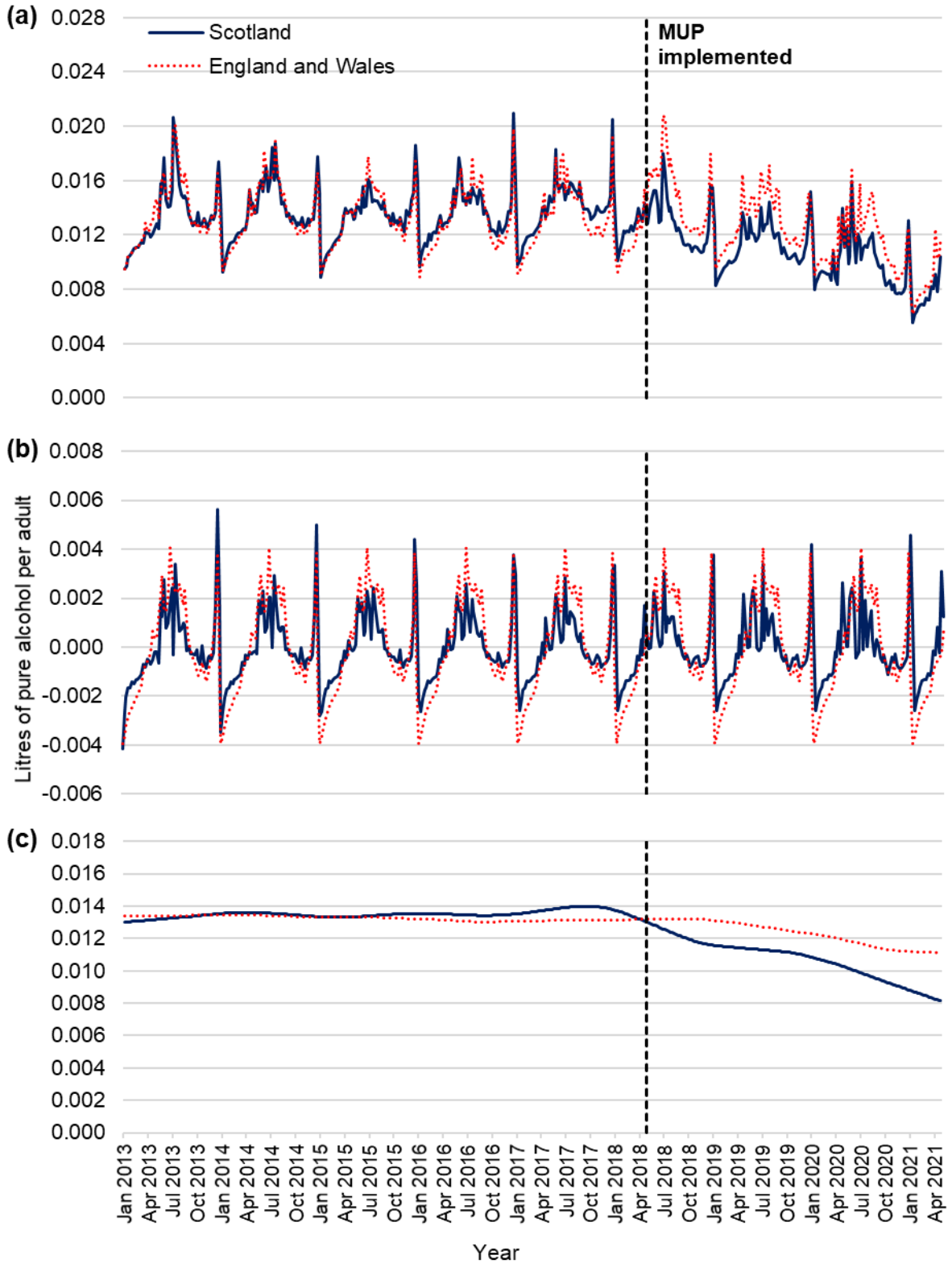
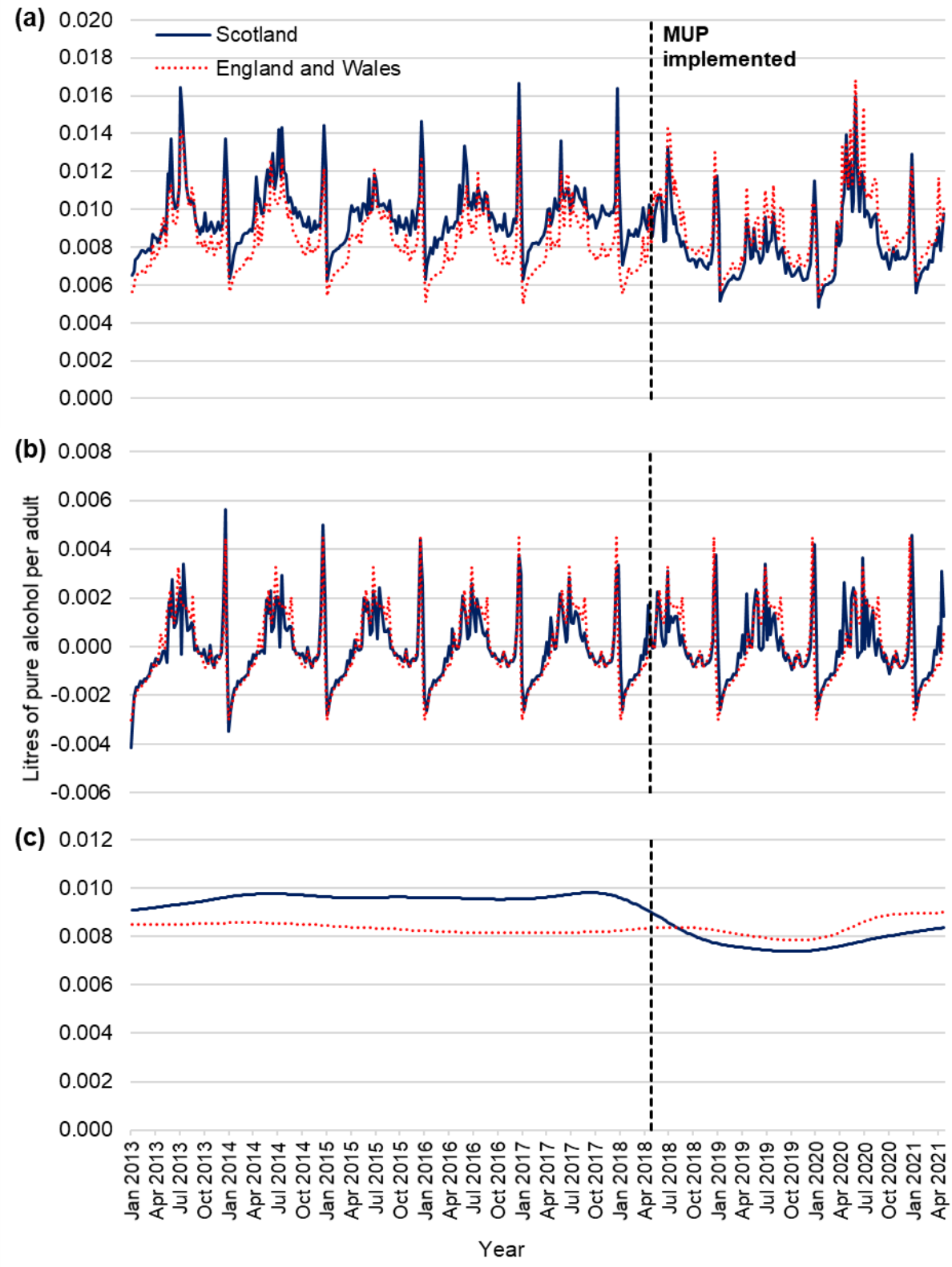


Figure A10: Volume of pure alcohol sold as cider through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Fortified wine

Figure A11: Total volume of pure alcohol sold as fortified wine (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

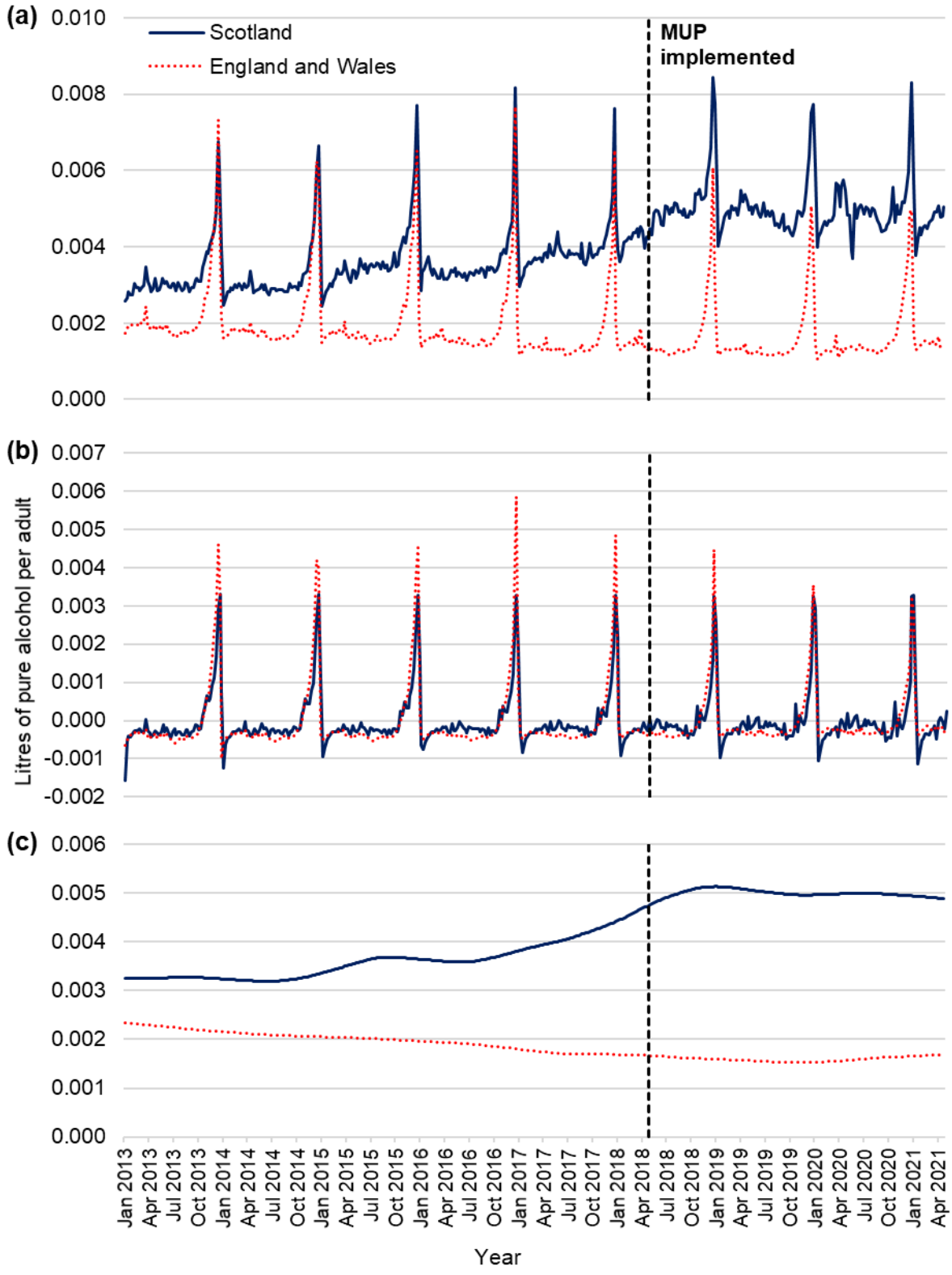
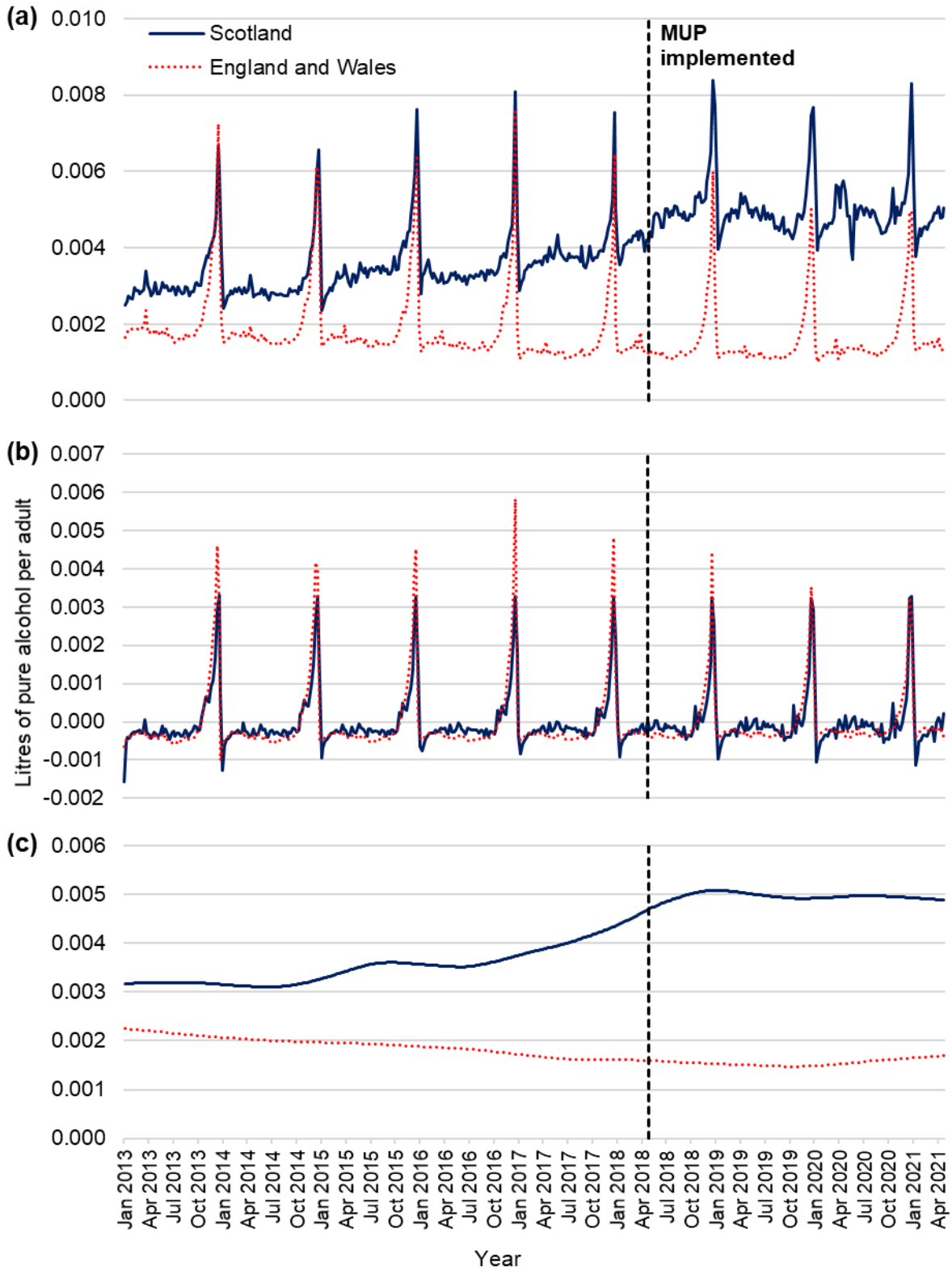


Figure A12: Volume of pure alcohol sold as fortified wine through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Ready-to-drink beverages (RTDs)

Figure A13: Total volume of pure alcohol sold as RTDs (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

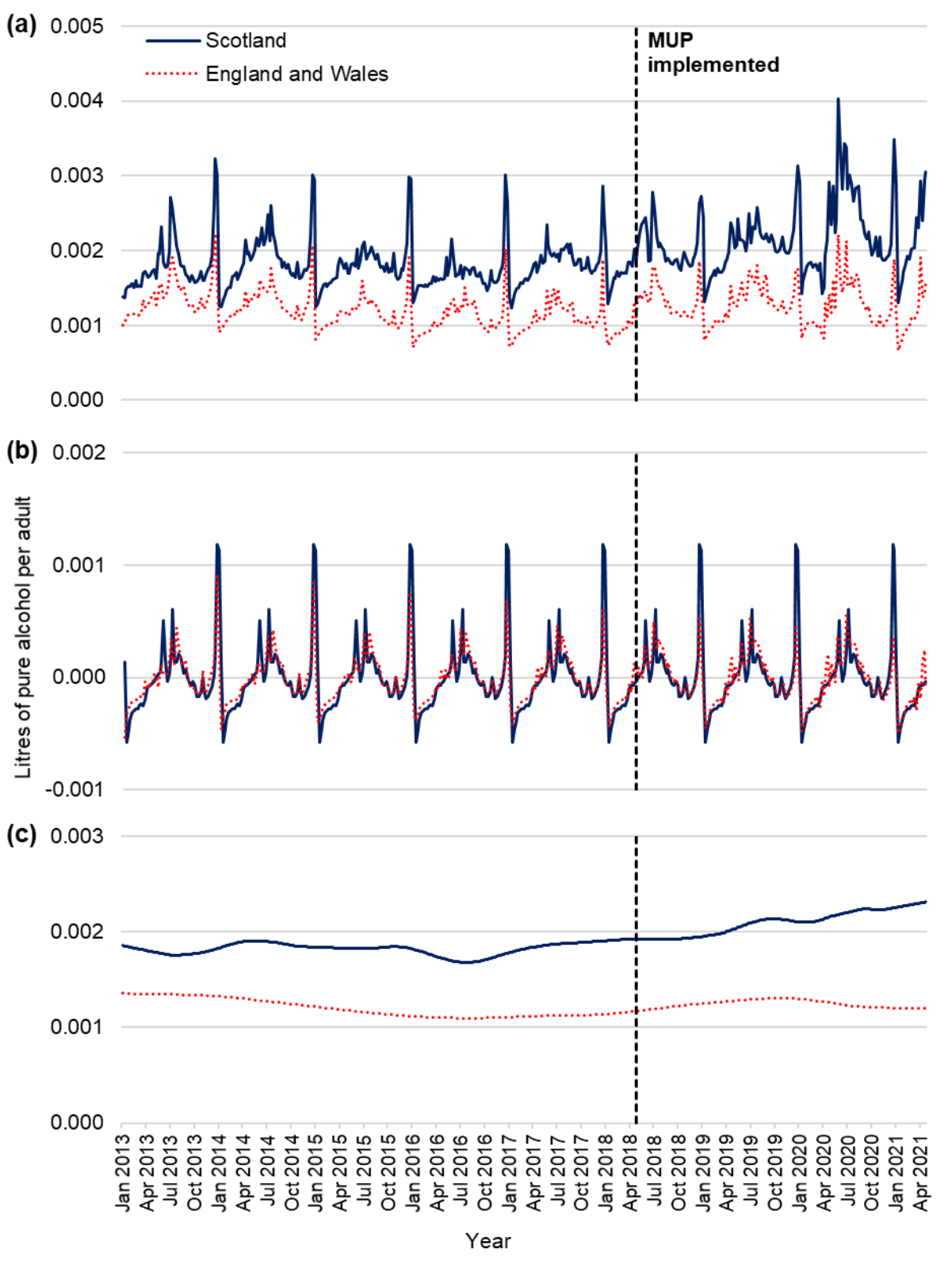
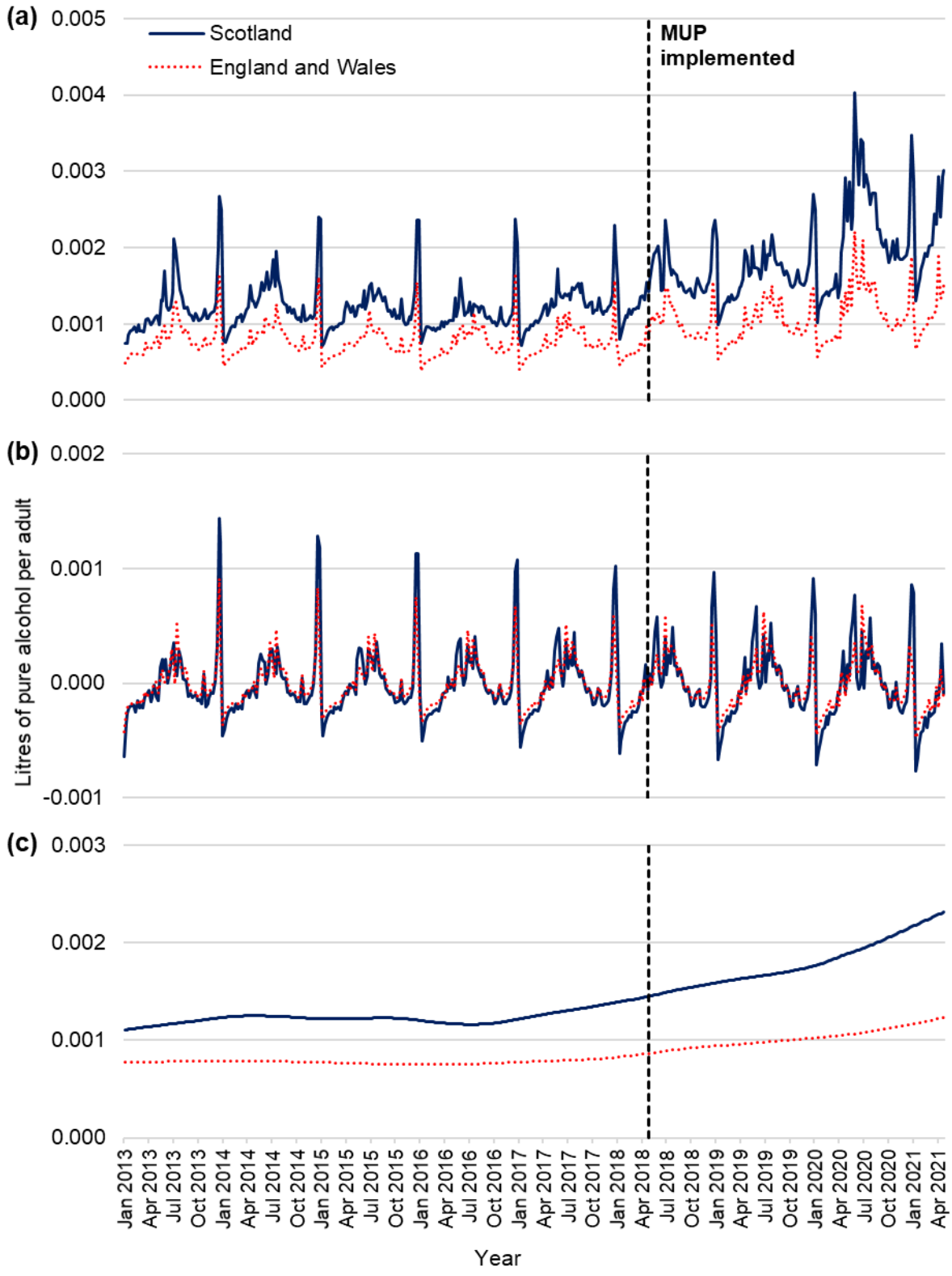


Figure A14: Volume of pure alcohol sold as RTDs through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Perry

Figure A15: Total volume of pure alcohol sold as perry (on- and off-trade combined) in Scotland and England & Wales, weekly, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components

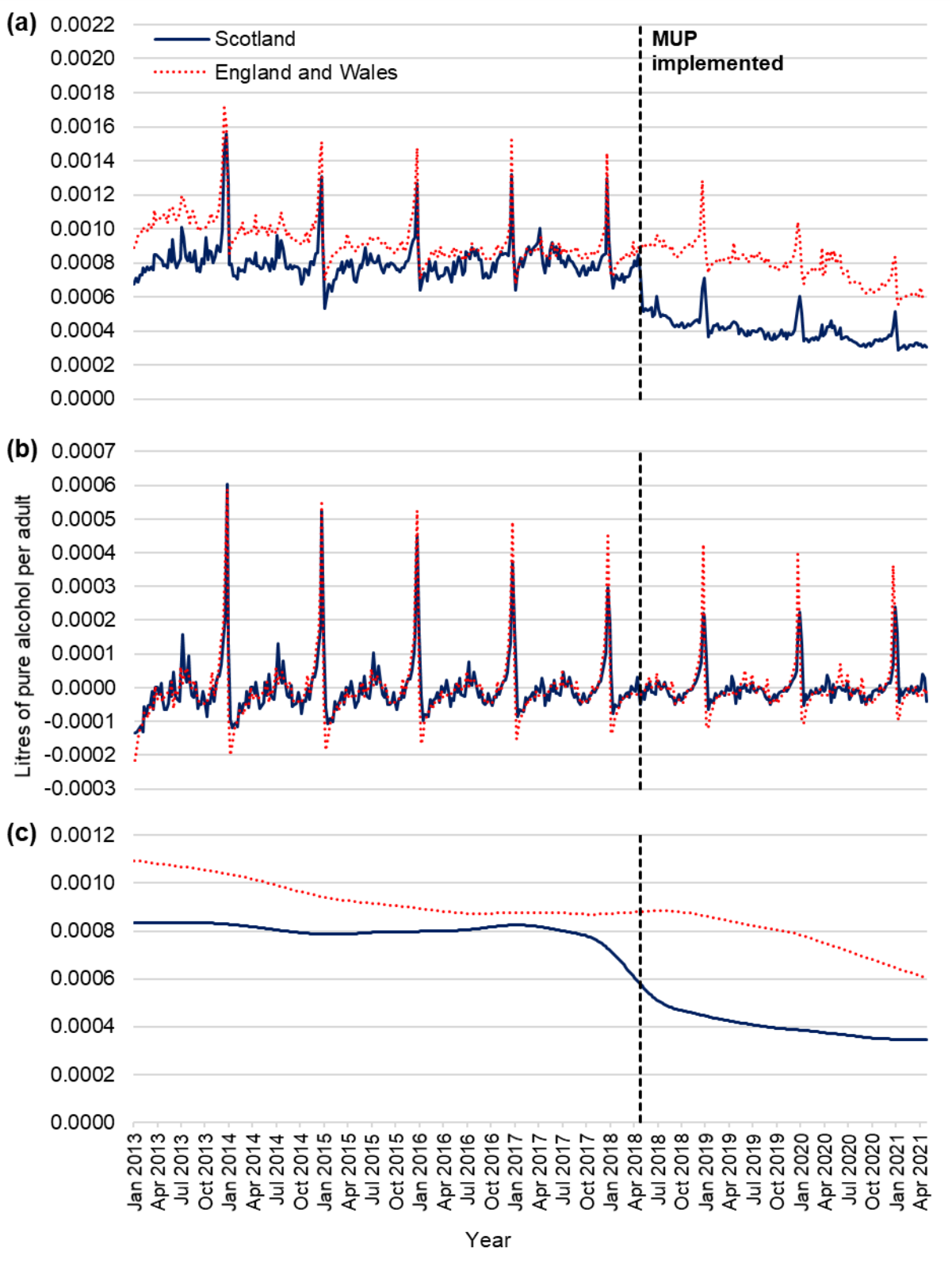
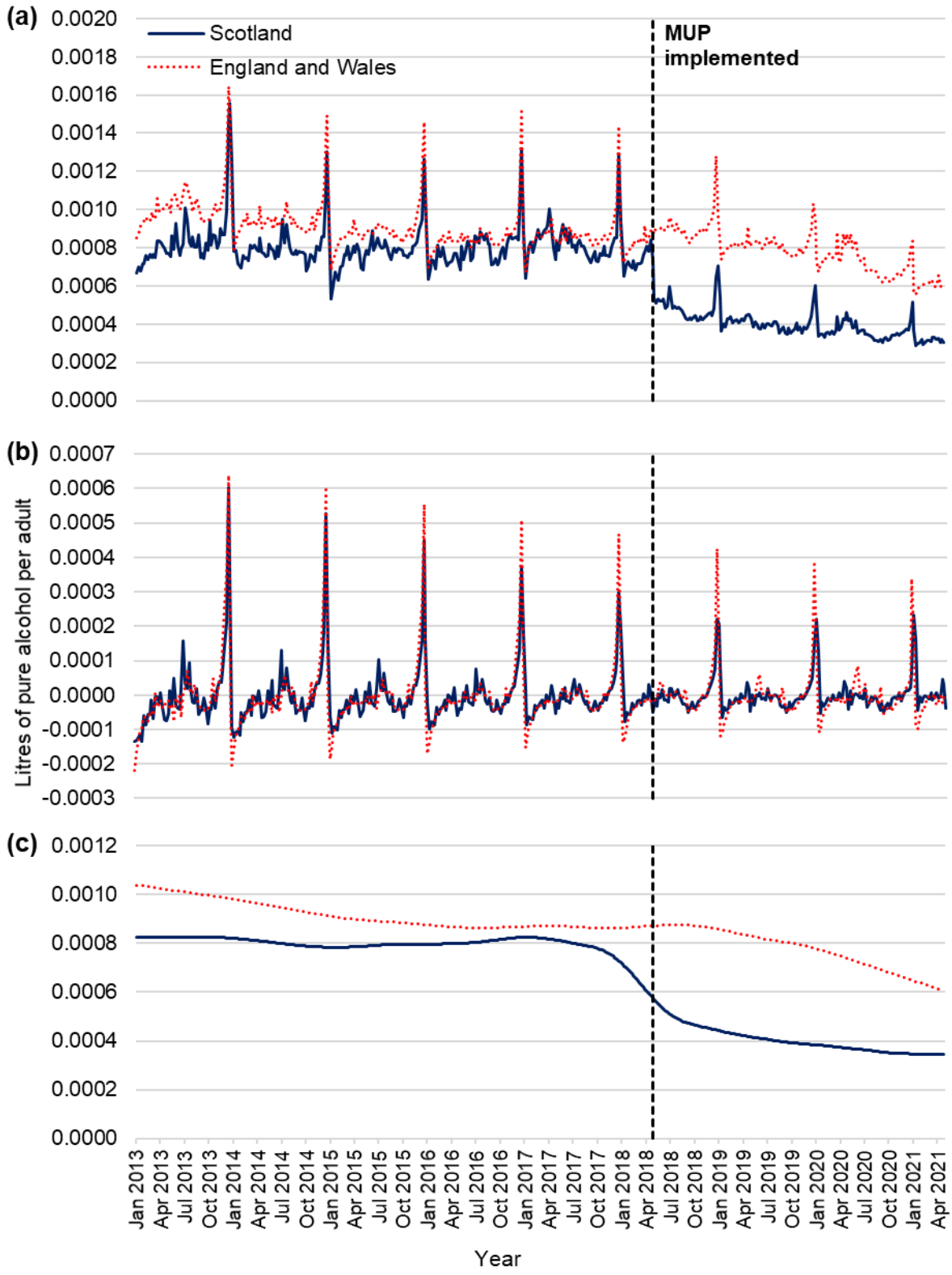


Figure A16: Volume of pure alcohol sold as perry through the off-trade in Scotland and England & Wales, January 2013 to May 2021, (a) weekly trend, and decomposed (b) seasonal and (c) trend components



Appendix 6: Interrupted time series – results tables

Throughout this section the following abbreviations are used:

LCI – Lower confidence interval (95%)

UCI – Upper confidence interval (95%)

RTDs – Ready-to-drink beverages

Key to notes:

1. Controlled: model includes trends in alcohol sales in England & Wales as a covariate.
2. Adjusted: model includes trends in household disposable income and, for analyses of specific drink categories, sales of the other drink categories as covariates.
3. Adjusted: model include trends in household disposable income, on-trade sales and, for analyses of specific drink categories, sales of the other drink categories as covariates.
4. Adjusted: model include trends in household disposable income.
5. Models are adjusted for underlying seasonal and secular trends.
6. Models are adjusted for the introduction of COVID-related restrictions.
7. Models are adjusted for the introduction of MUP in Wales.
8. Post-intervention study period is truncated to 22 months post-MUP (February 2020) due to the introduction of COVID-related restrictions and/or the introduction of MUP in Wales.
9. No results for perry are presented due to there being no on-trade perry sales recorded in Scotland in some weeks.
10. Controlled: model includes trends in alcohol sales in NE or NW England, as indicated, as a covariate.

11. Pre-intervention study period starts January 2017 due to availability of IRI data; results using Nielsen data were reproduced using the same pre-intervention time period for comparability.

Primary outcomes

Table A1: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-1.1%	-2.9%	0.8%	0.263
Spirits	-0.7%	-3.0%	1.6%	0.559
Beer	0.3%	-3.5%	4.2%	0.887
Wine	-1.5%	-3.0%	0.0%	0.044
Cider	-6.5%	-13.2%	0.8%	0.077
Perry	-33.2%	-38.5%	-27.5%	<0.001
Fortified wine	15.1%	7.0%	23.8%	<0.001
RTDs	11.0%	-0.7%	24.0%	0.065

Notes: 5, 6 (see key to notes on page 73)

Table A2: Change (%) in total (on- and off-trade combined) alcohol sales in England & Wales in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	2.4%	0.0%	4.9%	0.051
Spirits	3.1%	-0.7%	7.1%	0.108
Beer	5.6%	0.8%	10.5%	0.021
Wine	-3.4%	-5.0%	-1.7%	<0.001
Cider	11.7%	6.2%	17.6%	<0.001
Perry	6.7%	-3.3%	17.9%	0.196
Fortified wine	-2.1%	-9.2%	5.5%	0.569
RTDs	9.7%	0.6%	19.7%	0.037

Notes: 5, 6, 7 (see key to notes on page 73)

Table A3: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-2.9%	-4.0%	-1.9%	<0.001
Spirits	-4.8%	-6.5%	-3.2%	<0.001
Beer	-3.0%	-4.4%	-1.7%	<0.001
Wine	0.2%	-0.6%	1.1%	0.583
Cider	-15.0%	-18.5%	-11.3%	<0.001
Perry	-34.4%	-40.0%	-28.1%	<0.001
Fortified wine	15.3%	9.8%	21.2%	<0.001
RTDs	-2.8%	-9.2%	4.2%	0.425

Notes: 1, 5, 6, 7 (see key to notes on page 73)

Table A4: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-3.0%	-4.2%	-1.8%	<0.001
Spirits	-4.9%	-6.6%	-3.1%	<0.001
Beer	-2.3%	-3.9%	-0.7%	0.006
Wine	0.6%	-0.6%	1.7%	0.325
Cider	-13.5%	-16.9%	-10.0%	<0.001
Perry	-31.6%	-38.4%	-24.1%	<0.001
Fortified wine	13.5%	7.5%	19.8%	<0.001
RTDs	-0.5%	-6.9%	6.3%	0.878

Notes: 1, 2, 5, 6, 7 (see key to notes on page 73)

Table A5: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-1.3%	-3.2%	0.6%	0.187
Spirits	-2.0%	-4.7%	0.8%	0.159
Beer	0.7%	-1.9%	3.2%	0.610
Wine	-0.7%	-1.9%	0.5%	0.254
Cider	-10.5%	-17.7%	-2.8%	0.008
Perry	-34.5%	-39.4%	-29.2%	<0.001
Fortified wine	15.2%	6.9%	24.1%	<0.001
RTDs	17.9%	4.3%	33.3%	0.008

Notes: 5, 6 (see key to notes on page 73)

Table A6: Change (%) in off-trade alcohol sales in England & Wales in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	2.5%	0.2%	4.9%	0.035
Spirits	3.3%	0.8%	5.8%	0.010
Beer	5.2%	2.2%	8.2%	<0.001
Wine	-3.0%	-4.2%	-1.7%	<0.001
Cider	14.7%	7.1%	22.9%	<0.001
Perry	7.5%	-1.1%	16.8%	0.089
Fortified wine	-1.9%	-9.2%	6.0%	0.627
RTDs	19.0%	4.2%	35.9%	0.010

Notes: 5, 6, 7 (see key to notes on page 73)

Table A7: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-3.2%	-4.3%	-2.2%	<0.001
Spirits	-5.6%	-6.9%	-4.2%	<0.001
Beer	-3.1%	-4.8%	-1.3%	<0.001
Wine	1.0%	0.3%	1.7%	0.007
Cider	-23.9%	-25.8%	-21.9%	<0.001
Perry	-34.9%	-40.3%	-28.9%	<0.001
Fortified wine	15.4%	9.8%	21.4%	<0.001
RTDs	2.2%	-5.3%	10.3%	0.577

Notes: 1, 5, 6, 7 (see key to notes on page 73)

Table A8: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-3.6%	-4.8%	-2.5%	<0.001
Spirits	-5.5%	-7.5%	-3.4%	<0.001
Beer	-1.6%	-3.7%	0.5%	0.140
Wine	1.8%	0.8%	2.8%	<0.001
Cider	-21.5%	-24.6%	-18.3%	<0.001
Perry	-31.3%	-37.7%	-24.2%	<0.001
Fortified wine	13.8%	8.6%	19.3%	<0.001
RTDs	3.6%	-3.4%	11.1%	0.321

Notes: 1, 3, 5, 6, 7 (see key to notes on page 73)

Secondary outcome

Table A9: Change (%) in on-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-0.2%	-2.8%	2.5%	0.901
Spirits	0.2%	-2.1%	2.5%	0.860
Beer	-0.4%	-2.5%	1.6%	0.671
Wine	0.0%	-1.3%	2.0%	0.942
Cider	0.0%	-0.5%	0.5%	0.770
Perry				
Fortified wine	0.7%	-0.6%	2.0%	0.283
RTDs	-0.5%	-1.4%	0.4%	0.309

Notes: 5, 8, 9 (see key to notes on page 73)

Table A10: Change (%) in on-trade alcohol sales in England & Wales in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	0.1%	-2.1%	2.4%	0.913
Spirits	0.1%	-2.7%	2.9%	0.954
Beer	0.4%	-1.4%	2.1%	0.686
Wine	-0.2%	-2.2%	1.8%	0.858
Cider	0.5%	-1.9%	3.0%	0.683
Perry	0.9%	-3.0%	4.9%	0.670
Fortified wine	0.0%	-2.1%	2.1%	0.966
RTDs	-0.1%	-1.5%	1.3%	0.902

Notes: 5, 8 (see key to notes on page 73)

Table A11: Change (%) in on-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	0.0%	-0.3%	0.3%	0.283
Spirits	0.0%	-0.3%	0.3%	0.960
Beer	0.1%	0.0%	0.2%	0.097
Wine	-0.2%	-0.4%	0.0%	0.053
Cider	-0.2%	-0.5%	0.5%	0.945
Perry				
Fortified wine	0.3%	-0.5%	1.1%	0.507
RTDs	-0.5%	-1.1%	0.1%	0.093

Notes: 1, 5, 8, 9 (see key to notes on page 73)

Table A12: Change (%) in on-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	0.0%	-0.2%	0.1%	0.465
Spirits	0.0%	-0.3%	0.3%	0.945
Beer	0.1%	-0.1%	0.2%	0.289
Wine	-0.2%	-0.4%	0.0%	0.027
Cider	-0.1%	-0.7%	0.4%	0.606
Perry				
Fortified wine	0.4%	-0.3%	1.0%	0.286
RTDs	-0.5%	-1.1%	0.1%	0.109

Notes: 1, 4, 5, 8, 9 (see key to notes on page 73)

Supplementary and sensitivity analyses

Excluding on-trade adjustment (off-trade only)

Table A13: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled (excluding on-trade adjustment))

Drink category	MUP effect	LCI	UCI	p value
All	-3.6%	-4.8%	-2.5%	<0.001
Spirits	-5.7%	-7.3%	-4.2%	<0.001
Beer	-1.8%	-3.8%	0.3%	0.191
Wine	2.0%	0.8%	3.2%	<0.001
Cider	-19.7%	-23.4%	-16.2%	<0.001
Perry	-32.3%	-40.1%	-23.4%	<0.001
Fortified wine	13.5%	8.0%	19.3%	<0.001
RTDs	3.5%	-3.0%	10.3%	0.310

Notes: 1, 2, 5, 6, 7 (see key to notes on page 73)

Using a shorter post-intervention time period

Table A14: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland after MUP was implemented, by drink category (unadjusted, no control), using a shorter post-intervention time period

Drink category	MUP effect	LCI	UCI	p value
All	-1.0%	-2.4%	0.5%	0.180
Spirits	-0.6%	-3.0%	1.9%	0.633
Beer	-0.3%	-2.1%	1.6%	0.773
Wine	-1.6%	-2.4%	-0.7%	<0.001
Cider	-9.8%	-18.0%	-0.7%	0.034
Perry	-33.8%	-39.0%	-28.0%	<0.001
Fortified wine	12.3%	3.3%	22.2%	0.006
RTDs	13.8%	7.2%	20.8%	<0.001

Notes: 5, 8 (see key to notes on page 73)

Table A15: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland after MUP was implemented, by drink category (adjusted, controlled), using a shorter post-intervention time period

Drink category	MUP effect	LCI	UCI	p value
All	-3.5%	-4.4%	-2.6%	<0.001
Spirits	-5.3%	-7.2%	-3.4%	<0.001
Beer	-2.6%	-3.9%	-1.3%	<0.001
Wine	0.5%	-0.6%	1.6%	0.351
Cider	-17.1%	-20.0%	-14.1%	<0.001
Perry	-31.6%	-37.8%	-24.7%	<0.001
Fortified wine	11.3%	3.9%	19.2%	0.002
RTDs	2.7%	-2.3%	8.0%	0.296

Notes: 1, 2, 5, 8 (see key to notes on page 69)

Table A16: Change (%) in off-trade alcohol sales in Scotland after MUP was implemented, by drink category (unadjusted, no control), using a shorter post-intervention time period

Drink category	MUP effect	LCI	UCI	p value
All	-1.3%	-3.0%	0.6%	0.172
Spirits	-2.0%	-4.6%	0.7%	0.145
Beer	1.0%	-1.7%	3.8%	0.479
Wine	-0.8%	-1.8%	0.2%	0.113
Cider	-13.9%	-22.8%	-4.0%	0.007
Perry	-34.0%	-39.3%	-28.3%	<0.001
Fortified wine	12.4%	3.1%	22.6%	0.008
RTDs	21.3%	11.9%	31.6%	<0.001

Notes: 5, 8 (see key to notes on page 73)

Table A17: Change (%) in off-trade alcohol sales in Scotland after MUP was implemented, by drink category (adjusted, controlled), using a shorter post-intervention time period

Drink category	MUP effect	LCI	UCI	p value
All	-4.0%	-5.2%	-2.8%	<0.001
Spirits	-6.8%	-9.0%	-4.6%	<0.001
Beer	-2.1%	-4.2%	0.1%	0.058
Wine	1.7%	0.7%	2.7%	<0.001
Cider	-23.8%	-27.3%	-20.1%	<0.001
Perry	-31.8%	-37.6%	-25.4%	<0.001
Fortified wine	11.1%	3.3%	19.4%	0.004
RTDs	6.0%	-0.2%	12.5%	0.056

Notes: 1, 3, 5, 8 (see key to notes on page 73)

Net difference in alcohol sales (Scotland minus England & Wales)

Table A18: Change (%) in total (on- and off-trade combined) alcohol sales in the three years after MUP was implemented, Scotland minus England & Wales, by drink category (unadjusted)

Drink category	MUP effect	LCI	UCI	p value
All	-3.3%	-4.4%	-2.2%	<0.001
Spirits	-6.3%	-8.1%	-4.4%	<0.001
Beer	-4.4%	-5.7%	-3.1%	<0.001
Wine	2.1%	1.1%	3.1%	<0.001
Cider	-18.3%	-20.1%	-16.4%	<0.001
Perry	-33.7%	-40.1%	-26.6%	<0.001
Fortified wine	17.8%	11.2%	24.9%	<0.001
RTDs	-1.9%	-7.3%	3.8%	0.503

Notes: 5, 6, 7 (see key to notes on page 73)

Table A19: Change (%) in total (on- and off-trade combined) alcohol sales in the three years after MUP was implemented, Scotland minus England & Wales, by drink category (adjusted)

Drink category	MUP effect	LCI	UCI	p value
All	-3.2%	-4.5%	-1.9%	<0.001
Spirits	-3.3%	-5.1%	-1.4%	<0.001
Beer	-2.2%	-3.9%	-0.5%	0.011
Wine	5.9%	4.6%	7.2%	<0.001
Cider	-16.7%	-18.6%	-14.8%	<0.001
Perry	-30.4%	-37.3%	-22.6%	<0.001
Fortified wine	24.7%	16.5%	33.5%	<0.001
RTDs	3.6%	-2.4%	9.9%	0.249

Notes: 2, 5, 6, 7 (see key to notes on page 73)

Table A20: Change (%) in off-trade alcohol sales in the three years after MUP was implemented, Scotland minus England & Wales, by drink category (unadjusted)

Drink category	MUP effect	LCI	UCI	p value
All	-3.9%	-5.0%	-2.7%	<0.001
Spirits	-6.4%	-7.9%	-4.8%	<0.001
Beer	-4.4%	-5.8%	-2.9%	<0.001
Wine	2.5%	1.8%	3.3%	<0.001
Cider	-25.1%	-27.1%	-23.0%	<0.001
Perry	-34.8%	-40.8%	-28.1%	<0.001
Fortified wine	17.9%	11.0%	25.2%	<0.001
RTDs	-2.2%	-9.8%	6.1%	0.593

Notes: 5, 6, 7 (see key to notes on page 73)

Table A21: Change (%) in off-trade alcohol sales in the three years after MUP was implemented, Scotland minus England & Wales, by drink category (adjusted)

Drink category	MUP effect	LCI	UCI	p value
All	-4.3%	-5.6%	-3.1%	<0.001
Spirits	-3.9%	-5.6%	-2.1%	<0.001
Beer	-1.5%	-2.8%	-0.2%	0.020
Wine	5.8%	4.8%	6.9%	<0.001
Cider	-23.6%	-25.5%	-21.7%	<0.001
Perry	-38.0%	-40.5%	-35.4%	<0.001
Fortified wine	27.2%	20.4%	34.3%	<0.001
RTDs	4.8%	-2.4%	12.5%	0.198

Notes: 3, 5, 6, 7 (see key to notes on page 73)

Adjusting for alcohol sales in Aldi and Lidl

Table A22: Change (%) in total (on- and off-trade combined) alcohol sales, including uplift for Aldi and Lidl sales, in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-1.5%	-3.5%	0.6%	0.166
Spirits	-1.5%	-4.0%	0.9%	0.220
Beer	-0.3%	-3.8%	3.4%	0.880
Wine	-1.6%	-3.7%	0.5%	0.135
Cider	-5.7%	-12.7%	1.9%	0.137
Perry	-33.1%	-38.6%	-27.1%	<0.001
Fortified wine	14.8%	6.6%	23.7%	<0.001
RTDs	11.4%	-0.3%	24.5%	0.056

Notes: 5, 6 (see key to notes on page 73)

Table A23: Change (%) in total (on- and off-trade combined) alcohol sales, including uplift for Aldi and Lidl sales, in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-3.6%	-4.9%	-2.3%	<0.001
Spirits	-5.5%	-7.3%	-3.7%	<0.001
Beer	-3.0%	-4.7%	-1.2%	<0.001
Wine	0.1%	-1.2%	1.3%	0.908
Cider	-13.0%	-16.5%	-9.4%	<0.001
Perry	-31.6%	-38.3%	-24.2%	<0.001
Fortified wine	13.6%	8.0%	19.4%	<0.001
RTDs	-0.4%	-6.8%	6.4%	0.901

Notes: 1, 2, 5, 6, 7 (see key to notes on page 73)

Table A24: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-1.5%	-3.7%	0.9%	0.216
Spirits	-2.8%	-5.6%	0.0%	0.052
Beer	-0.7%	-3.5%	2.3%	0.646
Wine	-1.2%	-2.7%	0.2%	0.092
Cider	-10.2%	-17.6%	-2.1%	0.014
Perry	-34.2%	-39.4%	-28.5%	<0.001
Fortified wine	14.9%	6.5%	24.0%	<0.001
RTDs	17.7%	4.0%	33.1%	0.009

Notes: 5, 6 (see key to notes on page 73)

Table A25: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-4.4%	-5.7%	-3.1%	<0.001
Spirits	-6.2%	-7.7%	-4.6%	<0.001
Beer	-2.8%	-5.0%	-0.5%	0.015
Wine	1.2%	0.3%	2.1%	0.008
Cider	-18.6%	-22.3%	-14.9%	<0.001
Perry	-31.3%	-37.6%	-24.2%	<0.001
Fortified wine	13.7%	8.5%	19.2%	<0.001
RTDs	6.2%	-0.4%	13.3%	0.066

Notes: 1, 3, 5, 6, 7 (see key to notes on page 73)

Litres of pure alcohol per adult drinker

Table A26: Change (%) in total (on- and off-trade combined) alcohol sales, litres per adult drinker, in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-1.4%	-3.3%	0.4%	0.129
Spirits	-1.0%	-3.4%	1.5%	0.430
Beer	0.0%	-3.8%	4.0%	0.998
Wine	-2.0%	-3.4%	-0.5%	0.009
Cider	-6.6%	-13.3%	0.6%	0.072
Perry	-33.3%	-38.7%	-27.5%	<0.001
Fortified wine	14.9%	6.8%	23.7%	<0.001
RTDs	10.8%	-0.8%	23.8%	0.068

Notes: 5, 6 (see key to notes on page 73)

Table A27: Change (%) in total (on- and off-trade combined) alcohol sales, litres per adult drinker, in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-3.7%	-5.2%	-2.3%	<0.001
Spirits	-5.1%	-6.6%	-3.6%	<0.001
Beer	-2.9%	-4.6%	-1.1%	0.001
Wine	0.2%	-0.8%	1.3%	0.674
Cider	-13.5%	-17.0%	-9.8%	<0.001
Perry	-31.6%	-38.5%	-23.9%	<0.001
Fortified wine	13.4%	7.4%	19.7%	<0.001
RTDs	-0.6%	-7.0%	6.3%	0.860

Notes: 1, 2, 5, 6, 7 (see key to notes on page 73)

Table A28: Change (%) in off-trade alcohol sales, litres per adult drinker, in Scotland in the three years after MUP was implemented, by drink category (unadjusted, no control)

Drink category	MUP effect	LCI	UCI	p value
All	-1.0%	-3.3%	1.3%	0.374
Spirits	-2.4%	-5.1%	0.4%	0.088
Beer	-0.2%	-2.7%	2.4%	0.881
Wine	-1.0%	-2.4%	0.3%	0.141
Cider	-10.7%	-16.5%	-4.6%	<0.001
Perry	-33.1%	-38.7%	-26.9%	<0.001
Fortified wine	15.0%	6.7%	24.0%	<0.001
RTDs	17.8%	4.2%	33.1%	0.009

Notes: 5, 6 (see key to notes on page 73)

Table A29: Change (%) in off-trade alcohol sales, litres per adult drinker, in Scotland in the three years after MUP was implemented, by drink category (adjusted, controlled)

Drink category	MUP effect	LCI	UCI	p value
All	-4.4%	-5.7%	-3.1%	<0.001
Spirits	-6.2%	-7.5%	-4.8%	<0.001
Beer	-2.1%	-4.2%	0.1%	0.056
Wine	1.6%	0.6%	2.5%	<0.001
Cider	-20.4%	-23.9%	-16.8%	<0.001
Perry	-31.2%	-37.7%	-24.1%	<0.001
Fortified wine	13.8%	8.5%	19.2%	<0.001
RTDs	6.3%	-0.4%	13.4%	0.065

Notes: 1, 3, 5, 6, 7 (see key to notes on page 73)

Alternative geographical control

Table A30: Change (%) in total (on- and off-trade combined) alcohol sales in NE and NW England, and in Scotland (with NE and NW England as control) in the three years after MUP was implemented

Model	MUP effect	LCI	UCI	p value
North East (NE) (unadjusted, no control)	3.0%	0.8%	5.2%	0.007
Scotland (adjusted, NE control)	-4.3%	-5.5%	-3.2%	<0.001
North West (NW) (unadjusted, no control)	2.0%	-0.3%	4.4%	0.082
Scotland (adjusted, NW control)	-4.2%	-5.6%	-2.7%	<0.001

Notes: All models: 5, 6, 7. Adjusted and controlled models: 2, 10 (see key to notes on page 73)

Table A31: Change (%) in off-trade alcohol sales in NE and NW England, and in Scotland (with NE and NW England as control) in the three years after MUP was implemented

Model	MUP effect	LCI	UCI	p value
North East (NE) (unadjusted, no control)	3.4%	1.5%	5.3%	<0.001
Scotland (adjusted, NE control)	-5.2%	-6.7%	-3.7%	<0.001
North West (NW) (unadjusted, no control)	2.4%	0.2%	4.6%	0.030
Scotland (adjusted, NW control)	-4.3%	-5.8%	-2.7%	<0.001

Notes: All models: 5, 6, 7. Adjusted and controlled models: 3, 10 (see key to notes on page 73)

Using a different source of off-trade alcohol retail sales data

Table A32: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented, IRI and Nielsen, by drink category (unadjusted, no control)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	0.8%	-4.0%	5.9%	0.734	-0.2%	-3.5%	3.2%	0.904
Spirits	-0.7%	-5.7%	4.5%	0.790	-5.8%	-9.1%	-2.3%	0.001
Beer	8.3%	1.2%	16.0%	0.021	1.3%	-4.3%	7.3%	0.657
Wine	-2.5%	-5.6%	0.7%	0.124	-1.4%	-4.1%	1.3%	0.297
Cider	2.1%	-3.4%	7.8%	0.464	-1.4%	-15.8%	15.6%	0.865
Perry	-42.3%	-52.9%	-35.9%	<0.001	-28.0%	-31.5%	-24.3%	<0.001
Fortified wine	28.3%	9.2%	50.8%	0.002	15.8%	6.6%	25.8%	<0.001
RTDs	17.3%	2.0%	34.9%	0.025	-3.2%	-11.0%	5.2%	0.438

Notes: 5, 6, 11 (see key to notes on page 73)

Table A33: Change (%) in total (on- and off-trade combined) alcohol sales in England & Wales in the three years after MUP was implemented, IRI and Nielsen, by drink category (unadjusted, no control)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	2.2%	-1.3%	5.9%	0.215	4.8%	-0.3%	10.2%	0.064
Spirits	1.2%	-1.1%	3.5%	0.318	3.8%	1.6%	6.0%	<0.001
Beer	15.7%	10.6%	21.2%	<0.001	8.9%	-1.0%	19.7%	0.077
Wine	-4.5%	-6.8%	-2.1%	<0.001	-5.3%	-7.9%	-2.6%	<0.001
Cider	14.3%	6.1%	23.0%	<0.001	15.3%	9.1%	21.8%	<0.001
Perry	-6.9%	-17.0%	4.4%	0.218	11.2%	-1.4%	25.5%	0.083
Fortified wine	-15.7%	-21.1%	-9.8%	<0.001	-2.9%	-8.8%	3.5%	0.367
RTDs	4.8%	-1.9%	11.9%	0.165	8.9%	1.2%	17.1%	0.023

Notes: 5, 6, 7, 11 (see key to notes on page 73)

Table A34: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented, IRI and Nielsen, by drink category (unadjusted, controlled)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	-2.9%	-4.4%	-1.4%	<0.001	-3.2%	-4.8%	-1.6%	<0.001
Spirits	-8.3%	-11.6%	-4.8%	<0.001	-4.8%	-6.7%	-2.8%	<0.001
Beer	-2.2%	-4.1%	-0.4%	0.017	-2.3%	-3.9%	-0.6%	0.008
Wine	-0.5%	-2.1%	1.1%	0.529	0.9%	-1.2%	3.0%	0.415
Cider	-20.3%	-22.4%	-18.9%	<0.001	-17.4%	-21.2%	-13.4%	<0.001
Perry	-37.8%	-49.3%	-23.7%	<0.001	-35.9%	-38.9%	-32.8%	<0.001
Fortified wine	18.2%	5.0%	33.1%	0.005	19.1%	13.2%	25.4%	<0.001
RTDs	5.6%	-3.5%	15.5%	0.232	-6.3%	-10.9%	-1.4%	0.011

Notes: 1, 5, 6, 7, 11 (see key to notes on page 73)

Table A35: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented, IRI and Nielsen, by drink category (adjusted, controlled)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	-3.4%	-4.8%	-2.0%	<0.001	-3.3%	-4.9%	-1.6%	<0.001
Spirits	-3.5%	-5.7%	-1.2%	0.002	-3.3%	-4.5%	-2.1%	<0.001
Beer	2.0%	-1.2%	5.3%	0.223	-1.6%	-3.9%	0.7%	0.170
Wine	-3.9%	-6.3%	-1.4%	0.002	-1.5%	-4.2%	1.2%	0.269
Cider	-12.3%	-15.8%	-8.7%	<0.001	-7.8%	-12.3%	-3.1%	0.001
Perry	-36.6%	-47.3%	-23.7%	<0.001	-31.8%	-36.0%	-27.3%	<0.001
Fortified wine	16.0%	-0.6%	35.4%	0.059	19.7%	14.8%	24.8%	<0.001
RTDs	10.4%	0.6%	21.2%	0.036	-5.8%	-8.3%	-3.2%	<0.001

Notes: 1, 2, 5, 6, 7, 11 (see key to notes on page 73)

Table A36: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, IRI and Nielsen, by drink category (unadjusted, no control)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	3.0%	-1.8%	8.0%	0.228	-0.3%	-3.3%	2.8%	0.849
Spirits	0.2%	-3.4%	3.9%	0.937	-1.8%	-4.5%	1.0%	0.204
Beer	6.6%	-2.7%	16.9%	0.168	3.1%	-0.4%	6.8%	0.082
Wine	-2.8%	-5.6%	-0.1%	0.044	-0.9%	-3.1%	1.3%	0.413
Cider	1.6%	-3.2%	6.7%	0.509	-10.0%	-15.1%	-4.5%	<0.001
Perry	-44.5%	-56.2%	-29.5%	<0.001	-28.6%	-31.8%	-25.4%	<0.001
Fortified wine	12.4%	-11.5%	42.7%	0.335	13.9%	3.5%	25.3%	0.007
RTDs	20.7%	3.9%	40.2%	0.013	5.0%	-3.1%	13.7%	0.229

Notes: 5, 6, 11 (see key to notes on page 73)

Table A37: Change (%) in off-trade alcohol sales in England & Wales in the three years after MUP was implemented, IRI and Nielsen, by drink category (unadjusted, no control)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	3.2%	-1.5%	8.1%	0.187	5.9%	1.6%	10.4%	0.006
Spirits	2.2%	-1.0%	5.5%	0.187	4.7%	2.2%	7.1%	<0.001
Beer	14.0%	8.0%	20.4%	<0.001	11.3%	5.6%	17.4%	<0.001
Wine	-5.5%	-8.5%	-2.5%	<0.001	-2.7%	-5.7%	0.3%	0.079
Cider	16.0%	10.0%	22.3%	<0.001	22.4%	13.9%	31.4%	<0.001
Perry	1.0%	-17.4%	23.5%	0.922	11.4%	-1.3%	25.7%	0.079
Fortified wine	-18.9%	-21.4%	-16.3%	<0.001	-3.1%	-8.7%	2.7%	0.285
RTDs	7.5%	-6.8%	24.1%	0.318	7.8%	-5.0%	22.2%	0.242

Notes: 5, 6, 7, 11 (see key to notes on page 73)

Table A38: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, IRI and Nielsen, by drink category (unadjusted, controlled)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	-2.6%	-4.4%	-0.8%	0.005	-3.9%	-5.7%	-2.2%	<0.001
Spirits	-1.7%	-3.3%	-0.1%	0.036	-5.2%	-6.7%	-3.8%	<0.001
Beer	0.2%	-1.9%	2.4%	0.840	-4.2%	-6.9%	-1.4%	0.004
Wine	-0.4%	-2.0%	1.1%	0.591	0.0%	-2.0%	2.0%	0.961
Cider	-15.3%	-19.0%	-11.4%	<0.001	-23.0%	-26.4%	-19.3%	<0.001
Perry	-44.6%	-56.4%	-29.7%	<0.001	-36.1%	-39.6%	-32.5%	<0.001
Fortified wine	16.4%	1.7%	33.3%	0.027	12.7%	5.3%	20.6%	<0.001
RTDs	5.6%	-4.2%	16.4%	0.271	-2.2%	-6.9%	2.7%	0.368

Notes: 1, 5, 6, 7, 11 (see key to notes on page 73)

Table A39: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented, IRI and Nielsen, by drink category (adjusted, controlled)

	IRI				Nielsen			
Drink category	MUP effect	LCI	UCI	p value	MUP effect	LCI	UCI	p value
All	-2.8%	-4.6%	-1.0%	0.003	-4.2%	-6.0%	-2.4%	<0.001
Spirits	-2.6%	-4.1%	-1.1%	0.001	-5.0%	-6.4%	-3.5%	<0.001
Beer	9.9%	6.8%	13.0%	<0.001	1.6%	-1.6%	4.9%	0.335
Wine	-4.2%	-6.0%	-2.4%	<0.001	-1.0%	-2.9%	0.9%	0.291
Cider	-13.7%	-17.7%	-9.6%	<0.001	-16.3%	-20.8%	-11.5%	<0.001
Perry	-39.3%	-59.7%	-8.7%	0.016	-30.7%	-34.0%	-27.3%	<0.001
Fortified wine	16.9%	3.7%	31.9%	0.010	17.3%	11.3%	23.6%	<0.001
RTDs	11.3%	-0.4%	24.4%	0.059	-0.2%	-5.2%	5.0%	0.931

Notes: 1, 3, 5, 6, 7, 11 (see key to notes on page 73)

Falsification of intervention date

Table A40: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland with an MUP implementation 6 months before actual implementation

Model	MUP effect	LCI	UCI	p value
Scotland, (unadjusted, no control)	-0.3%	-2.7%	2.2%	0.829
Scotland, (adjusted, controlled)	-1.1%	-2.5%	0.3%	0.126

Notes: All models: 5, 6; adjusted and controlled model: 1, 2 (see key to notes on page 73)

Table A41: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland with an MUP implementation 6 months after actual implementation

Model	MUP effect	LCI	UCI	p value
Scotland, (unadjusted, no control)	-2.0%	-4.2%	0.2%	0.073
Scotland, (adjusted, controlled)	-1.0%	-2.4%	0.5%	0.186

Notes: All models: 5, 6; adjusted and controlled model: 1, 2 (see key to notes on page 73)

Table A42: Change (%) in off-trade alcohol sales in Scotland with an MUP implementation 6 months before actual implementation

Model	MUP effect	LCI	UCI	p value
Scotland, (unadjusted, no control)	0.5%	-1.5%	2.6%	0.614
Scotland, (adjusted, controlled)	0.0%	-1.8%	1.8%	0.994

Notes: All models: 5, 6; adjusted and controlled model: 1, 3 (see key to notes on page 73)

Table A43: Change (%) in off-trade alcohol sales in Scotland with an MUP implementation 6 months after actual implementation

Model	MUP effect	LCI	UCI	p value
Scotland, (unadjusted, no control)	-3.2%	-5.2%	-1.1%	0.003
Scotland, (adjusted, controlled)	-1.7%	-3.2%	-0.2%	0.026

Notes: All models: 5, 6; adjusted and controlled model: 1, 3 (see key to notes on page 73)

Using a different analytical approach

Table A44: Change (%) in total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented using the Unobserved Components Method

Model	MUP effect	LCI	UCI	p value
Scotland (unadjusted, no control)	-0.8%	-3.2%	1.6%	0.521
EW (unadjusted, no control)	5.9%	0.8%	11.3%	0.024

Notes: All models: 5, 6; EW model: 7 (see key to notes on page 73)

Table A45: Change (%) in off-trade alcohol sales in Scotland in the three years after MUP was implemented using the Unobserved Components Method

Model	MUP effect	LCI	UCI	p value
Scotland (unadjusted, no control)	-1.3%	-3.7%	1.1%	0.294
EW (unadjusted, no control)	3.4%	0.0%	6.9%	0.045

Notes: All models: 5, 6; EW model: 7 (see key to notes on page 73).

Test of change in variability

Residuals from a SARIMA on alcohol sales in Scotland were squared. An ARIMA model was then run on the squared residuals with MUP as the only covariate.

Table A46: Change (%) in the variability of total (on- and off-trade combined) alcohol sales in Scotland in the three years after MUP was implemented

Model	MUP effect	LCI	UCI	p value
Scotland (adjusted, no control)	0.1%	-0.1%	0.3%	0.190

Notes: 4 (see key to notes on page 73)

Table A47: Change (%) in the variability of off-trade alcohol sales in Scotland in the three years after MUP was implemented

Model	MUP effect	LCI	UCI	p value
Scotland (adjusted, no control)	0.2%	-0.1%	0.5%	0.301

Notes: 4 (see key to notes on page 73)

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