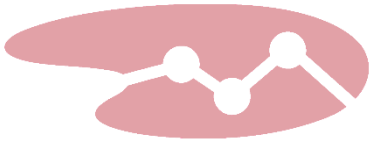
2022

Container Deposit Scheme Price Monitoring

12-MONTH REPORT



Pink Lake
analytics

Executive Summary

Based on data available to September 2021, there is not strong evidence that beverage prices have risen by more than the weighted average scheme price of 12.82 cents as a result of the introduction of the Container Deposit Scheme (CDS).

The overall estimate of the price impact of the CDS on prices of non-alcoholic beverages is 13.2 cents in metro markets and 7.2 cents in regional markets. For alcoholic beverages the estimates are 3.9 cents in metro markets and 14.4 cents regional markets.

The method for estimating the price impacts is a difference-in-difference estimator, derived from fitted linear regression models of beverage prices. The models use information about the market, retailer, brand, beverage type, pack size and container size to model prices. The model also allows for a price trend over time and a one-off change at October 2020 which is measured separately for WA and other states. The WA-specific change at October 2020 is the estimate of the impact of the CDS.

The estimates of price impacts in this report are based on prices observed 12-15 months prior to and 12 months after the introduction of the CDS. An interim report was provided after 6 months of data were available after the introduction of the CDS. The results of this report supersede those of the 6-month report.

Table of Contents

1 The Container Deposit Scheme

Western Australians can now take their empty beverage containers to a Containers for Change refund point and receive 10 cents for every eligible container returned.

The container deposit scheme, Containers for Change, commenced on 1 October 2020.

The scheme's objectives (**Department of Water and Environmental Regulation 2019b**) are to:

- increase recovery and recycling of empty beverage containers
- reduce the number of empty beverage containers that are disposed of as litter or to landfill
- ensure that first responsible suppliers of beverage products take product stewardship responsibility
- provide opportunities for social enterprise and benefits for community organisations
- create opportunities for employment
- complement existing collection and recycling activities for recyclable waste.

Beverage containers between 150 millilitres and 3 litres in volume eligible for the refund include:

- Soft-drink cans and bottles
- bottled waters – both plastic and glass
- small flavoured-milk drinks
- beer and cider cans and bottles
- sports drinks and spirit-based mixed drinks.

2 Price Monitoring

2.1 Economic Regulation Authority terms of reference

The Treasurer has asked the ERA to monitor and report on the prices of beverages affected by the Container Deposit Scheme.

The Western Australian Container Deposit Scheme commenced on 1 October 2020 and allows consumers to take empty beverage containers to a refund point to receive a refund of 10 cents. Introduction of the scheme will likely result in an increase in the prices of some beverages.

The Treasurer has asked ERA to report on (**Hon Ben Wyatt MLA 2019**):

1. the effect of the Scheme on prices of beverages during the monitoring period;
2. the method applied by the ERA to assess the effect of the Scheme on prices of beverages during the monitoring period; and
3. recommendations to address any adverse effects on prices arising from the Scheme and on the need to continue price monitoring.

In monitoring the effect of the scheme on prices, the ERA must monitor the effect in regional and remote Western Australia.

2.2 Pink Lake Analytics terms of reference

The ERA engaged statistical consulting firm Pink Lake Analytics to assist in quantifying beverage prices changes, if any, that are attributable to the container deposit scheme for the ERA's Draft Report and Final Report.

Pink Lake Analytics was engaged to, for each of the ERA's reports:

- Review the raw datasets and prepare for analysis;
- Perform difference-in-difference analysis on each dataset for each product categories and in aggregate;
- Consider changes in price indices for beverages published by the ABS; and
- Draft an analytical report on the analysis and results.

In undertaking this analysis, Pink Lake Analytics had access to the following data sets:

- Non-alcoholic beverage prices;
- Alcoholic beverage prices;
- Regional beverage prices.

3 Data

To meet the terms of reference of the price monitoring study, datasets need to cover both metropolitan and regional WA; other Australian states for comparison; and six types of alcoholic and non-alcoholic beverages.

The datasets available to ERA and Pink Lake Analytics are summarised in Table 3.1 and the coverage is visualised in Figure 3.1. The two metropolitan data sources are existing products from data providers. The regional dataset was commissioned by the ERA for the purpose of monitoring beverage prices.

Table 3.1: Data sources for price monitoring

	The Nielsen Company	**The Invigor Group**	**Goomalling Community Resource Centre**
Scope	WA and selected other states	WA and all other states	42 regional WA towns
Beverages	Non-alcoholic	Alcoholic	Alcoholic and non-alcoholic
Frequency	4 weekly	Monthly	Monthly

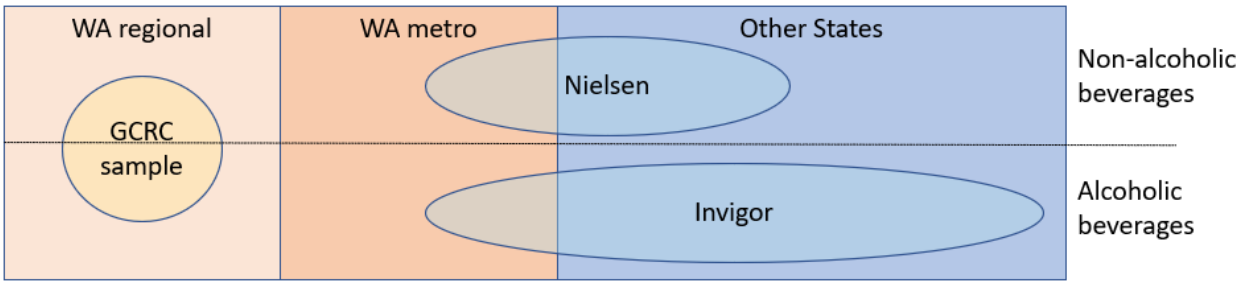


Figure 3.1: Illustration of coverage of available data

3.1 Metro WA non-alcoholic beverage prices

The metropolitan non-alcoholic beverage price data are collected by Nielsen. The data are collected via scanned receipts of purchases by consumers recruited by Nielsen for survey purposes. The drink categories are shown in Table 3.2.

Table 3.2: Drink categories - metro data, non-alcoholic beverages

Analysis category	**Nielsen drink categories**
Soft Drinks	Softdrinks, Energy Drinks, Flavoured Milk, Sport Drinks, Mixers, RTD_Tea
Water	MineralWater, StillFunctional_Water
Fruit Juice	Juice

The Nielsen data include the number of units of each product that have been purchased. This allows for a weighted regression model to be used that gives more weight to more commonly purchased products.

3.2 Metro WA alcoholic beverage prices

The prices of alcoholic beverages in metropolitan markets are collected by Invigor. These data are collected via web-scraping of online liquor stores. The data are available for every state and territory in Australia from October 2019 to September 2021 inclusive.

3.3 Regional beverage prices

Container beverage prices were collected in 42 Western Australian regional and remote towns over the period July 2019 to September 2021. Where possible, identical products were sampled each month to enable an unbroken chain of prices for individual items. As price and product information were entered manually by price collectors into spreadsheets, substantial editing was required as part of the analysis by Pink Lake Analytics to match individual items over time and also to use recorded information to derive the price per container.

3.4 Data Quality Assessment

The datasets were filtered to include only containers that are eligible containers under the CDS (**Department of Water and Environmental Regulation 2019a**). Also, records were only kept in the sample if they:

1. Had a valid price or a price that could be interpreted by recorded text in the case of the regional sample (e.g. "2 for $4.00");
2. Had a valid pack size and a container size that is CDS eligible;
3. Had a price between $0.20 and $100.00 as some records clearly had incorrectly recorded the price of a different pack size to the one stated which invalidates the derived container price;
4. Had a recorded brand, container and container size; and
5. Had at least 4 observations before the introduction of the CDS and 4 observations after.

As the regional sample data were recorded manually, some of these observations were filtered out due to insufficient information. The sample sizes remaining after each of these filtering steps are shown in Table 3.3. The last step of filtering, requiring that there are at least 4 observations before and after the CDS introduction, removes a potential bias due to products that are only captured in the earlier or later months of the study. For example, if newly added products were of higher value than the average, this would introduce an upward bias to the measurement of price changes over time. The large drop for fruit juice sample is mostly due to containers being a litre or more in capacity and therefore not eligible for the CDS.

Table 3.3: Sample sizes for regional data through data filtering stages.

	Price recorded	Pack size recorded and container CDS eligible	Price trimmed	Brand recorded	n >=4 pre/post
Soft drinks	11111	10000	9983	9729	9424
Water	7099	5769	5758	5340	5327
Fruit juice	8098	898	898	882	882
Beer	9744	9383	9381	9209	9185
Cider	1950	1895	1895	1841	1841
RTD	5880	5693	5692	5516	5514
Total	**43882**	**33638**	**33607**	**32517**	**32173**

There remained some records that were clearly assigned the incorrect pack size. For example, the price of a 4-pack for a product being recorded each month at a retailer and then increasing to the price of a 24-

pack. Records for a specific item at the same retailer and market that were greater than 3 times that item's median price or less than one third of the median price were removed.

There was no requirement that identical products were sampled across states. Such a restriction would exclude many products that are particular to, or popular in, certain states. The modelling methods employed do not require that identical products are present in WA and comparison state samples. Some products in the comparison states were excluded from the regional data analysis (cider and RTDs sold in packs of 24 or more) because this was a broad class of products priced in metropolitan online stores but not collected in the regional data; and pack size had a very strong relationship with container price.

Due to the restrictions in place to prevent the spread of COVID-19, data collection in regional stores was paused over March and April 2020. There were also fewer locations sampled in May 2020. The missing data during this period does not preclude the use of the statistical models presented here. Time in these models is an attribute of each price measurement than can partially explain variation in price via a linear trend over time and a shift in level at the time of the CDS introduction. Each price measurement has the time attribute recorded so such modelling is possible. This kind of missing data problem would be more of an issue with a time series model such as an autoregressive model that assumes time series data with regular frequency.

As the metropolitan data were gathered electronically, there was less of a need for editing, compared to the regional data. The sample sizes for the WA metropolitan sample and the interstate sample are presented in Table 3.4. The sample sizes shown are the number of distinct price observations for each category.

Table 3.4: Sample sizes for metropolitan WA and states other than WA.

	Metro WA sample	**Other states sample**
Soft drinks	1948	10837
Water	493	2664
Fruit juice	130	962
Beer	74705	481245
Cider	17613	113379
RTD	26545	179236
Total	**121434**	**788323**

4 Modelling Price Changes

The concept of statistical modelling of the price impact of the CDS is to develop a model for price that that explains a product's price in terms of the characteristics of the product and the market. If variation in pricing can also be usefully explained by whether the price was gathered before or after the introduction of the CDS, the influence of this factor in dollar terms can be estimated.

4.1 Difference-in-Difference Estimator

The difference-in-difference estimator is the parameter estimate from a fitted model of beverage price. This is the estimator used in the monitoring of beverage prices by other regulators in NSW (**Independent Pricing and Regulatory Tribunal NSW 2018**) and Queensland (**Queensland Productivity Commission 2020**) and is the estimator preferred by the ERA. The qualities of this estimator have been reviewed in depth and found to be well-suited to the purpose of estimating the change in price attributable to the introduction of the CDS in WA.

The difference-in-difference estimator can be implemented by both a multiple linear regression model and a linear mixed effects model.

The purpose of including the linear mixed effects model in the analysis is to observe how sensitive the estimates of price impacts are to the choice of model. We would expect the two methods to give similar results, although the mixed effects model would normally give lower standard errors. The multiple linear regression model has a more natural way of including weighted data via weighted least squares. This makes the multiple linear regression model more desirable for the aggregate estimates for non-alcoholic and alcoholic beverages which use weights to include the relative importance of the individual beverage types.

We consider the multiple linear regression model the primary model for this analysis. The linear mixed effects model is another analytical tool that provides a cross-check for confirmation of results.

The two models are defined below.

4.1.1 Multiple linear regression model

The form of the linear model is as follows:

$$P_{it} = \beta_0 + \beta_1 \text{WA}_i + \beta_2 \text{CDSWA}_t + \beta_3 \text{WA}_i \times \text{CDSWA}_t + \boldsymbol{\gamma}\mathbf{X}_{it} + \epsilon_{it}$$

where:

- P_{it} is the price in dollars of item i at time t;
- $\text{WA}_i = 1$ if the i^{th} price comes from Western Australia and 0 otherwise;
- $\text{CDSWA}_t = 1$ if time t is after the introduction of the CDS in Western Australia and 0 otherwise;
- $\mathbf{X}$ is a matrix of explanatory variables of the i^{th} measurement at time t; and
- β_3 is the parameter of interest as a measure of price impact of the introduction of the CDS on Western Australian prices.

Prices from multiple states are modelled so that any effect that coincides in timing with the introduction of the CDS in WA but affects multiple states does not confound the estimate of the introduction of the CDS on prices in WA.

The linear model was implemented with the **lm()** function in the base **stats** package of R. This function uses a direct method to solve the linear least-squares problem to fit the model. To keep only those explanatory variables that were useful in explaining variation in price, step-wise variable selection was used based on the Akaike Information Criterion (AIC)[1]. This was implemented with the **stepAIC** function from the Modern Applied Statistics with S (**MASS**) package (Venables and Ripley 2002). This procedure helps to identify a parsimonious model[2] for container price. The variables that this procedure selected can be seen in the output in the Appendix.

4.1.2 Linear mixed effects model

An alternative to the multiple linear regression model given above is a linear mixed effects model. The linear mixed effects model includes a random effect for the variation between individuals. In this case, an individual is a particular product on a shelf of a particular store and its price is monitored over time. The variation between individuals is captured by the μ_i term in the model equation below, where each i is particular product in a particular store measured at time t. A linear trend over time is included in the $\beta_0 t$ term in the model form:

$$P_{it} = \mu_i + \beta_0 t + \beta_1 \mathrm{WA}_i + \beta_2 \mathrm{CDSWA}_t + \beta_3 \mathrm{WA}_i \times \mathrm{CDSWA}_t + \epsilon_{it}$$

The linear mixed effects model was implemented with the **lme()** function in the **nlme** package of R (Pinheiro et al. 2020). The **lme()** function uses a restricted maximum likelihood method for parameter estimation.

The trajectories of prices over time for individual goods are shown in Figures 4.1 and 4.2. Although there are many items represented on the same plot in these figures, the transparency of the lines allows the overall dispersion and trend of the prices to be observed. The darker paths in soft drinks and water show that many items had a constant price until October 2020 and then a uniform increase.

[1] Akaike information criterion - Wikipedia

[2] That is, favouring a simple model if it has the same predictive power as a more complex model.

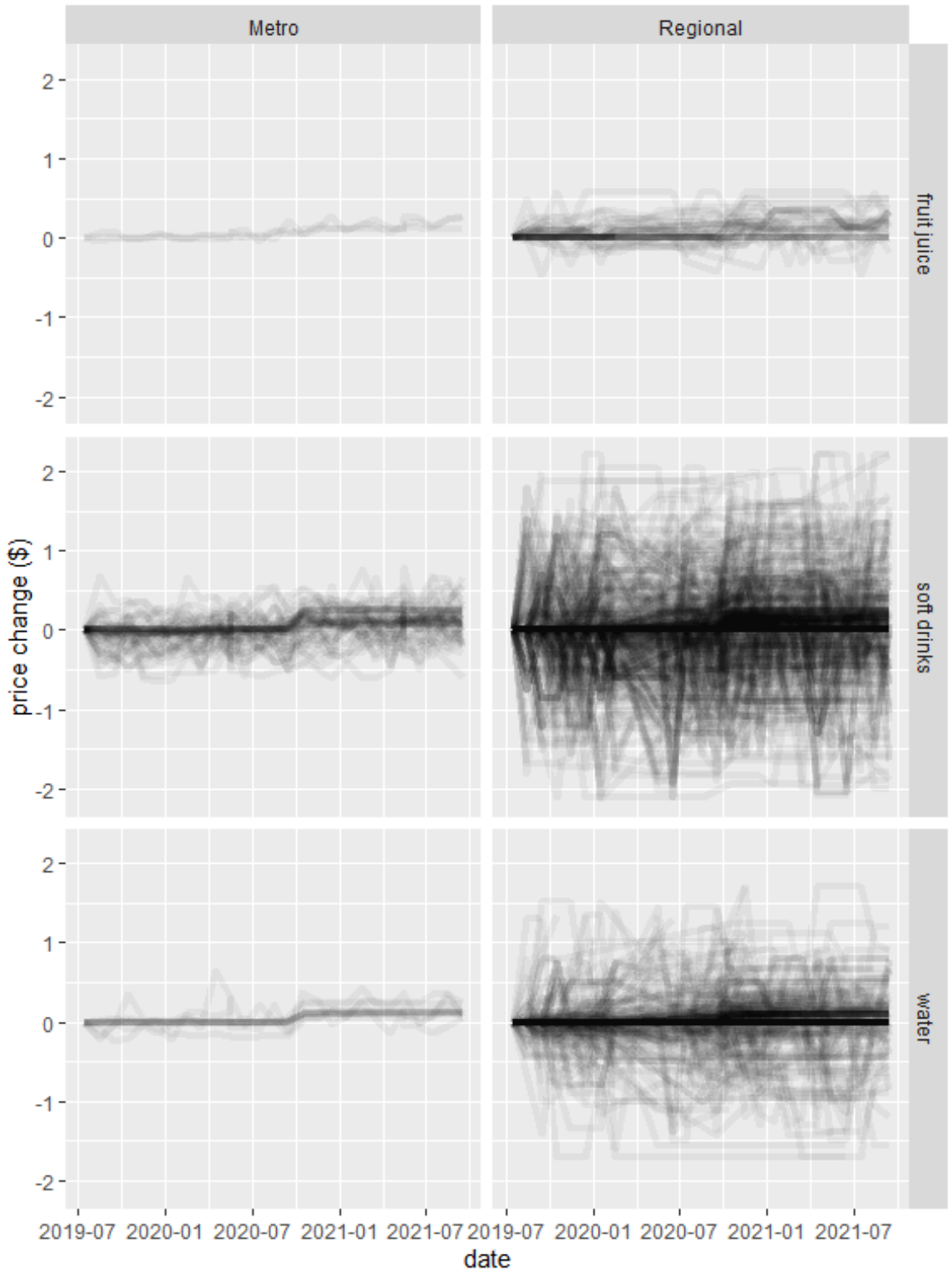


Figure 4.1: Price changes over time in WA non-alcoholic beverages. Each line represents an individual store item. Darker grey lines show multiple items with the same price overlayed. Zero on the y-axis represents the first price observed for the individual product.

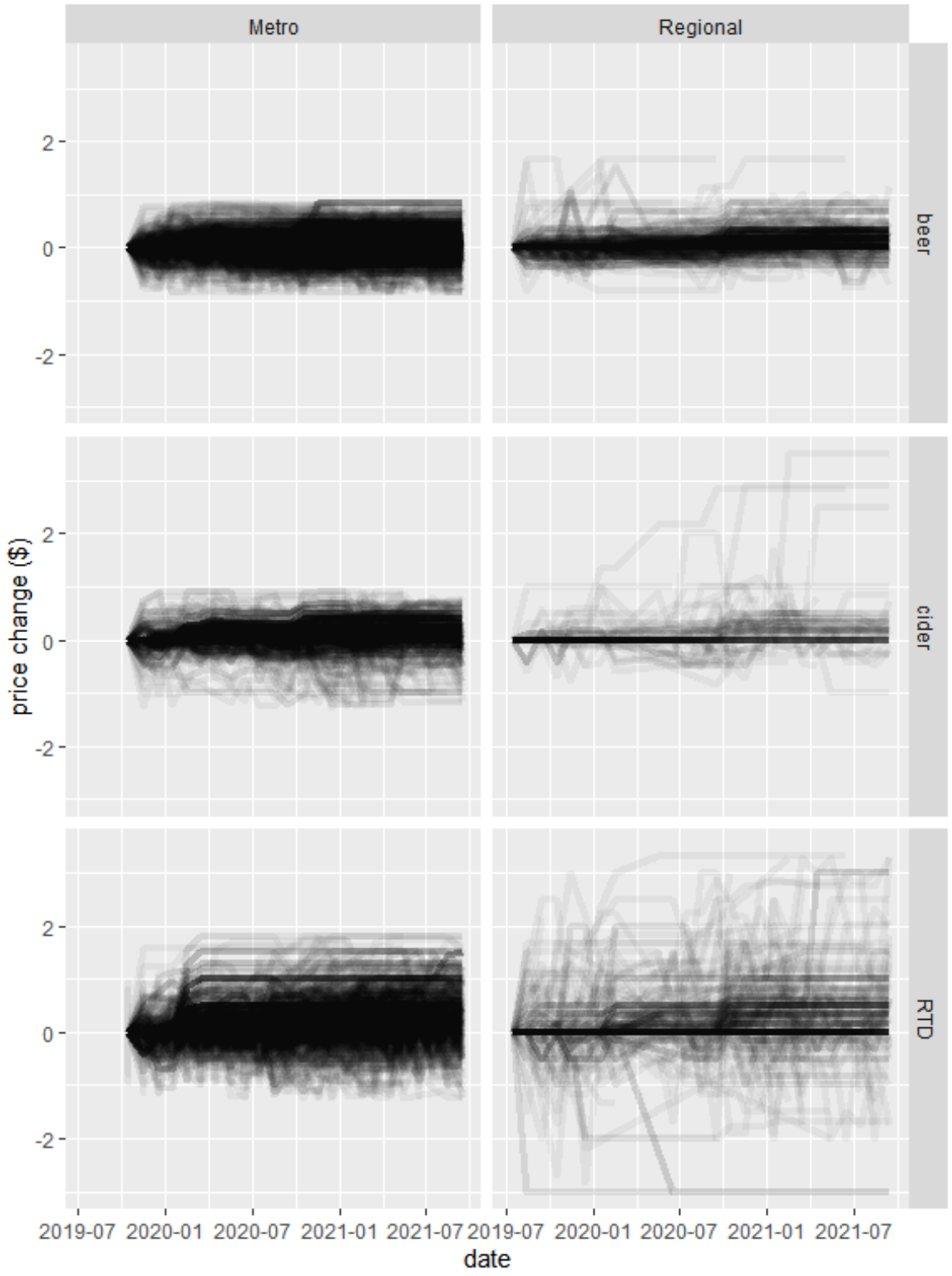


Figure 4.2: Price changes over time in WA alcoholic beverages. Each line represents an individual store item. Darker grey lines show multiple items with the same price overlayed. Zero on the y-axis represents the first price observed for the individual product.

4.2 Combining data sources

In order to create an estimate of the price impact of the CDS across non-alcoholic beverages and across non-alcoholic beverages, the available data needs to be weighted in some way so that drink categories that account for more sales have more influence on the overall estimate. The metropolitan non-alcoholic data have sale volumes for each product and these are used in estimation for each drink category and for the overall metropolitan non-alcoholic beverage estimate. The relative contribution of soft drinks, water and fruit juice observed in the metropolitan sample can also be used to weight these three drink categories in the regional data to get an estimate for non-alcoholic drinks.

The relative contribution of each non-alcoholic drink category is shown in Table 4.1.

Table 4.1: Share of non-alcoholic drink categories according to Nielson data

Drink category	Share (%)
Fruit juice	3.2
Soft drinks	78.6
Water	18.2

For alcoholic drinks, the relative market share of beer, cider and RTDs is measured in market research (**Morgan 2019**) and discussed in industry commentary (**Jackson 2019**). This analysis of Australian consumer habits in 2019 indicate the market share to be approximately as in Table 4.2.

Table 4.2: Share of alcoholic drink categories according to Morgan research

Drink category	Share (%)
Beer	82.3
Cider	7.0
RTD	10.7

4.3 Variable Selection

The explanatory variables available for modelling of metro non-alcoholic beverage prices were:

- state
- product_class
- brand_class
- retailer_class
- pack_class
- container volume
- date

For alcoholic drinks in metro sample:

- state
- product_class
- brand_class
- material
- retailer_class
- pack_class
- ml_containers
- date

The regional sample included the same variables as well as a variable describing remoteness of the town where the sample was collected.

State

The states available in the Nielson dataset were WA, NSW, Queensland and Victoria. The Invigor dataset based on web-scraped data cover all states and territories.

Table 4.3: States available

Non-alcoholic	**Alcoholic**
Western Australia	Western Australia
New South Wales	New South Wales
Victoria	Victoria
Queensland	Queensland
	South Australia
	Tasmania
	Northern Territory
	Australian Capital Territory

The results for alcoholic beverages below are presented for two different sets of comparison states: Firstly, for NSW, Victoria and Queensland; and secondly for all states. This allows observation of sensitivity of estimates to the set of states used for comparison. We consider the key comparison to be with the larger states of NSW, Victoria and Queensland which are available for both alcoholic and non-alcoholic beverages. The results when using all Australian states and territories are included when available as a cross-check.

Product class

Table 4.4: Product classes

Drink Category	Product classes
Soft drinks	Energy Drinks; Flavoured milk; Iced tea / coffee; Mixers; Soft drinks; Sport_Drinks
Water	Mineral Water; Still Water
Fruit juice	Fruit juice
Beer	Full strength major; Full strength other; Low alcohol
Cider	Cider-apple; Cider-other; Cider-pear
RTD	Whisky ; Rum; Vodka; other

Brand class

Non-alcoholic beverage brands were classified into three categories: Major Brands, Tier 2 brands; and Other brands. These are in Table 4.5.

Table 4.5: Brand categories - non-alcoholic beverages

Drink Category	Major Brands	Tier 2
Soft Drinks	Coca-Cola Amatil, Asahi	Private Labels (Woolworths,Coles,Aldi)
Water	Coca-Cola Amatil, Asahi	Private Labels (Woolworths,Coles,Aldi)
Fruit Juice	Lion, Asahi,Heinz	Private Labels (Woolworths,Coles,Aldi)

Alcoholic beverage brands were classified into three categories shown in Table 4.6 according to the parent company of the brand.

Table 4.6: Brand categories - alcoholic beverages

Drink Category	Brand group 1	Brand group 2
Beer	Carlton United Breweries / Asahi	Lion / Kirin
Cider	Carlton United Breweries / Asahi	Lion / Kirin
RTD	Carlton United Breweries / Asahi	Diageo

Retailer class

Non-alcoholic retailer classes were classified into three categories: Major Retailers; Tier 2 retailers; and Other retailers. These are in Table 4.7.

Table 4.7: Retailer categories - non-alcoholic beverages

Retailer class	Retailers
Major Retailers	Woolworths, Coles
Tier 2 Retailers	IGA Group, Aldi, Farmer Jacks
Other Retailers	others

Alcoholic retailer categories were classified into three categories shown in Table 4.8.

Table 4.8: Retailer categories - alcoholic beverages

Retailer class	Retailers
Coles Retailers	Coles group liquor stores
Woolworths Retailers	Woolworths group liquor stores
Hotel	Pubs and Hotels (regional dataset only)
Other Retailers	others

Pack class

Non-alcoholic pack classes were classified into two categories whilst alcoholic pack classes were classified into three categories: These are in Table 4.9.

Table 4.9: Pack class

Non-alcoholic	Alcoholic
1	1<6
2+	6<24
	24+

Container size

For non-alcoholic beverages, the container size classes in Table 4.10 are used.

Table 4.10: Container size

Container size	Container volume
Small	599ml or less
Medium	600-1000ml
Large	1001ml or more

For alcoholic beverage containers, there is less variation in container size and the volume of the container in millilitres is used as a continuous explanatory variable.

Remoteness

The Australian Statistical Geographic Standard codes each area in Australia to a remoteness index. The towns in the regional sample were matched to their remoteness classifications in Table 4.11 by postcode.

Table 4.11: ASGS remoteness categories

Remoteness level
Inner Regional Australia
Outer Regional Australia
Remote Australia
Very Remote Australia

Time

The month and year in which the measurement is taken is also entered as an explanatory variable to model a linear trend over time.

5 Results

The estimates of the price change attributable to the introduction of the CDS are given in the following sections, firstly for the primary model which is the multiple linear regression model, then for the linear mixed effects model.

The figures in these sections include bars that represent 95% confidence intervals around the parameter estimates. The two models produce broadly similar estimates of price impact. The linear mixed effects model produces estimates with narrower confidence intervals as this model uses the added information of the same product being measured over time.

Impact estimates for some beverages have quite wide 95% confidence intervals. For example, RTDs and cider in regional markets and water and fruit juice in metropolitan markets. This reflects lower sample sizes for these beverages as well as variation in container prices that is less well explained by the known characteristics of the products and retailer. There is more sample available for the beverages that make up a larger proportion of the aggregate non-alcoholic and alcoholic beverage classes. In the case of the regional sample, soft drinks and beer have more products in sample than other beverages. This is because the number of products sampled is jointly related to the number of products available in stores and the market share of these beverage types. The estimates for aggregate non-alcoholic and alcoholic beverage classes benefit from this characteristic of the sample as they are weighted by market share of the beverage types.

The regional cider sample gives an estimate of price change that is above the 12.82 cent weighted average scheme price and the 95% confidence interval for the linear mixed model estimate lies above this point too. The regional sample for cider can be seen in Figure 4.2 to have a small sample and some products with very high price increases over this period.

5.1 Multiple Linear Regression Model (primary model)

This section provides the results for the primary estimation model, the multiple linear regression model.

Figure 5.1 shows estimates CDS impact on metropolitan prices to be near the weighted average scheme price of 12.82 cents for non-alcoholic beverages and less than this for alcoholic beverages. Estimates of regional prices impacts shown in Figure 5.2 show estimates for alcoholic beverages at a higher level.

The estimated price changes, with standard errors in brackets, are also recorded in Table 5.1 to Table 5.2. This shows that a one-sided test for whether the price impact on regional alcoholic beverages is higher than the weighted average scheme price is statistically significant at the 0.05 level.

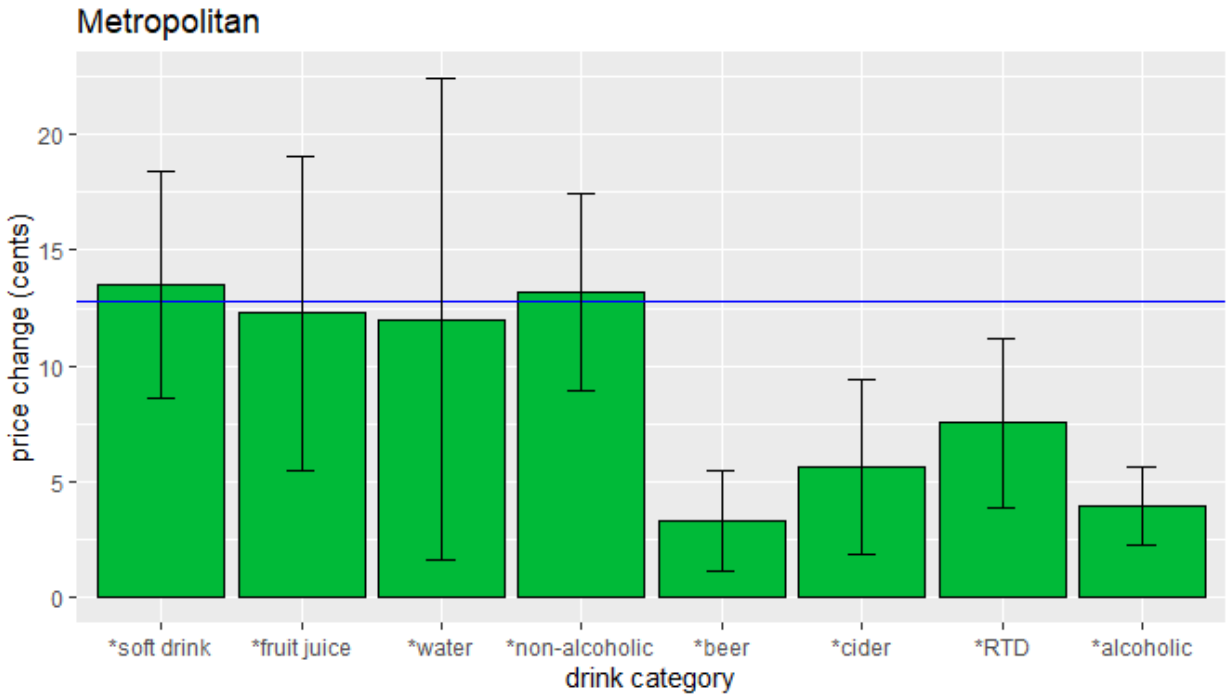


Figure 5.1: Estimated CDS price changes with error bars representing 95% confidence intervals for multiple linear regression model. Metropolitan data. Horizontal blue line is at 12.82 cents, the weighted average scheme price. Drink categories with change estimates different to zero at the 0.01 level of significance are labelled with "*". Data are from WA, NSW, QLD and VIC.

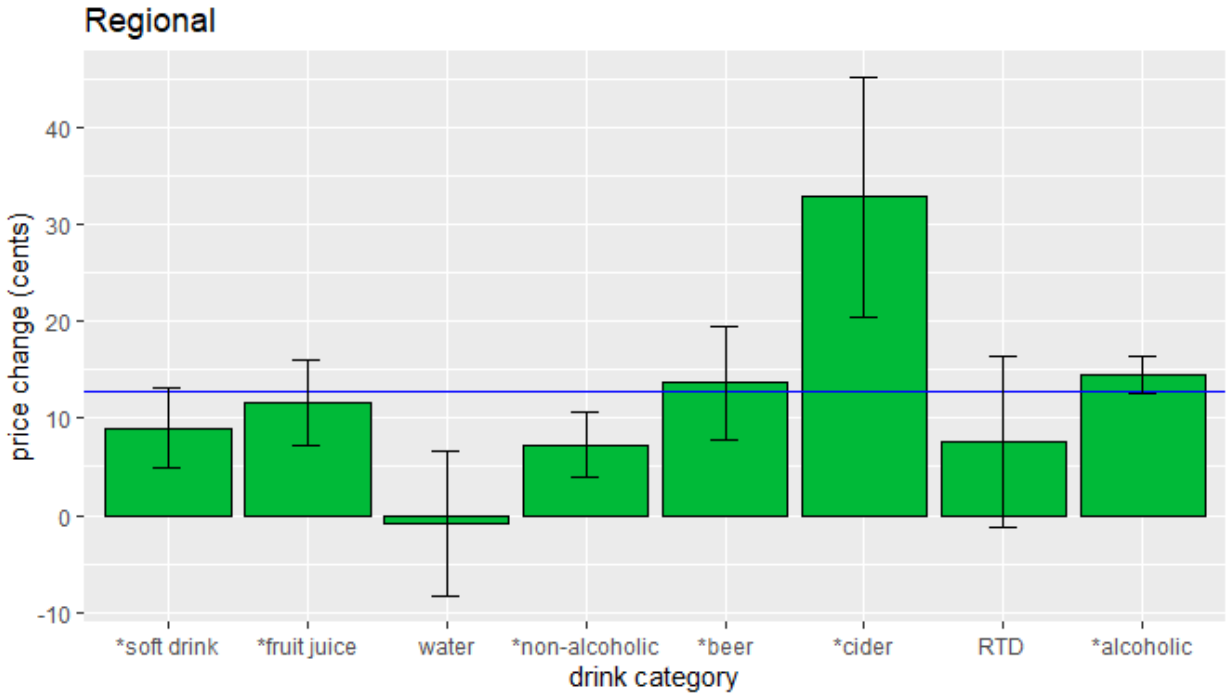


Figure 5.2: Estimated CDS price changes with error bars representing 95% confidence intervals for multiple linear regression model. Regional data. Horizontal blue line is at 12.82 cents, the weighted average scheme price. Drink categories with change estimates different to zero at the 0.01 level of significance are labelled with "*". Data are from WA, NSW, QLD and VIC.

Table 5.1: CDS price change estimate (standard error) for alcoholic beverage markets. Primary model.

region	model	subset	beer	cider	RTD	alcoholic
metro	lm	all	3.2***	5.2***	6.9***	3.7***
			(1.0)	(1.8)	(1.7)	(0.8)
metro	lm	WA+NSW+QLD+VIC	3.3***	5.7***	7.5***	3.9***
			(1.1)	(1.9)	(1.9)	(0.9)
regional	lm	all	13.5***	32.8***$$$	6.7	14.1***$
			(3.0)	(6.2)	(4.3)	(0.9)
Regional	lm	WA+NSW+QLD+VIC	13.6***	32.8***$$$	7.6*	14.4***$
			(3.0)	(6.3)	(4.5)	(1.0)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

Table 5.2: CDS price change estimate (standard error) for non-alcoholic beverage markets. Primary model.

Region	model	subset	soft drinks	water	fruit juice	non-alcoholic
Metro	lm	WA+NSW+QLD+VIC	13.5***	12.0**	12.3***	13.2***
			(2.5)	(5.3)	(3.5)	(2.2)
Regional	lm	WA+NSW+QLD+VIC	8.9***	-0.9	11.6***	7.2***
			(2.1)	(3.8)	(2.2)	(1.7)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

Table 5.3 and 5.4 give the 95% confidence intervals for the estimates. Confidence intervals are obtained based on normal approximations to the distribution of estimators. These are calculated via the R function `confint.lm()` for multiple linear regression models.

Table 5.3: CDS price change estimate (95% confidence interval) for alcoholic beverages.

Region	model	subset	beer	cider	RTD	alcoholic
Metro	lm	all	(1.1 , 5.2)	(1.7 , 8.7)	(3.5 , 10.3)	(2.1 , 5.3)
metro	lm	WA+NSW+QLD+VIC	(1.1 , 5.5)	(1.9 , 9.4)	(3.9 , 11.2)	(2.2 , 5.6)
regional	lm	all	(7.7 , 19.4)	(20.6 , 45.0)	(-1.8 , 15.2)	(12.2 , 15.9)
regional	lm	WA+NSW+QLD+VIC	(7.8 , 19.5)	(20.5 , 45.1)	(-1.2 , 16.3)	(12.5 , 16.3)

Table 5.4: CDS price change estimate (95% confidence interval) for non-alcoholic beverages.

region	model	subset	soft drinks	water	fruit juice	non-alcoholic
metro	lm	WA+NSW+QLD+VIC	(8.6 , 18.4)	(1.6 , 22.4)	(5.5 , 19.1)	(8.9 , 17.4)
regional	lm	WA+NSW+QLD+VIC	(4.8 , 13.0)	(-8.3 , 6.6)	(7.2 , 16.0)	(3.8 , 10.6)

Tables 5.5 and 5.6 show comparisons with the draft results based on 6 months of data since the introduction of the CDS. The estimated impact for alcoholic beverages has decreased in the metropolitan market and increased in the regional market. The biggest change for alcoholic beverage data is the improvement of the Invigor data as more products have been added to the dataset. The non-alcoholic impact estimates are generally in line with those of the draft report.

Table 5.5: CDS price change estimate (standard error) for alcoholic beverage markets. Primary model. 6-month and 12-month reports.

report	region	model	subset	beer	cider	RTD	alcoholic
6 months	metro	lm	WA+NSW+QLD+VIC	8.3***	9.7***	0.7	7.6***
				(1.4)	(2.4)	(2.4)	(1.0)
12 months	metro	lm	WA+NSW+QLD+VIC	3.3***	5.7***	7.5***	3.9***
				(1.1)	(1.9)	(1.9)	(0.9)
6 months	regional	lm	WA+NSW+QLD+VIC	8.1***	23.1***$	-1.9	8.2***
				(2.6)	(6.3)	(4.6)	(1.3)
12 months	regional	lm	WA+NSW+QLD+VIC	13.6***	32.8***$$$	7.6*	14.4***$
				(3.0)	(6.3)	(4.5)	(1.0)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

Table 5.6: CDS price change estimate (standard error) for non-alcoholic beverage markets. Primary model. 6-month and 12-month reports.

Report	region	model	subset	soft drinks	water	fruit juice	non-alcoholic
6 months	metro	lm	WA+NSW+QLD+VIC	10.4***	10.8	11.9***	10.5***
				(2.9)	(6.7)	(4.3)	(2.5)
12 months	metro	lm	WA+NSW+QLD+VIC	13.5***	12.0**	12.3***	13.2***
				(2.5)	(5.3)	(3.5)	(2.2)
6 months	regional	lm	WA+NSW+QLD+VIC	8.1***	3.1	13.7***	7.3***
				(2.5)	(5.2)	(3.0)	(2.2)
12 months	regional	lm	WA+NSW+QLD+VIC	8.9***	-0.9	11.6***	7.2***
				(2.1)	(3.8)	(2.2)	(1.7)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

It is evident that there estimated increase in cider prices in regional WA is particularly large. To illustrate how much this influences the overall estimate for alcoholic beverages, we present in Table 5.7 an estimate for regional alcoholic beverages with cider omitted.

Table 5.7: CDS price change estimate (standard error) for regional alcoholic beverage markets. Primary model.

region	model	subset	beer	cider	RTD	alcoholic	alcoholic without cider
regional	lm	all	13.5*** (3.0)	32.8***$$$ (6.2)	6.7 (4.3)	14.1***$ (0.9)	12.8*** (1.0)
regional	lm	WA+NSW+QLD+VIC	13.6*** (3.0)	32.8***$$$ (6.3)	7.6* (4.5)	14.4***$ (1.0)	13.1*** (1.0)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

5.2 Linear Mixed Effects Model

The linear mixed model presented in this section provides a cross-check for comparison to the results from the primary model presented above. This check can show how sensitive estimation is to the choice of model.

The results given in Figures 5.3 and 5.4 show a similar pattern to the results from the primary model. For example, estimates for alcoholic beverages are generally higher in regional markets. The estimates are generally close to those of the primary model for metropolitan markets but tend to be higher than the primary model for the regional market.

As stated earlier, there is no formal weighting of the beverage types to form the aggregate alcoholic and non-alcoholic estimates for the linear mixed effects model. These aggregate estimates should be treated with caution and those of the primary model should be favoured.

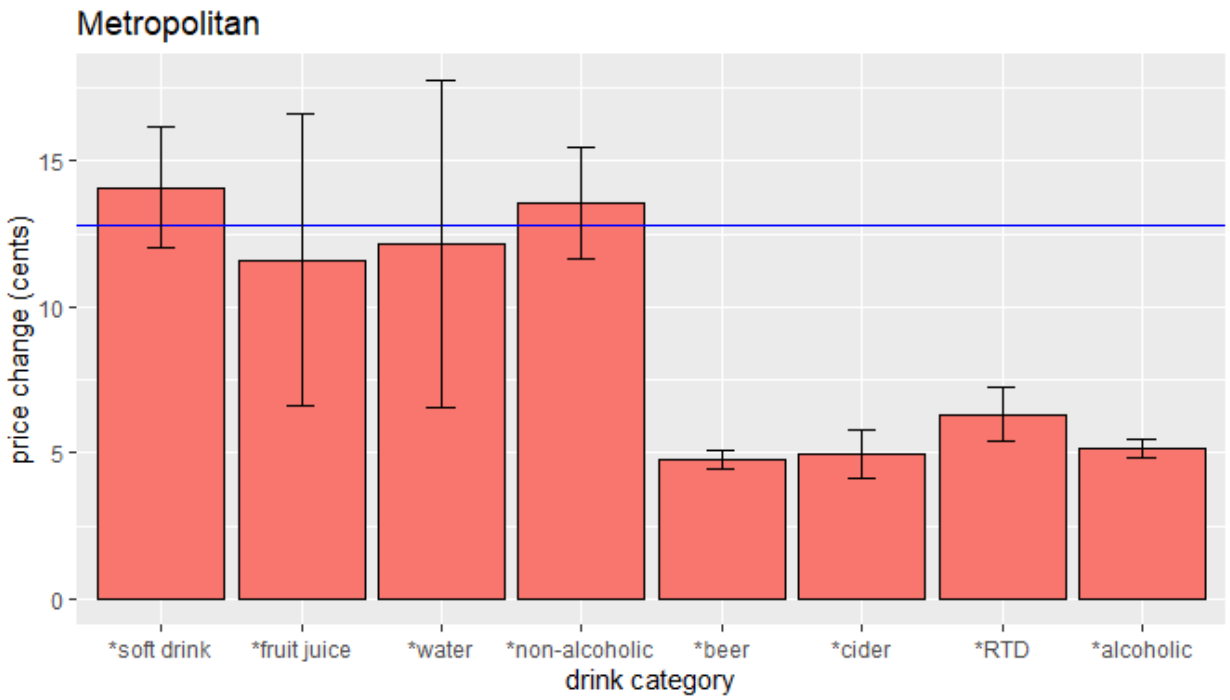


Figure 5.3: Estimated CDS price changes with error bars representing 95% confidence intervals for linear mixed model. Metropolitan data. Horizontal blue line is at 12.82 cents, the weighted average scheme price. Drink categories with change estimates different to zero at the 0.01 level of significance are labelled with "*". Data are from WA, NSW, QLD and VIC.

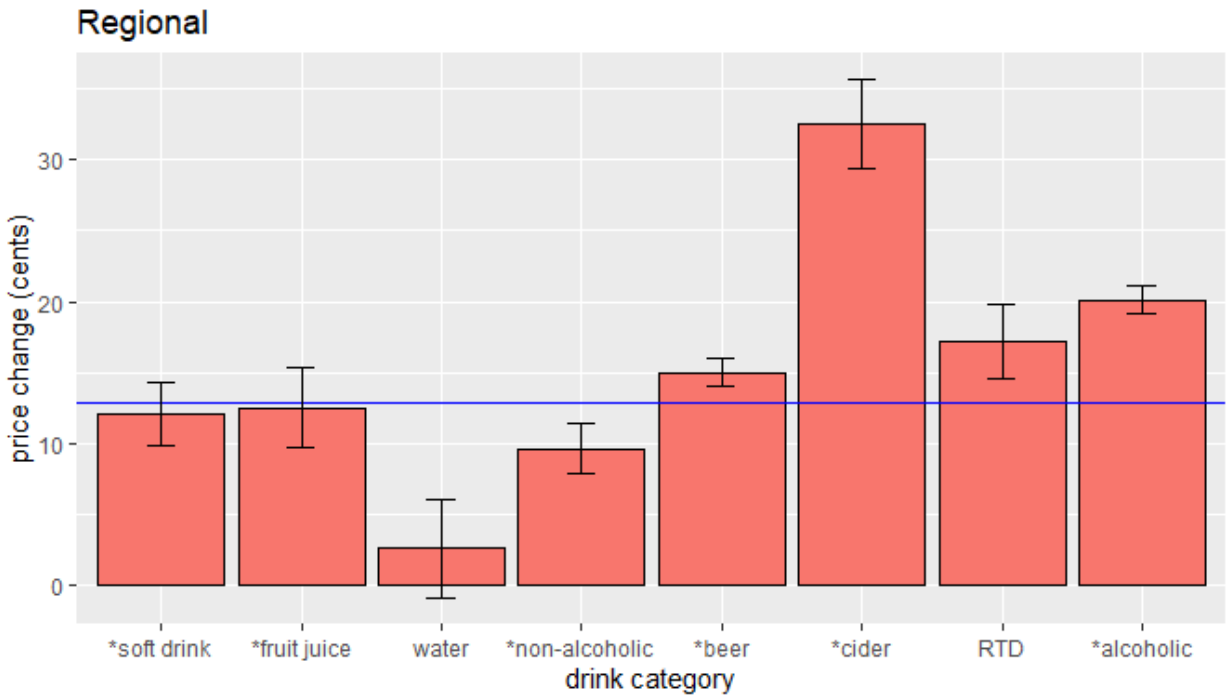


Figure 5.4: Estimated CDS price changes with error bars representing 95% confidence intervals for linear mixed model. Regional data. Horizontal blue line is at 12.82 cents, the weighted average scheme price. Drink categories with change estimates different to zero at the 0.01 level of significance are labelled with "*". Data are from WA, NSW, QLD and VIC.

Table 5.8: CDS price change estimate (standard error) for metropolitan alcoholic beverage markets. Mixed effects model.

region	model	subset	beer	cider	RTD	alcoholic
metro	lme	all	4.3*** (0.2)	4.5*** (0.4)	5.6*** (0.5)	4.6*** (0.2)
metro	lme	WA+NSW+QLD+VIC	4.8*** (0.2)	5.0*** (0.4)	6.3*** (0.5)	5.2*** (0.2)
regional	lme	all	14.5***$$$ (0.5)	32.0***$$$ (1.6)	16.4***$$$ (1.3)	19.5***$$$ (0.5)
regional	lme	WA+NSW+QLD+VIC	15.0***$$$ (0.5)	32.6***$$$ (1.6)	17.2***$$$ (1.3)	20.1***$$$ (0.5)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

Table 5.9: CDS price change estimate (standard error) for metropolitan non-alcoholic beverage markets. Mixed effects model.

region	model	subset	soft drinks	water	fruit juice	non-alcoholic
metro	lme	WA+NSW+QLD+VIC	14.1*** (1.1)	12.2*** (2.9)	11.6*** (2.5)	13.6*** (1.0)
regional	lme	WA+NSW+QLD+VIC	12.0*** (1.1)	2.6 (1.8)	12.5*** (1.5)	9.6*** (0.9)

Note: '*', '**', '***' mean estimate is significantly different to zero at 0.1, 0.05 and 0.01 levels respectively. '$', '$$', '$$$' mean that the estimate is also significantly higher than 12.82 cents at the 0.1, 0.05 and 0.01 levels respectively.

Table 5.10 and 5.11 give the 95% confidence intervals for the estimates. Confidence intervals are obtained based on normal approximations to the distribution of estimators. These are calculated via the R function `intervals.lme()` for linear mixed models.

Table 5.10: CDS price change estimate (95% confidence interval) for alcoholic beverages.

region	model	subset	beer	cider	RTD	alcoholic
metro	lme	all	(4.0 , 4.6)	(3.7 , 5.3)	(4.7 , 6.5)	(4.3 , 4.9)
metro	lme	WA+NSW+QLD+VIC	(4.4 , 5.1)	(4.1 , 5.8)	(5.4 , 7.3)	(4.8 , 5.5)
regional	lme	all	(13.5 , 15.5)	(28.9 , 35.1)	(13.9 , 19.0)	(18.5 , 20.4)
regional	lme	WA+NSW+QLD+VIC	(14.0 , 16.0)	(29.4 , 35.7)	(14.6 , 19.8)	(19.1 , 21.1)

Table 5.11: CDS price change estimate (95% confidence interval) for non-alcoholic beverages.

region	model	subset	soft drinks	water	fruit juice	non-alcoholic
metro	lme	WA+NSW+QLD+VIC	(12.0 , 16.2)	(6.6 , 17.8)	(6.6 , 16.6)	(11.7 , 15.5)
regional	lme	WA+NSW+QLD+VIC	(9.8 , 14.3)	(-0.9 , 6.1)	(9.7 , 15.4)	(7.8 , 11.4)

5.3 CDS impact as measured by CPI

The official Consumer Price Index (CPI) is released quarterly by the Australian Bureau of Statistics (**Australian Bureau of Statistics 2021**). The CPI follows 87 expenditure classes that are priced over time in each of the 8 capital cities. Of these, the following have been analysed in this section:

1. Beer
2. Waters, soft drinks and juices
3. Alcoholic beverages
4. Spirits
5. Milk
6. Wine

The first two expenditure classes should be mostly made up of beverage containers that are eligible for the CDS. The third is a broader expenditure group that includes some eligible beverages. The fourth expenditure class includes RTD beverages but also straight spirit products. The last two expenditure classes are not CDS eligible.

The CPI growth in these expenditure classes for Perth can be seen in Figure 5.5 alongside the CPI series for the same measures in other capitals. This figure shows that *beer* and *waters, soft drinks and juices* increase after the September 2020 quarter whereas *milk* and *wine* have no noticeable increase beyond the CPI series for other states.

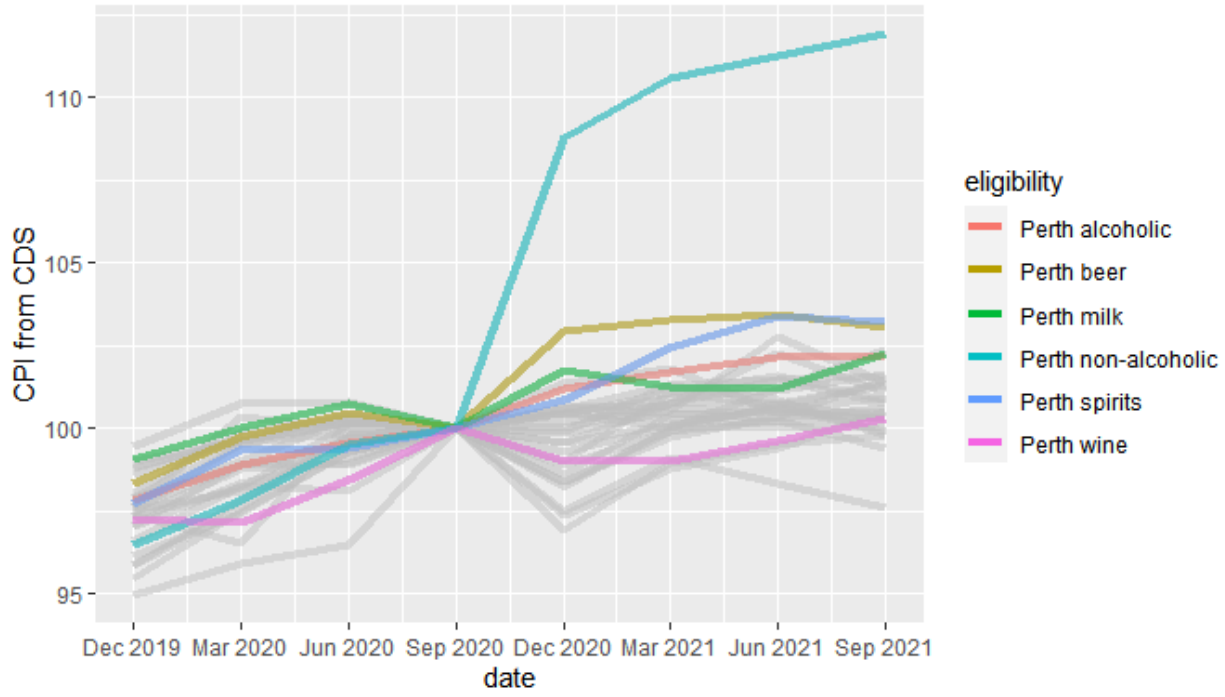


Figure 5.5: CPI series for studied expenditure classes in Perth. Other capital CPI series shown in grey. Series have been indexed to 100 at September 2020, the last publication before the introduction of the CDS.

As the CPI is published as an index, we can look at the growth of prices in each of these expenditure classes from before 1st October 2020 to after. We do this by comparing the 4 quarters of data before this date and

the 4 quarters available after. We can compare the growth in price in Perth to that of other capitals and from this estimate the impact of the CDS on Perth prices in percentage terms. That is, the growth in price in Perth is modelled as the growth in price in other capitals times the growth attributable to the introduction of the CDS. Applying this percentage impact to the median beverage container price observed before the CDS introduction from the Invigor and Nielsen data, an estimate of the price impact in cents is calculated.

Table 5.12: Changes to CPI pre (4 quarters) and post (4 quarters) CDS introduction. Container price is median Perth price pre-CDS.

	CPI change Perth (%)	**CPI change other capitals (%)**	**CDS impact (%)**	**Container price ($)**	**CDS impact (cents)**
Alcoholic beverages	2.8	1.4	1.3	4.0	5.4
Beer	3.6	1.2	2.3	3.8	8.8
Milk	1.7	0.7	1.0	-	-
Spirits	3.4	1.7	1.6	-	-
Waters, soft drinks and juices	12.4	1.7	10.5	1.2	12.9
Wine	1.3	1.4	-0.1	-	-

The results, given in Table 5.12, show that the highest impacts on CPI are in the expected expenditure classes of Beer and Waters, soft drinks and juices. The impacts in terms of cents are not too different from those of our own analysis of retailer data. For beer, the impact is estimated to be 8.8 cents (compared to 3.3 cents from the analysis of Invigor data).

For the Waters, soft drinks and juices the impact is estimated to be 12.9 compared to the impact on non-alcoholic beverages from the analysis of Nielsen data of 13.5 cents.

Appendix

6 Multiple linear regression models for metro prices

The output from the linear models fitted to each dataset are given in this Appendix. The parameter of interest, representing the estimate of price change attributable to the introduction of the CDS in WA, is **`WA:WA_CDS`** and this output is expressed in dollars. For example, the first table shows the estimates for the parameter **`WA:WA_CDS`** to be 0.1350 with a standard error of 0.0252 which is a 13.50 cent estimated increase due to the CDS with a standard error of 2.52 cents.

6.1 Metro soft-drinks model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.6539	0.6719	-3.95	1e-04	***
WA	-0.2071	0.0186	-11.16	0e+00	***
WA_CDS	-0.0881	0.0155	-5.69	0e+00	***
stateQLD	-0.0310	0.0094	-3.30	1e-03	***
stateVIC	-0.1725	0.0095	-18.11	0e+00	***
product_classFlavoured_Milk	0.1692	0.0248	6.82	0e+00	***
product_classMixers	-0.4896	0.0262	-18.67	0e+00	***
product_classRTD_Tea	0.5556	0.0297	18.72	0e+00	***
product_classSoftdrinks	-0.4158	0.0234	-17.79	0e+00	***
product_classSport_Drinks	-0.7383	0.0299	-24.72	0e+00	***
brand_classother	-0.3082	0.0091	-33.85	0e+00	***
brand_classtier 2	-1.0397	0.0125	-83.42	0e+00	***
retailer_classother	0.1618	0.0342	4.73	0e+00	***
retailer_classtier 2	-0.0599	0.0117	-5.10	0e+00	***
pack_classsingle	1.1012	0.0211	52.10	0e+00	***
container_sizeM	0.8395	0.0174	48.34	0e+00	***
container_sizeS	0.1411	0.0205	6.88	0e+00	***
date	0.0002	0.0000	5.99	0e+00	***
WA:WA_CDS	0.1350	0.0252	5.36	0e+00	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Observations	Residual Std. Error	R^2	Adjusted R^2
12,785	3.66	0.727	0.726

6.2 Metro water model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.6094	0.0593	10.285	0.0000	***
WA	-0.1756	0.0387	-4.536	0.0000	***
WA_CDS	0.0262	0.0161	1.628	0.1037	
stateQLD	-0.0062	0.0199	-0.311	0.7557	
stateVIC	-0.1251	0.0192	-6.531	0.0000	***
product_classStillFunctional_Water	0.6061	0.0187	32.445	0.0000	***
brand_classother	0.0739	0.0342	2.159	0.0309	*
brand_classtier 2	-0.7179	0.0340	-21.127	0.0000	***
pack_classsingle	0.9934	0.0360	27.588	0.0000	***
container_sizeM	0.1119	0.0327	3.420	0.0006	***
container_sizeS	0.2536	0.0562	4.516	0.0000	***
WA:WA_CDS	0.1201	0.0531	2.262	0.0238	*

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Observations	Residual Std. Error	R^2	Adjusted R^2
3,157	3.64	0.673	0.672

6.3 Metro fruit-juice model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-0.9296	0.8181	-1.14	0.2561	
WA	-0.1479	0.0252	-5.88	0.0000	***
WA_CDS	-0.0616	0.0188	-3.28	0.0011	**
stateQLD	-0.0389	0.0111	-3.50	0.0005	***
stateVIC	-0.0947	0.0119	-7.99	0.0000	***
brand_classother	1.1042	0.0173	63.64	0.0000	***
brand_classtier 2	-0.1032	0.0114	-9.04	0.0000	***
container_sizeS	-1.5366	0.0238	-64.52	0.0000	***
date	0.0002	0.0000	3.72	0.0002	***
WA:WA_CDS	0.1226	0.0347	3.54	0.0004	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Observations	Residual Std. Error	R^2	Adjusted R^2
1,092	0.907	0.96	0.96

6.4 Metro beer model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.4848	0.0173	28.00	0.0000	***
WA	-0.0531	0.0084	-6.35	0.0000	***
WA_CDS	-0.0221	0.0056	-3.95	0.0001	***
stateQLD	-0.0272	0.0068	-3.97	0.0001	***
stateVIC	-0.0906	0.0067	-13.59	0.0000	***
materialglass	0.1731	0.0050	34.39	0.0000	***
product_classbeer-full strength other	0.7759	0.0072	108.01	0.0000	***
product_classbeer - low alc	-0.2423	0.0110	-22.08	0.0000	***
brand_class_fineLion	0.0121	0.0084	1.43	0.1514	
brand_class_fineother	0.2571	0.0072	35.66	0.0000	***
retailer_classwoolworths	0.4822	0.0085	56.91	0.0000	***
pack_class6<24	-0.9122	0.0062	-148.10	0.0000	***
pack_class24+	-1.9085	0.0061	-310.37	0.0000	***
ml_containers	0.0086	0.0000	320.08	0.0000	***
WA:WA_CDS	0.0330	0.0111	2.98	0.0028	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Observations	Residual Std. Error	R^2	Adjusted R^2
292,915	1.3	0.527	0.527

6.5 Metro cider model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.2929	0.0341	-67.30	0.0000	***
WA	-0.0875	0.0145	-6.04	0.0000	***
WA_CDS	-0.0712	0.0096	-7.40	0.0000	***
stateQLD	-0.0451	0.0117	-3.85	0.0001	***
stateVIC	-0.1584	0.0115	-13.73	0.0000	***
materialglass	0.9825	0.0096	102.47	0.0000	***
product_classCider-other	0.4574	0.0099	46.32	0.0000	***
product_classCider-pear	-0.0148	0.0135	-1.10	0.2730	
brand_class_fineLion	1.0163	0.0230	44.11	0.0000	***
brand_class_fineother	0.6347	0.0133	47.61	0.0000	***
retailer_classwoolworths	0.4633	0.0130	35.59	0.0000	***
pack_class6<24	-1.5633	0.0111	-140.66	0.0000	***
pack_class24+	-1.8818	0.0104	-181.21	0.0000	***
ml_containers	0.0151	0.0001	195.12	0.0000	***
WA:WA_CDS	0.0566	0.0193	2.94	0.0033	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Observations	Residual Std. Error	R^2	Adjusted R^2
70,547	1.1	0.648	0.648

6.6 Metro RTD model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-4.5767	0.7161	-6.39	0.0000	***
WA	-0.1109	0.0141	-7.88	0.0000	***
WA_CDS	-0.0732	0.0161	-4.54	0.0000	***
stateQLD	-0.0170	0.0113	-1.51	0.1323	
stateVIC	-0.1065	0.0111	-9.61	0.0000	***
materialglass	0.3926	0.0093	42.04	0.0000	***
product_classRTD-other	-0.2241	0.0129	-17.40	0.0000	***
product_classRTD-rum	-0.4481	0.0146	-30.76	0.0000	***
product_classRTD-vodka	-0.6431	0.0122	-52.89	0.0000	***
brand_class_fineDiageo	0.5610	0.0151	37.10	0.0000	***
brand_class_fineother	0.1250	0.0125	10.01	0.0000	***
retailer_classwoolworths	0.1650	0.0109	15.16	0.0000	***
pack_class6<24	-1.8652	0.0112	-165.90	0.0000	***
pack_class24+	-2.2092	0.0093	-237.79	0.0000	***
ml_containers	0.0065	0.0001	94.71	0.0000	***
date	0.0005	0.0000	11.85	0.0000	***
WA:WA_CDS	0.0752	0.0186	4.05	0.0001	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Observations	Residual Std. Error	R^2	Adjusted R^2
107,314	1.31	0.445	0.445

7 Multiple linear regression models for regional prices

7.1 Regional soft-drink model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	2.2821	0.0389	58.599	0.0000	***
WA	0.1697	0.0611	2.779	0.0055	**
WA_CDS	-0.0243	0.0136	-1.791	0.0733	
stateQLD	-0.0476	0.0163	-2.916	0.0036	**
stateVIC	-0.1473	0.0168	-8.784	0.0000	***
remotenessOuter Regional Australia	-0.0504	0.0245	-2.063	0.0391	*
remotenessRemote Australia	0.0658	0.0273	2.413	0.0158	*
remotenessVery Remote Australia	0.3968	0.0267	14.857	0.0000	***
product_classFlavoured_Milk	-0.5661	0.0268	-21.149	0.0000	***
product_classiced tea / coffee	0.0045	0.0297	0.151	0.8801	
product_classMixers	-1.3458	0.0354	-38.011	0.0000	***
product_classSoftdrinks	-1.1453	0.0219	-52.406	0.0000	***
product_classSport_Drinks	-0.8937	0.0354	-25.259	0.0000	***
brand_classother	-0.2784	0.0162	-17.166	0.0000	***
brand_classtier 2	-0.9023	0.0287	-31.473	0.0000	***
brand_classCoca-Cola	0.8284	0.0272	30.500	0.0000	***
brand_classAsahi	0.5840	0.0395	14.789	0.0000	***
retailer_classother	0.2064	0.0398	5.181	0.0000	***
retailer_classtier 2	0.0628	0.0196	3.208	0.0013	**
retailer_classMajor	-1.6397	0.0475	-34.543	0.0000	***
retailer_classTier 2	-1.0264	0.0452	-22.704	0.0000	***
pack_classsingle	0.9819	0.0221	44.408	0.0000	***
pack_class1<6	1.9982	0.0298	67.039	0.0000	***
container_sizeM	0.7009	0.0160	43.739	0.0000	***
container_sizeS	-0.1218	0.0203	-6.016	0.0000	***
WA:WA_CDS	0.0894	0.0209	4.286	0.0000	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Observations	Residual Std. Error	R^2	Adjusted R^2
18,904	0.706	0.714	0.714

7.2 Regional water model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	1.4381	0.0540	26.629	0.0000	***
WA	-0.7035	0.0627	-11.229	0.0000	***
WA_CDS	-0.0135	0.0301	-0.450	0.6528	
stateQLD	-0.0480	0.0376	-1.276	0.2019	
stateVIC	-0.1527	0.0355	-4.298	0.0000	***
remotenessOuter Regional Australia	-0.1387	0.0348	-3.984	0.0001	***
remotenessRemote Australia	-0.1160	0.0401	-2.895	0.0038	**
remotenessVery Remote Australia	0.1317	0.0381	3.456	0.0006	***
product_classStillFunctional_Water	0.3599	0.0251	14.319	0.0000	***
brand_classother	-0.2240	0.0426	-5.255	0.0000	***
brand_classtier 2	-0.8785	0.0442	-19.895	0.0000	***
brand_classCoca-Cola	0.6563	0.0503	13.045	0.0000	***
brand_classAsahi	0.2585	0.0624	4.145	0.0000	***
retailer_classother	1.1692	0.0326	35.858	0.0000	***
retailer_classtier 2	-0.0551	0.0409	-1.347	0.1781	
retailer_classMajor	-0.6251	0.0294	-21.229	0.0000	***
pack_classsingle	0.7421	0.0381	19.482	0.0000	***
pack_class1<6	1.3522	0.0309	43.700	0.0000	***
container_sizeM	-0.3403	0.0261	-13.017	0.0000	***
container_sizeS	-0.6131	0.0317	-19.317	0.0000	***
WA:WA_CDS	-0.0087	0.0381	-0.229	0.8187	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Observations	Residual Std. Error	R^2	Adjusted R^2
7,171	0.776	0.62	0.619

7.3 Regional fruit-juice model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	2.1085	0.0292	72.104	0.000	***
WA	-0.8703	0.0381	-22.815	0.000	***
WA_CDS	-0.0118	0.0145	-0.811	0.417	
stateQLD	-0.1053	0.0180	-5.864	0.000	***
stateVIC	-0.0798	0.0174	-4.586	0.000	***
remotenessOuter Regional Australia	-0.0388	0.0274	-1.413	0.158	
remotenessRemote Australia	-0.0224	0.0294	-0.763	0.446	
remotenessVery Remote Australia	0.1304	0.0290	4.499	0.000	***
brand_classother	1.0768	0.0207	52.086	0.000	***
brand_classtier 2	-0.1336	0.0207	-6.463	0.000	***
brand_classHienz	0.9466	0.0321	29.471	0.000	***
brand_classAsahi	0.5700	0.0688	8.285	0.000	***
retailer_classother	0.1806	0.0292	6.182	0.000	***
retailer_classMajor	-0.1925	0.0224	-8.610	0.000	***
pack_class1<6	1.9347	0.0513	37.681	0.000	***
container_sizeS	-1.4811	0.0257	-57.730	0.000	***
WA:WA_CDS	0.1157	0.0224	5.158	0.000	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Observations	Residual Std. Error	R^2	Adjusted R^2
1,704	0.225	0.93	0.929

7.4 Regional beer model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.5081	0.0193	26.3193	0.0000	***
WA	-0.2940	0.0474	-6.1988	0.0000	***
WA_CDS	-0.0224	0.0055	-4.0558	0.0000	***
stateQLD	-0.0283	0.0068	-4.1831	0.0000	***
stateVIC	-0.0915	0.0066	-13.8906	0.0000	***
remotenessOuter Regional Australia	-0.2220	0.0421	-5.2787	0.0000	***
remotenessRemote Australia	-0.0973	0.0513	-1.8972	0.0578	
remotenessVery Remote Australia	0.1231	0.0472	2.6097	0.0091	**
materialglass	0.1879	0.0057	33.1867	0.0000	***
materialunknown	0.0631	0.9106	0.0693	0.9448	
product_classbeer-full strength other	0.7675	0.0079	96.9046	0.0000	***
product_classbeer - low alc	-0.2113	0.0117	-18.1408	0.0000	***
brand_class_fineLion	-0.0034	0.0093	-0.3654	0.7148	
brand_class_fineother	0.2541	0.0081	31.4101	0.0000	***
retailer_classwoolworths	0.4789	0.0096	49.8348	0.0000	***
retailer_classother	0.2912	0.0392	7.4235	0.0000	***
retailer_classhotel	0.7272	0.0398	18.2810	0.0000	***
pack_class6<24	-0.8994	0.0070	-128.4507	0.0000	***
pack_class24+	-1.9056	0.0070	-272.5699	0.0000	***
ml_containers	0.0085	0.0000	281.5925	0.0000	***
WA:WA_CDS	0.1365	0.0297	4.5978	0.0000	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Observations	Residual Std. Error	R^2	Adjusted R^2
226,098	1.29	0.535	0.535

7.5 Regional cider model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.2850	0.0476	-48.04	0.0000	***
WA	0.3632	0.1024	3.55	0.0004	***
WA_CDS	-0.0831	0.0129	-6.44	0.0000	***
stateQLD	-0.0387	0.0157	-2.47	0.0135	*
stateVIC	-0.1852	0.0155	-11.96	0.0000	***
remotenessOuter Regional Australia	-0.1308	0.0905	-1.44	0.1486	
remotenessRemote Australia	0.4402	0.1086	4.05	0.0001	***
remotenessVery Remote Australia	0.2050	0.0997	2.06	0.0398	*
materialglass	1.0084	0.0153	65.97	0.0000	***
product_classCider-other	0.2958	0.0153	19.28	0.0000	***
product_classCider-pear	-0.0296	0.0209	-1.42	0.1568	
brand_class_fineLion	1.0896	0.0361	30.21	0.0000	***
brand_class_fineother	0.3771	0.0216	17.50	0.0000	***
retailer_classwoolworths	0.2710	0.0251	10.79	0.0000	***
retailer_classother	-0.3098	0.0832	-3.72	0.0002	***
retailer_classhotel	0.8563	0.0847	10.11	0.0000	***
pack_class6<24	-1.6627	0.0143	-116.57	0.0000	***
ml_containers	0.0164	0.0001	158.72	0.0000	***
WA:WA_CDS	0.3279	0.0628	5.22	0.0000	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Observations	Residual Std. Error	R^2	Adjusted R^2
37,004	1.21	0.612	0.612

7.6 Regional RTD model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-7.0322	1.0739	-6.548	0.0000	***
WA	0.0852	0.0691	1.234	0.2173	
WA_CDS	-0.0704	0.0234	-3.011	0.0026	**
stateQLD	0.0055	0.0153	0.359	0.7197	
stateVIC	-0.1231	0.0151	-8.170	0.0000	***
remotenessOuter Regional Australia	-0.1826	0.0607	-3.007	0.0026	**
remotenessRemote Australia	0.4912	0.0738	6.659	0.0000	***
remotenessVery Remote Australia	0.1010	0.0678	1.490	0.1361	
materialglass	0.4137	0.0146	28.296	0.0000	***
product_classRTD-other	-0.1050	0.0195	-5.372	0.0000	***
product_classRTD-rum	-0.3333	0.0218	-15.309	0.0000	***
product_classRTD-vodka	-0.5242	0.0180	-29.082	0.0000	***
brand_class_fineDiageo	0.5725	0.0235	24.377	0.0000	***
brand_class_fineother	0.1885	0.0198	9.529	0.0000	***
retailer_classwoolworths	0.0946	0.0175	5.417	0.0000	***
retailer_classother	-0.2805	0.0590	-4.756	0.0000	***
retailer_classhotel	0.8209	0.0591	13.885	0.0000	***
pack_class6<24	-1.9532	0.0141	-138.207	0.0000	***
ml_containers	0.0082	0.0001	84.872	0.0000	***
date	0.0006	0.0001	9.597	0.0000	***
WA:WA_CDS	0.0758	0.0446	1.701	0.0889	

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Observations	Residual Std. Error	R^2	Adjusted R^2
59,492	1.46	0.352	0.352

References

Australian Bureau of Statistics. 2021. "Consumer Price Index, Australia." https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/consumer-price-index-australia/mar-2021.

Department of Water and Environmental Regulation. 2019a. "List of Beverage Containers Included in the Container Deposit Scheme." https://dwer.wa.gov.au/sites/default/files/WA_CDS_beverage_container_list.pdf.

———. 2019b. "WA Container Deposit Scheme." https://dwer.wa.gov.au/cds.

Hon Ben Wyatt MLA. 2019. "Report on the Effects of the Container Deposit Scheme on Beverage Prices in Western Australia - Final Terms of Reference." https://www.erawa.com.au/cproot/20488/2/-2019.CDS.Inq-Final-Terms-of-Reference.PDF.

Independent Pricing and Regulatory Tribunal NSW. 2018. "Container Deposit Scheme Monitoring." https://www.ipart.nsw.gov.au/Home/Industries/Special-Reviews/Reviews/Container-Deposit-Scheme/Container-Deposit-Scheme-Monitoring.

Jackson, Deborah. 2019. "The Huge Shifts Changing Alcohol Retailing in Australia." https://theshout.com.au/national-liquor-news/the-huge-shifts-changing-alcohol-retailing-in-australia/.

Morgan, Roy. 2019. "Alcohol Retail Currency Report."

Pinheiro, Jose, Douglas Bates, Saikat DebRoy, Deepayan Sarkar, and R Core Team. 2020. *nlme: Linear and Nonlinear Mixed Effects Models*. https://CRAN.R-project.org/package=nlme.

Queensland Productivity Commission. 2020. "Container Deposit Scheme Monitoring." https://www.qpc.qld.gov.au/reviews/pricing-review-of-container-refund-scheme/.

Venables, W. N., and B. D. Ripley. 2002. *Modern Applied Statistics with s*. Fourth. New York: Springer. http://www.stats.ox.ac.uk/pub/MASS4.