



INTERIM REPORT

NSW Container Deposit Scheme

Impacts on beverage expenditure and consumption

*Prepared for
Independent Pricing and Regulatory Tribunal (IPART)
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Executive summary

The NSW Container Deposit Scheme commenced on December 1st, 2017. This scheme pays a ten-cent deposit to consumers who return an eligible drink container, with the deposits funded through a levy on suppliers of containers. The purpose of this report is to estimate whether the introduction of this scheme has had an impact on:

- the quantity of beverages purchased for consumption in NSW
- the amount of money spent by consumers on beverages in NSW
- the market shares of large and small retailers in NSW

This work has been commissioned by the Independent Pricing and Regulatory Tribunal of NSW and is designed to complement other analysis into the impacts of the CDS on prices paid by NSW consumers of beverages.

Datasets used

This analysis is conducted using two primary data sources:

- the Nielsen Homescan Panel — this provides data for households who scan their individual purchases of products, providing transaction data for each beverage purchased by the households. The household coverage is across all of Australia. The time period coverage is from January 2016 to February 2018.
- administrative data from Exchange for Change — this provides containers sold by material type (aluminium, glass and plastic) for each first supplier. The time period covered is December 2016 to January 2018. This dataset was made available to the CIE under strict confidentiality parameters.

Estimated impacts of the CDS on expenditure and consumption

The results presented in this report are preliminary results from the analysis of data to February 2018. A final report will be conducted with additional data in October 2018. There are good reasons to be cautious in interpreting the findings of the impacts of the CDS at this stage.

- There is a significant amount of variation in the underlying consumption trends. This makes it more challenging to identify the impacts of the CDS versus the impacts of other factors.
- There are strong seasonal effects (beverage consumption is typically higher through summer) which coincides with the introduction of the CDS, and different seasonal patterns across states.

Bearing this in mind, the main results from the analysis in this report are shown in table 1.

1 Summary of preliminary conclusions

Sector	Consumption	Expenditure
Non-alcoholic beverages	Estimated reduction of 6 per cent or 0.9 litres per household per month The largest impacts (by volume) are from soft drinks, followed by water Evidence of larger impacts for multi-pack products rather than single bottles	Evidence supports expenditure change being close to zero
Alcoholic beverages	No clear evidence of impacts at this stage	No clear evidence of impacts at this stage

Source: The CIE.

The area where it appears the CDS may have had an impact to date is on the consumption of non-alcoholic beverages.

- The CDS has reduced **consumption** of non-alcoholic drinks by around 900mL (~6 per cent) per household per month. This is driven by reductions in soft drink and bottled water (table 2). This result (at the aggregate level) is statistically significant and robust to changes in model specification.
- The impacts appear largest for multi-pack products, rather than for single beverages.

2 Estimated impact of the CDS on consumption of non-alcoholic beverage types

	Water	Soft drink	Juice	Total
Estimated impact (Litres)	-0.3	-0.59***	0.01	-0.89***
Standard error	(0.2)	(0.21)	(0.09)	(0.3)
Implied percentage change	-10.3%	-6.9%	0.3%	-6.1%

Note: *** indicates that the estimate is significant at the 1% level.

Source: CIE calculations.

One way to test the reliability of the main conclusions above is estimate the impact of the CDS using different modelling assumptions. This report conducts a sensitivity analysis with respect to:

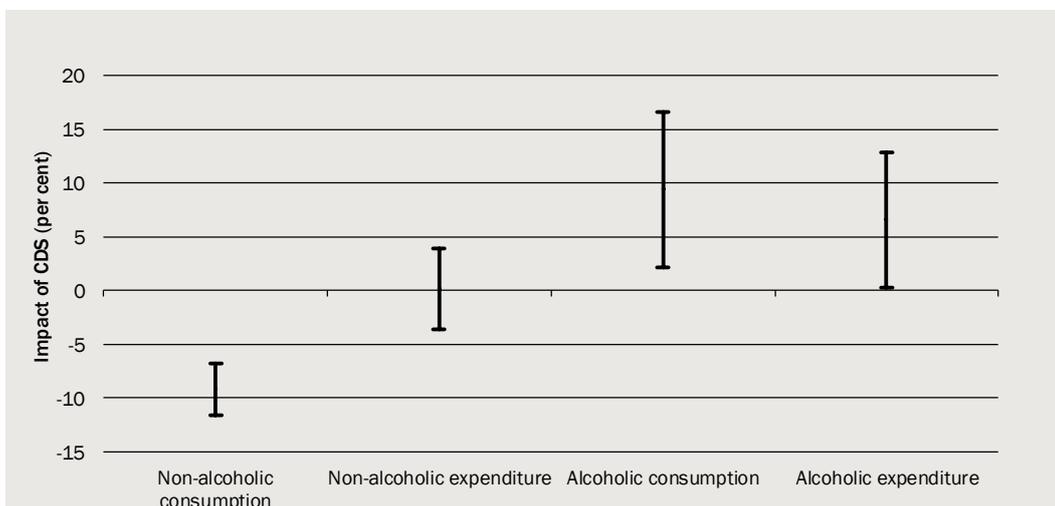
- whether to use Victorian households as the 'control group' in the regression, or include all Australian states and territories
- whether to allow seasonal trends that vary by state, and
- whether to fit a linear or logistic model.

The range of estimates generated by changing these assumptions is shown in chart 3.¹ This shows that the estimates regarding non-alcoholic consumption are relatively robust

¹ Note that the range of estimates in chart 2 are slightly larger than the estimate in table 1. This occurs because chart 2 is based on the linear average of the estimates across the three months in each model specification, while table 1 estimates the average impact of the CDS directly, which will result in slightly different results.

to the changes in model specification, while the results for alcoholic beverages are quite sensitive. This provides further reason to interpret the alcohol results with caution.

3 The sensitivity of the main results to different modelling assumptions



Data source: CIE calculations.

The final report will be produced using data up to October 2018, and it is expected that this will improve the reliability and robustness of the estimated impact of the CDS.

More detailed estimates

In addition to the average estimates of the CDS that are reported above, this report also estimates the impact of the CDS across a variety of market categories, including:

- the impact of the CDS by month since the CDS was introduced
- the impact by beverage category
- the impact for large and small retailers and for larger and small suppliers
- the impact in metropolitan versus regional areas

While these estimates provide interesting insight into what is occurring in the NSW beverage market, they are conducted using smaller sample sizes and are typically less reliable than the main estimates.

1 Introduction

The NSW Container Deposit Scheme (CDS), Return and Earn, commenced on 1 December 2017. This scheme allows for containers returned to collection points to earn a 10-cent refund and for containers recycled by materials recovery facilities (MRFs) to also receive a refund that will be shared between MRFs and local councils. The cost of the scheme, including the refund, is paid for at the point of (and by any entity responsible for) first beverage supply into NSW.

What the CIE has been asked to do?

The Independent Pricing and Regulatory Tribunal of NSW (IPART) has been asked by the Premier to monitor and report on the impact of the implementation of the Container Deposit Scheme (CDS) on container beverage prices. In particular, IPART will monitor and report on:

- 1 the effect of the CDS on prices of beverages supplied in a container,
- 2 the effect of the CDS on competition for beverages and the performance and conduct of suppliers, and
- 3 any other market impacts on consumers that arise from the commencement of the CDS, for the period from 1 November 2017 to 1 December 2018 (monitoring period).

To inform this reporting process, IPART NSW has asked the Centre for International Economics to conduct a quantitative analysis of beverage consumption data that identifies:

- the impact of the CDS on consumer spending on alcoholic and non-alcoholic beverages, including:
 - whether there is an observed change in quantity consumed and/or money spent on beverages in each section of the beverage market
 - whether this varies by geographic region
 - whether this varies by beverage category, or between different sizes of beverages.
- the extent to which the CDS has impacted on the market share of small retailers relative to large retailers.

This analysis is conducted using two data sources:

- the Nielsen Homescan Consumption Panel, which tracks the consumption behaviour of a representative sample of Australian households.
- administrative data from Exchange for Change, which includes the total quantity of each type of beverage sold in NSW by each supplier.

This interim report contains analysis of data up to February 2018, while a final report will be delivered in October that will include analysis of an additional 6 months of data.

The analysis contained in this report is designed to complement other analysis being conducted for the IPART review of the CDS. For instance, IPART is conducting an analysis of price changes that have occurred following the CDS.

Expected impacts of the CDS

The aim of the container deposit scheme is to incentivise the return of beverage containers on the part of consumers in the form of a 10-cent refund per bottle. As this mechanism is funded on an industry levy, first suppliers of beverages in NSW effectively pay for the refund. With respect to consumer behaviour, consumers may change their patterns of beverage consumption as a result of the CDS. These changes will be driven by:

- The extent to which the CDS levy is passed through to consumers by first suppliers
- The extent to which these price increases are perceived as real price increases – i.e. to what extent is the retail price increase of beverages offset by the refund from container returns.

The interactions between these two forces could lead to unique outcomes regarding overall demand for beverages in NSW. Under a scenario with full participation in ‘earn and return’, any passthrough of the CDS charge would be fully offset by the refunds. In this case, the price increase would be neutralised and it would be reasonable to expect little change in consumer patterns regarding beverages. Alternatively, for customers who do not participate in earn and return, CDS passthrough would constitute a real price increase, and, depending on overall sensitivity to price increases, this could lead to a decrease in demand for beverages. This could be the case for households who find it costly to participate in earn and return due to a lack of nearby collection facilities.

Changes in overall beverage consumption vs expenditure

Theoretically, we would expect that:

- the CDS would increase the price of beverages, as some part of the CDS levy is passed through to consumers
- in response, consumers would reduce the amount of consumption of CDS-eligible products
- the overall impacts of the CDS on a household’s expenditure on beverages could go up or down depending on which of the above impacts is larger
 - if the reduction in consumption is proportionally larger than the increase in prices, then expenditure would fall. For example, if prices increase by 5 per cent and quantity consumed falls by 10 per cent, the expenditure on beverages will fall
 - if the reduction in consumption is proportionally the same as the increase in prices, then expenditure would remain the same

- if the reduction in consumption is proportionally smaller than the increase in prices, then expenditure would increase

This suggests that, overall, we would expect to find stronger results for impacts on consumption. In theory, however, the impacts expenditure and consumption are multi-dimensional depending on the relative strengths of price sensitivity and participation in earn and return (chart 1.1).

1.1 Different impacts on consumption and spending

Elastic	Inelastic	Unit elastic
Decreased consumption	Decreased consumption	Decreased consumption
Decreased spending	Increased spending	Unchanged spending

Source: CIE Illustration.

The changes in consumer purchasing patterns may not occur immediately. There may also be complicated responses to the CDS within beverage types. For example, people may substitute to larger products, because these have a lower proportional CDS levy — a 1.5L soft drink has the same CDS charge as a 0.5L soft drink.

Within different regions there could also be different effects. This could partly reflect the income levels or demographic characteristics that vary between regional and metropolitan areas. However, it could also reflect design elements of the CDS. For instance, if people in regional areas were typically further away from a collection depot, then they may be more likely to reduce consumption following the introduction of the CDS. For areas on the border, it could also reflect people being able to purchase product from neighbouring states that does not have a CDS levy added into the price.

The empirical approach

The main empirical approach used in this report to estimate the impact of the CDS is a fixed effects regression model using household level consumption and expenditure data from the Nielsen Homescan Consumer Panel (box 1.2).

The intuition behind this approach is that it compares the behaviour of households before and after the introduction of the CDS in New South Wales and in a control group (Victoria in the main specification). If the typical household in NSW reduces consumption (compared to the control group) following the introduction of the CDS, then the model will identify this change as the impact of the CDS.

The main challenges with this approach are:

- noisy underlying consumption data: This is particularly acute with alcohol consumption data which has significantly fewer observations than non-alcoholic consumption data
- seasonal trends in beverage consumption: There is a strong seasonal trend in beverage consumption that coincides with the introduction of the CDS (people tend to drink more in summer). If this is not adequately accounted for, then it will impact on the estimated impact of the CDS.

For this interim report, these issues have primarily been addressed by running the model using a variety of different specifications. The issues of noisy data and seasonal variation will be better able to be accounted for with data for the final report. However, the extent to which there are other factors that impact on beverage consumption that we cannot account for, and that get attributed to the CDS, will remain an issue even with more data available.

1.2 The fixed effects regression model

The impact of the CDS on beverage consumption is estimated using a fixed effects regression model. The main specification of this model is:

$$Y_{it} = \alpha_i + \beta_{1t} + \beta_{2t} + cds*nsw_{it} + u_{it}$$

Where:

- Y_{it} is the predicted variable, which include monthly expenditure, monthly consumption (in litres), log of consumption and log of income.
- α_i is a household level fixed effect that estimates the different level of demand at the household level
- β_{1t} is a time-based fixed effect that capture general trends in consumption of beverages across Australia.
- $cds*nsw_{it}$ captures the effect of the CDS. It is a dummy that occurs among household in NSW after the start of the CDS.
- u_{it} is the error term

The model is estimated on a monthly household panel which is generated from the Nielsen data, and is estimated independently on each beverage type.

A variety of alternative specifications were tested, including fitting a log model, incorporating seasonal trends (in addition to time fixed effects), and using all of Australia rather than Victoria as the control group. The main results from these specifications are shown in Appendix A.

Interpreting the results

This report estimates the impact of the CDS on a range of outcomes in the beverage market and some of these results are more reliable than others. In general, results are more reliable where they are:

- **Statistically significant.** Estimates in the report are reported with a measure of statistical significance. This is a technical measure of whether the estimate is likely to be a systematic impact of the CDS, as opposed to being generated by chance. An estimate will be statistically significant if most households show impacts in the same direction. While statistical significance is a very useful measure of model accuracy, it does have limitations. For instance, the statistical significance of a result is typically driven by the sample size, and so it is much more likely that the estimates will be

statistically significant for larger consumption categories, even if the impact was the same across categories. A statistically significant result could be found (or not found) also depending on whether there was another factor omitted from the analysis that occurred at the same time as the CDS. For example, if there was particularly hot weather since the CDS was introduced that led to greater beverage consumption across a lot of households, then this could show up as a statistically significant increase from the CDS.

- **Robust to modelling assumptions:** The estimation of the impact of the CDS is conducted using a fixed effects regression, and the estimated impact of the CDS can be impacted by the setup of this model. The appendix to this report tests the sensitivity of the main results to these modelling choices.
- **Relatively stable across time periods.** This report estimates the impact of the CDS by month. If the estimates are relatively stable across the 3 months of the CDS, it is a sign that the estimates are relatively reliable.
- **Consistent with economic intuition.** In some cases, the model generates results that are at odds with economic intuition (for instance, in the alcohol section, the modelling suggests that the CDS is responsible for a statistically significant increase in beer consumption). In such cases, it is highly likely that the result is due to noise in the underlying data, rather than the CDS resulting in an increase in beer consumption.

The results in this report are typically better estimated for non-alcoholic beverages, while smaller sample sizes mean that the estimates for alcoholic beverages and analysis of smaller market categories is typically less accurate. In all cases, estimates in the final report will be calculated with another 6 months of data, and will be more precise than the results in this interim report.

2 *Data sources*

This report analyses the impact of the CDS using two primary data sources. This chapter describes those data sources in detail, and identifies their strengths and weaknesses.

Nielsen Homescan Consumer Panel

The Nielsen Homescan Panel survey collects data on household consumption for 10 000 households across a wide variety of product categories. Survey participants scan the barcode of the products that they purchase and manually record the quantity of their purchase (together with the price paid), creating a panel dataset of consumption data.

For this study, the transaction level data for all beverage products purchased from January 2016 – February 2018 have been used. This data includes:

- a detailed description of the product purchased (e.g. Coca Cola Value Pack 30x375ml)
- the price that was paid
- the retailer
- the data of the transaction
- the location of the transaction (broken down into 14 regions within Australia)

For this study, these transactions were grouped into six categories, which include Beer, Wine, Spirits, Water, Soft drinks and Juice. The Homescan survey is designed to capture these products when they are purchased at a retail outlet for consumption at home. Therefore, the dataset does not contain information on beverages purchased through other channels, including:

- beverages purchased through the hospitality sector (such as bars and cafes)
- beverages purchased and consumed away from home (such as a drink purchased at a petrol station)
- beverages purchased by groups other than households (such as businesses)
- beverages consumed but not scanned for any other reason.

A final attribute of the data is that monthly consumption is equal to zero for many household/consumption categories pairs. This largely reflects the reality that alcohol purchases are less common across the population than non-alcoholic purchases. This feature of the data is also important for econometric design.²

² This is particularly important when deciding whether to fit a linear or log model. Without adjustment, a log model will drop zero observations, and while there are options that can be used to include zeros in the model, they typically perform poorly with such a high proportion of zeros in the sample.

Administrative data from exchange for change

Exchange for Change maintains an administrative dataset on 527 first suppliers registered with the scheme. This dataset maintains monthly historical information on container volume supply dating back to September 2016, as well as recent records during the CDS billing period up to January 2018. Further, information on container volumes are specified by container type, including containers made from:

- Aluminium
- Glass
- PET
- HDPE
- LPB
- Steel
- Other plastics
- Other materials

This dataset was made available to the CIE under strict confidentiality parameters. Using this information at the supplier level, it is possible to track changes in overall supply across the different container types, as well as by alcoholic and non-alcoholic beverages to measure changes in supplier market share since the introduction of the CDS.

3 *Impacts on consumers of non-alcoholic beverages*

Key points

- Econometric modelling of the individual non-alcoholic beverage categories is supportive of the CDS reducing the consumption (in litres) of these beverages, whilst no significant change was estimated for expenditure. The noise in the data means that measured impacts are not always significant.
- The estimated magnitude of the reduction in consumption across all non-alcoholic beverages is ~6 per cent
- The largest impacts in litres was for soft drinks, while there was also a reduction in bottled water consumption. On a percentage basis, the reduction in consumption of water is the largest impact
- The impacts of the CDS were also estimated at the container size level. As large multi-packs of beverages are typically cheaper per beverage, the CDS is a larger proportional share of the original product price, and may therefore be more impacted. Preliminary evidence suggests that the largest reductions in consumption occurred for multi-packs
- The impacts of the CDS were also measured across regions of NSW. The estimates imply reduced consumption for Sydney, with no change in regional areas. This result, however, is more likely a feature of the dataset having limited observations in regional areas rather than being a clear indication of different impacts of the CDS across NSW.

Changes in average household expenditure and consumption

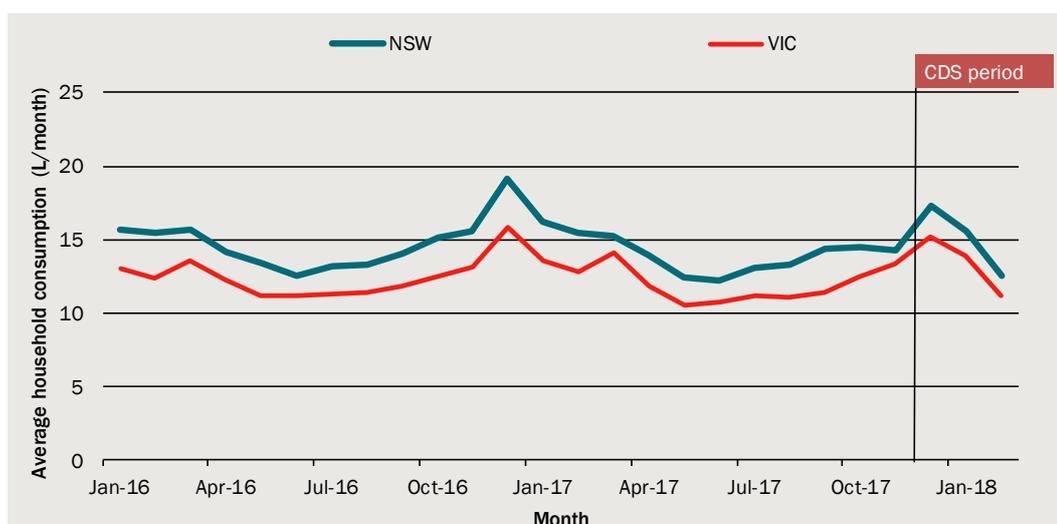
Utilising a panel dataset on household spending and consumption patterns, it is possible to track a sample of households across different geographic locations in NSW over time. By comparing the behaviour of households in NSW to another state such as Victoria, which has not since implemented a similar scheme to the CDS, it is possible to analyse differences in average household behaviour towards non-alcoholic beverages since the introduction of the CDS in NSW.

As can be seen, expenditure and consumption levels on non-alcoholic beverages in NSW has fluctuated over time (chart 3.2 and 3.1). Most notable is the similarity in the profiles of households in NSW with households in Victoria, including during seasonal months such as December, which is associated with a yearly peak in spending and consumption followed by falls in January. The time series track closely together over time, suggesting that Victorian households represent a good 'control group' for the estimation of the impact of the CDS.

Since the introduction of the CDS, expenditure and consumption on non-alcoholic beverages has fallen in both NSW and Victoria following the typical seasonal trend in beverage consumption.

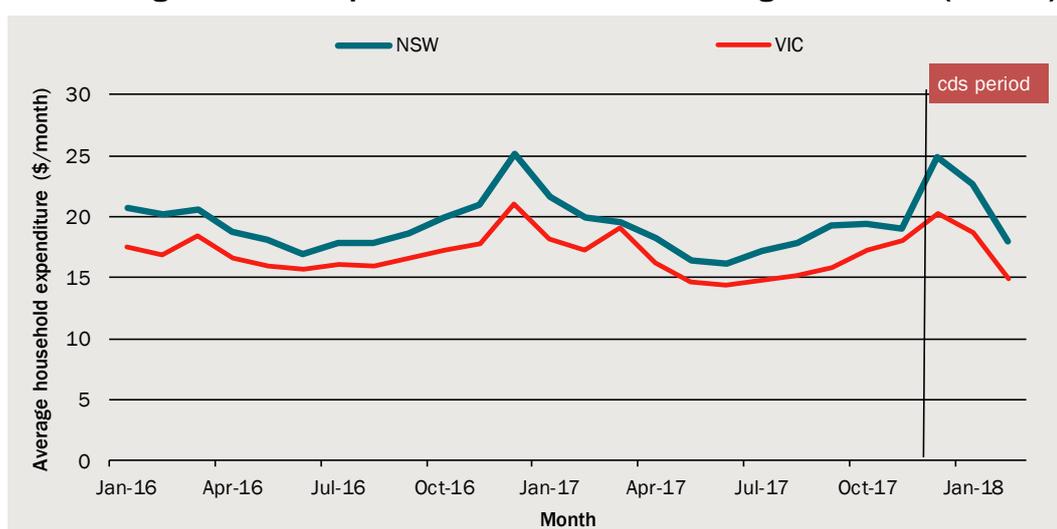
- The difference between consumption in NSW and Victoria has decreased slightly (chart 3.1)
- The difference between expenditure in NSW and Victoria has increased slightly on average since the CDS was introduced (chart 3.2)

3.1 Average household consumption on non-alcoholic beverages – 2016-18 (litres)



Data source: Nielsen Homescan.

3.2 Average household expenditure on non-alcoholic beverages – 2016-18 (nominal)



Data source: Nielsen Homescan.

This graphical analysis provides an overview of the trends in beverage consumption in NSW and Victoria. However, on its own, it is unclear whether the changes in consumption are due to the CDS or just due to natural variation in the underlying data. It is also possible that the impact of the CDS could be obscured by changes in household composition, or by aggregation of beverages (some of which are not included in the

CDS). The formal analysis in the following section is based on the same intuition as this graphical analysis, but is designed to better isolate the impact of the CDS.

Changes in household spending and consumption by beverage type

This section presents the main modelling results of the impact of the CDS on non-alcoholic beverage consumption and expenditure in NSW. The results are reported by month, and by beverage category. They are also estimated as the change in dollars (expenditure) and change in litres (consumption), which can be compared to the average household consumption in chart 3.3).

3.3 Average NSW consumption and expenditure on non-alcoholic beverages

Product category	Expenditure	Consumption
	\$/household/month	L/household/month
Fruit juices	5.6	3.1
Soft drinks	11.5	8.5
Water	2.3	2.9

Source: CIE analysis based on Nielsen Homescan data.

The reported impact of the CDS is based on the ‘preferred’ model, which is described in box 2.2, and includes household and time fixed effects, and estimates the impact of the CDS separately in each month. Various alternative specifications were tested, with the results from the models presented in Appendix A.

Summary of estimates for the CDS period

The CDS has reduced consumption of non-alcoholic drinks by around 900mL (~6 per cent) per household per month. This is driven by reductions in soft drink and bottled water (table 3.4). This considers the impact of the CDS since its introduction on average, rather than with a different month-to-month effect.

3.4 Estimated impact of the CDS on consumption of non-alcoholic beverage types

	Water	Soft drink	Juice	Total
Estimated impact (Litres)	-0.30	-0.59***	0.01	-0.89***
Standard error	(0.2)	(0.21)	(0.09)	(0.3)
Implied percentage change	-10.3%	-6.9%	0.3%	-6.1%

Note: *** indicates that the estimate is significant at the 1% level.

Source: CIE calculations.

We do not find statistically significant (or economically significant) impacts on expenditure.

If we model the impact of the CDS on aggregate non-alcoholic beverage consumption and expenditure, using different model specifications (see Appendix A), the reduction in

consumption is robust to model specification changes (chart 3.5). The impacts on expenditure range from positive to negative across the different models tested.

3.5 Impacts of the CDS on non-alcoholic beverages across different models



Data source: The CIE.

Month-by-month estimates

The estimated impact of the CDS on non-alcoholic beverage consumption and expenditure is presented on a month-by-month basis in table 3.6.³ These confirm a reduction in soft drink consumption and bottled water consumption. However, of note there is also an estimated impact in November 2017 prior to when the CDS was introduced. Also of note is the lack of statistical significance of results, reflecting the noisiness of household level consumption and expenditure data.

3.6 Estimated impacts on non-alcoholic beverage expenditure and consumption

	Nov-17	Dec-17	Jan-18	Feb-18
	\$/household/month	\$/household/month	\$/household/month	\$/household/month
Expenditure				
Soft drinks	-1.39***	0.76	0.54	-0.11
Bottled water	-0.36*	0.14	0.21	0.12
Fruit juices	-0.23	0.39	0.11	0.09
Consumption				
Soft drinks	-1.05**	-0.48	-0.58*	-0.81**
Bottled water	-0.47*	-0.41	-0.42	-0.18
Fruit juices	0.08	0.01	0.06	0.13

Note: *** for 1% significance, ** for 5% significance and * for 10% significance.

Source: CIE analysis based on Nielsen Homescan data.

³ Note that the average of the monthly estimates for December 2017 to February 2018 will be close to the impacts of the CDS on average, although not necessarily the same.

It is important to note that there has only been a small number of months since the CDS was introduced. This makes it more difficult to identify whether the estimated impacts are due to the CDS as opposed to other drivers of variation.⁴ The impact in November 2017 could indicate other factors have led to changes in consumption and are being attributed to the CDS. A longer time series since the CDS was implemented, as will be available for the final report, will provide greater confidence that impacts are not due to one-off fluctuations and seasonality.

Changes in household spending and consumption by container type

Another potential impact of the CDS is to generate substitution between beverage categories. This may occur because the CDS levy is charged at the same rate for different bottle sizes, and will therefore increase the relative attractiveness of larger bottles, and because multi-packs are typically cheaper per beverage and hence are proportionally more impacted by the CDS levy. For instance, it is possible that people will consume fewer 30 packs of soft drinks (which are charged the CDS levy 30 times), and consume more large bottles of soft drink (which are charged the CDS levy once).

The majority of consumption of water and soft drinks is either single beverages or 10-24 packs (table 3.7).

3.7 Consumption by product type

	Soft drink		Water	
	Volume	Expenditure	Volume	Expenditure
	L/household/month	L/household/month	L/household/month	L/household/month
Single	4.5	4.8	1.1	1.3
2-9	0.5	1.4	0.2	0.2
10-24	2.3	3.5	1.5	0.8
25-40	1.3	2.0	0.3	0.0
Total	8.5	11.5	2.9	2.3

Source: The CIE based on Nielsen Homescan data.

To test for this effect, the fixed effects model is re-run with products differentiated by different container sizes. Due to limitations on the number of observations across the beverage types, this analysis is limited to soft drinks and bottled water and is estimated as an average intercept across the three months of the CDS. The results, presented in table 3.8 shows that there is evidence of this effect occurring in both of these markets, but small sample sizes mean that these results should be treated cautiously. (The figure in brackets is the implied percentage reduction in each product category).

⁴ Decreases in expenditure and consumption were estimated for the month of November 2017 for soft drinks and bottled water. While it is possible that these estimates reflect ‘anticipation effects’ of the CDS, it is more likely due to underlying noise in the data, and is further reason to treat these results with caution.

3.8 Estimated impact of the CDS by container size

	Soft drinks	Water
	L/household/month	L/household/month
Consumption		
Single pack	-0.04 (-1%)	-0.1 (-9.7%)
2-9 pack	-0.07** (-15%)	0 (0%)
10-24 pack	-0.3*** (-23%)	-0.3 (-19%)
25-40 pack	-0.3*** (-26%)	0 (0%)
Expenditure		
Single pack	0.16 (3.4%)	-0.06 (-4.5%)
2-9 pack	-0.04 (-3.0%)	0.02 (10.5%)
10-24 pack	0.05 (1.4%)	0.05 (6.4%)
25-40 pack	-0.21 (0.1%)	0.01 (-)

Source: CIE calculations.

Changes in household spending and consumption by region

An additional consideration with respect to the impact of the CDS is geographic coverage. The degree of price change and sensitivity to such price changes may differ across the state. Also, given that participation in earn and return is a determinant of whether price increases are neutralised, proximity to collection facilities across the state could differ. This is particularly relevant to regional areas, which may involve longer travel times to collection facilities.

Due to there being fewer observations in the dataset in regional areas, the impacts of the CDS were not separated by month, but rather as all periods covered by the CDS. The estimates therefore will provide a measure of how expenditure and consumption across the different non-alcoholic beverage categories has changed since the introduction of the CDS in total.

The estimates suggest that:

- expenditure increased by more in regional NSW than in Sydney
- consumption decreased more in Sydney than in regional NSW.

However, due to sample sizes, very few of the results are statistically significant, and so it is not possible at this stage to identify whether there is a different impact in regional and metropolitan areas of NSW. This issue will be revisited in the final report with a larger dataset.

3.9 Estimated impacts on non-alcoholic beverages by region – average over months

	Sydney	Northern NSW	Southern NSW
	\$/household/month	\$/household/month	\$/household/month
Expenditure			
Soft drink	0.52	0.15	0.71
Bottled water	-0.00	0.41	0.45
Fruit juices	0.05	0.58*	0.29
Consumption			
Soft drink	-0.64**	-0.74	-0.18
Bottled water	-0.51*	-0.01	-0.05
Fruit juices	-0.10	0.14	0.05

Note: * ** for 1% significance, ** for 5% significance and * for 10% significance.

Source: CIE analysis based on Nielsen Homescan data.

4 Impacts on consumers of alcoholic beverages

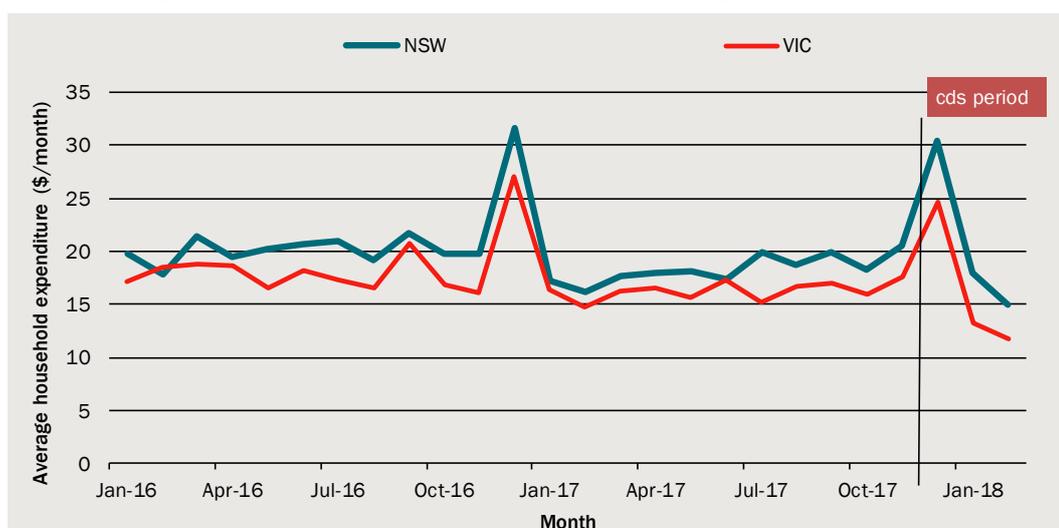
Key points

- The container deposit scheme applies differently to some types of alcohol. The scheme covers beer sold in bottles and cans, and ready to drink spirits. However, it does not cover bottles of spirits or wine.
- Average household expenditure and consumption of alcoholic beverages is more volatile compared to non-alcoholic beverages. This is partially due to there being fewer observations in the dataset on alcoholic beverages, increasing the difficulty of obtaining robust estimates for the impacts of the CDS.
- At this stage, no clear conclusions on the impact of the CDS can be drawn for alcoholic beverages.

Changes in average household expenditure and consumption

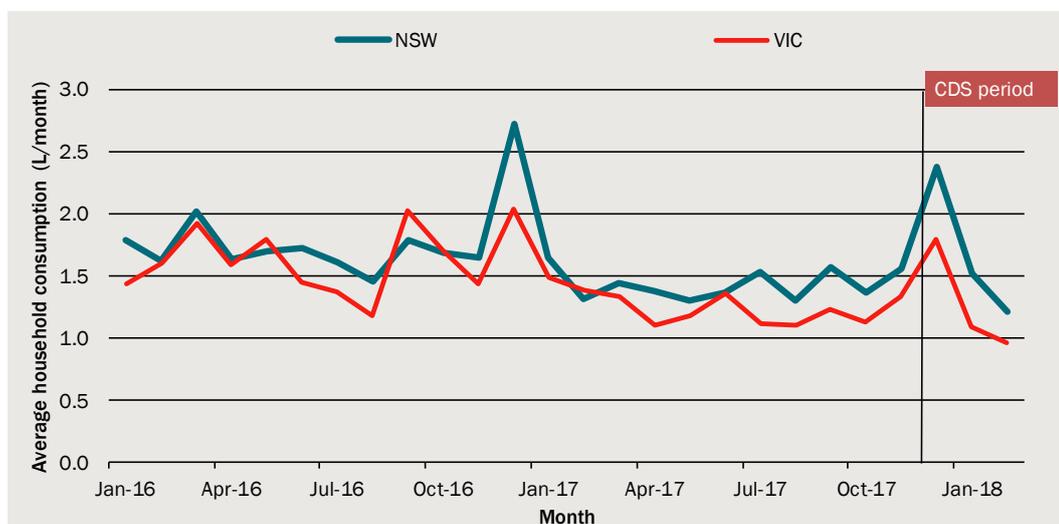
As can be seen in charts 4.1 and 4.2, expenditure and consumption of alcoholic beverages in NSW have fluctuated over time following a seasonal trend. This graphical analysis provides an overview of the trends in alcoholic beverage consumption in NSW and Victoria. However, on its own, it is unclear whether the changes in consumption are due to the CDS or just due to natural variation in the underlying data.

4.1 Average household expenditure on alcoholic beverages – 2016-18 (nominal)



Data source: CIE analysis based on Nielsen Homescan data. \$2017-18?

4.2 Average household consumption of alcoholic beverages – 2016-18 (litres)



Data source: CIE analysis based on Nielsen Homescan data.

Changes in household spending and consumption by beverage type

As was the case for non-alcoholic beverages, the impact of the CDS is estimated using a fixed effects regression model. The results are reported by month, and by beverage category. They are also estimated as the change in dollars (expenditure) and change in litres (consumption), which can be compared to the average household consumption in chart 4.3.

4.3 Average household expenditure and consumption of alcoholic beverages

Product type	Expenditure	Consumption
	\$/household/month	L/household/month
Beer	6.6	1.4
Wine	6.9	0.98
Spirits	6.4	0.23

Source: CIE analysis based on Nielsen Homescan data.

Modelled estimates month-by-month

The estimated impact of the CDS on alcohol consumption and expenditure is reported in table 4.4.

4.4 Estimated impacts on alcoholic beverage expenditure and consumption

	Nov-17	Dec-17	Jan-18	Feb-18
	\$/household/month	\$/household/month	\$/household/month	\$/household/month
Expenditure				
Beer	0.69	2.64**	1.68*	1.25
Wine	-0.10	0.80	0.03	0.00
Spirits	0.18	-0.28	0.99	0.54
Consumption				
Beer	0.18	0.54**	0.35*	0.28
Wine	~0	0.01	0.03	0.02
Spirits	0.04	-0.01	0.05	0.04

Note: * ** for 1% significance, ** for 5% significance and * for 10% significance.

Source: CIE analysis based on Nielsen Homescan data.

The coefficient estimates for the impact of the CDS across the months show no impact for spirits, whilst wine (which is exempt from the CDS) has not changed since the introduction of the CDS. The main exception is for beer:

- beer expenditure rose by \$2.64 in December 2017 compared to average monthly expenditure of \$6.6, which is 40 per cent higher
- beer consumption rose by 0.54 litres December 2017 compared to average monthly consumption of 1.4 litres, which is 39 per cent higher.

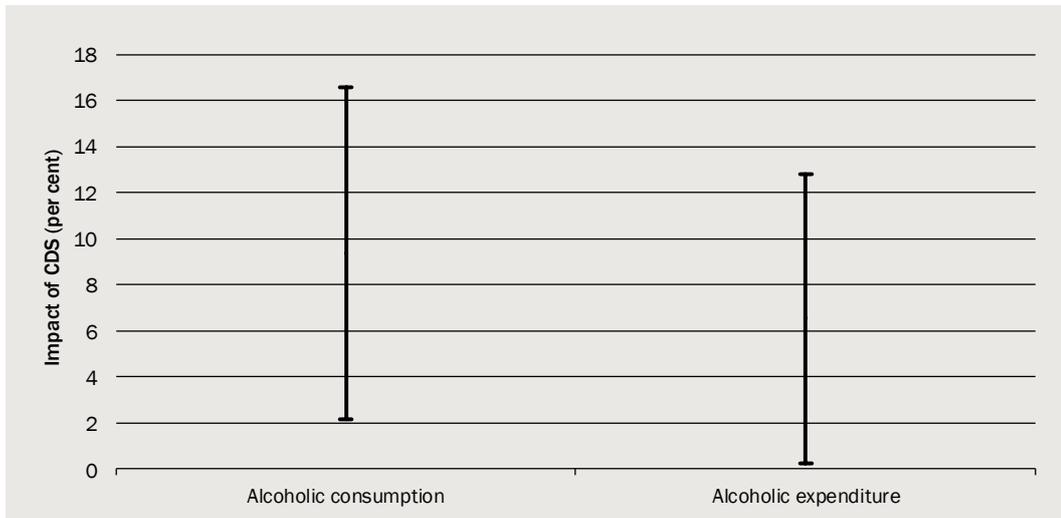
These results are surprising and also counterintuitive. The fact that beer expenditure and consumption should rise by such large magnitudes as a result of the CDS makes little economic sense. It is far more likely that, with fewer observations and greater volatility, this rise is more likely noise in the dataset that is unrelated to the CDS. As such, these estimates should not be interpreted as being the impacts of the CDS.

More observations over a longer time series will be needed in order to be able to make a conclusion about the impacts of the CDS on alcoholic beverage spending and consumption patterns with confidence.

Robustness across different models

The estimates of the impacts on alcoholic consumption and expenditure in total are much more sensitive to model specification than for non-alcoholic beverages (chart 4.5).

4.5 Impacts of the CDS on alcoholic beverages across different models



Data source: The CIE.

5 *Impacts of the CDS on market shares*

Key points

- **There is no clear evidence at this stage that market shares have been differently impacted for large and small suppliers or retailers.**

The role of first suppliers under the CDS

As of the most recent data provided to IPART by the NSW EPA, the container deposit scheme covers 527 first suppliers across both alcoholic and non-alcoholic beverages. Under the scheme, first suppliers are defined as those who are responsible for supplying beverages into the state. A first supplier can have any role in the supply chain including:⁵

- manufacturers who produce and bottle beverages in NSW
- wholesalers responsible for the delivery of beverages into NSW
- retailers located in NSW responsible for the delivery of beverages into NSW as well as retailers outside of NSW who sell to consumers in NSW (via online, etc...).

Suppliers of beverages that use containers covered by the CDS must register each individual beverage product supplied into NSW and these container. The container types covered by the scheme are predominantly glass, PET and aluminium.

Levy charged on first suppliers

The operation of the container deposit scheme is funded by a levy on all first suppliers.⁶ The fee charged to first suppliers includes:⁷

- the costs of refunds paid to customers
- the costs of refunds paid to MRFs for containers collected in the kerbside recycling system
- network fees to be paid to the network operator TOMRA-Cleanaway (which are determined by competitive tender and offset by the value of the collected recyclable materials)

⁵ NSW EPA, NSW First Supply Approach

⁶ This levy is paid in addition to an \$80 'Container Approval Application Fee' paid for each line of beverages supplied under the scheme (with a cap of \$3200 for small suppliers announced in February 2018)

⁷ Calculated from the sensitivity tables from the Source: Estimated costs and methodology on the NSW EPA website: <http://www.returnandearn.org.au/suppliers>

- an Administration Fee paid to the scheme coordinator Exchange for Change (determined by competitive tender)
- a monthly scheme compliance fee paid to the EPA.

The fees paid by each first supplier are proportional to the share of eligible containers sold by the supplier. For example, if a supplier sells 10 per cent of eligible containers under the scheme, they are billed for 10 per cent of the total scheme costs. Whilst different fees apply for different material types, there is no further difference in fees based on factors such as geographic location, likelihood that a product is recycled, or likelihood that a product enters the litter stream.

As the cost structure of the scheme changes, so too will the levies on first suppliers. A large part of this will be due to the recovery rate of containers, which was assumed by Exchange for Change to be at 100 per cent in the first period and 80 per cent by the third period. It is likely that the recovery rate will fall from this initial projection, which means that the levies on suppliers will reduce in the future.

Pathways of CDS impacts across different sized suppliers

The levies charged on first suppliers as a result of the CDS resemble the effects of a tax on supply, which ultimately raises the costs of supplying beverages in NSW. Some important considerations with respect to the impacts on first suppliers relate to:

- the extent to which first suppliers can pass through cost increases to end users
- whether these cost increases are borne more easily by larger suppliers which benefit from economies of scale, and
- whether any asymmetries in these effects across different businesses lead to changes in market share of beverage suppliers.

The extent to which any individual supplier can pass through the costs of the CDS to end users depends on the overall level of market concentration. In general, a greater degree of market power will imply a smaller proportion of the cost increase being passed through to customers. This occurs because in the absence of a tax, a monopolist will be able to charge a higher price than in a competitive market, and a levy such as the CDS reduces the ability of a supplier to extract monopoly rent. Effectively, a monopolist is already charging as high a price as possible and charging any higher would reduce its revenue.

In contrast, in a competitive market a full passthrough of the levy on first suppliers would occur. This is because a condition of competitive markets is that no individual supplier would be able to vary their prices above the competitive level and retain market share since their customers would buy from other suppliers at lower prices. In this instance, the effect of the CDS levy raises the marginal cost of supplying beverages and prices fully adjust to reflect this, with no changes to market share.

Impacts on NSW total beverage supply

A large number of beverages are supplied to NSW each month, with almost 400 million individual beverage containers supplied in December 2017, for example⁸. This volume means that in total, the beverage industry would be charged \$40 million in levies during the first month of the scheme if the levy were set at 10 cents per container⁹. To put this into perspective, this equates to approximately 1.2 per cent of the value of manufactured and imported beverages in NSW (chart 5.1).

5.1 CDS beverages by sector NSW, based on manufacture and import value

Sector	Revenue	Share of revenue
	\$m	Per cent
Alcoholic beverages	1 385	42
Liquor retailers	721	22
Licensed venues	425	13
Other (exports)	239	7
Non-alcoholic beverages	1 933	58
Supermarkets	1 206	36
Consumed at point-of-sale (e.g. cafes)	504	15
Other (on-line, convenience stores)	222	7

Note: Revenue shares and revenue numbers are calculated as the shares of manufactured and imported beverages supplied to each sector. The revenue is the revenue for the manufacturer and import cost, and does not include wholesale and retail margins. Wine and spirits have been excluded.

Source: The CIE, based on data from MCAAY & Curtin University: A guide to the alcohol industry, major alcohol companies in Australia: producers and distributors and IBISWorld, (\$2017-18).

In light of these cost increases on the part of beverage first suppliers, it is of interest to see if the overall total volume of beverage supply in NSW has decreased as a result. Of most relevance are beverage containers made from Aluminium, Glass and PET as these are used to bottle most beverages across the alcoholic and non-alcoholic variety. The time series data on beverage supply most notably indicate:

- seasonal peaks in beverage supply in the months of December, which is generally associated with greater beverage consumption over the holiday/festive period. Headline indicators would indicate that total beverage supply across the different container types was lower in December 2017, which coincided with the beginning of the CDS compared to December 2016:
 - 11 per cent less aluminium containers
 - 3 per cent less glass containers
 - 1 per cent more PET containers
 - 5 per cent less total containers

⁸ Exchange for change first supplier market share dataset, 28 February

⁹ CIE calculation based on Exchange for change dataset (assumes 10-cents per container multiplied by 400 million supplied beverages in December 2017). Note that the actual charges at the start of the scheme were above 10 cents to cover estimated administration costs.

- seasonal falls in the months of January, indicating typically reduced supply following the end of the festive season. Headline figures however indicate lower supply in January 2018 compared to January 2017:
 - 16 per cent less aluminium containers
 - 2 per cent less glass containers
 - 23 per cent less PET containers
 - 13 per cent less total containers

Changes in total beverage supply

Taken alone, these headline year on year supply changes would seem to indicate that the CDS is associated with lower beverage supply into NSW compared to the past. It is important however to account for the variance in the data before making this conclusion. Using statistical tests, it is possible to account for the natural fluctuations in the time series of beverage supply to gauge whether the observed changes are unique or part of usual volatility.

The statistical ‘t-test’ for the annual change in total beverage supply between January 2017 (before the CDS was implemented) and January 2018 (after the CDS was implemented) provides weak evidence to the hypothesis that beverage supply has decreased in the months since the CDS was implemented. This is the case across all the beverage container types, with high p-values indicating that there is no statistically significant difference between beverage supply over the year.

This test can further be narrowed to test differences between the beverage supply of alcoholic and non-alcoholic beverages. This is a useful exercise as it will allow impacts that might be unique to certain types of beverages to be separated. The results however, lead to the same conclusion of weak evidence to suggest any changes in beverage supply over the year.

Number and size of supply changes across suppliers

Although there is a lack of evidence to suggest total beverage supply in NSW has changed since the introduction of the CDS, it might be possible that different beverage suppliers have made individual supply changes in response to the CDS. This is especially important when considering the different size of suppliers, since the individual supply decisions of smaller beverage suppliers will be masked by larger suppliers when looking at headline totals.

One indicator of different impacts across suppliers is analysing the number of supply increases relative to decreases year on year (chart 5.2). According to this measure, more suppliers decreased their supply relative to increasing supply in January 2018 compared to January 2017. This is especially true for Aluminium, Glass and PET, which are the dominant container types used to bottle beverages. In interpreting these figures, it was not possible to distinguish between suppliers that supplied zero containers, and those that had not yet reported their sales. Therefore, the proportion of suppliers with zero sales is over-represented in this table, and the following chart.

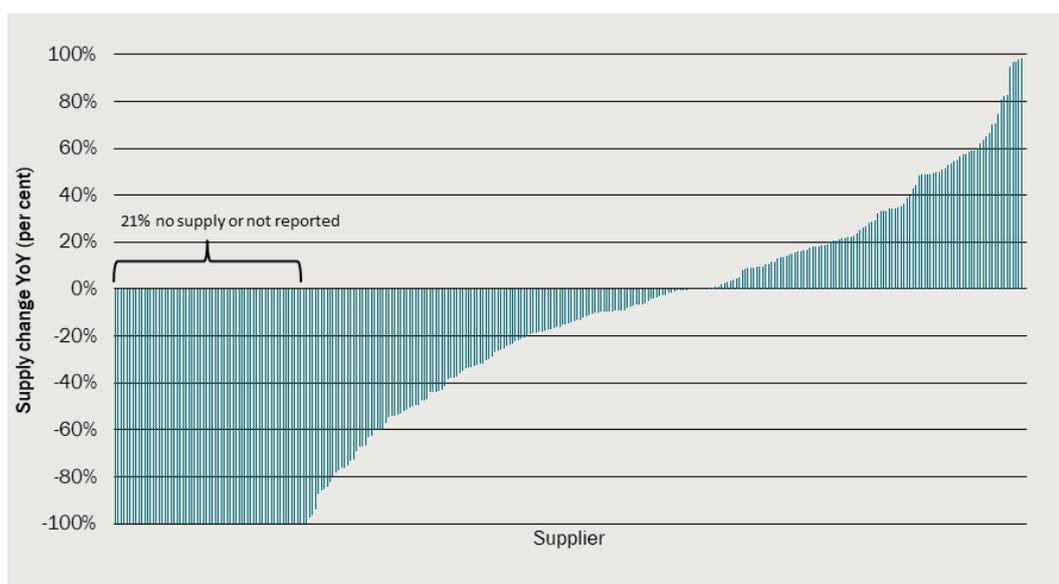
5.2 Number of suppliers who increased and decreased volumes year on year – January 2017-18

	Aluminium	Glass	HDPE	PET	LPB	Steel	Other Plastics	Other Material	Aggregate
	No.	No.	No.	No.	No.	No.	No.	No.	No.
Increase	58	85	9	89	26	10	4	3	158
Decrease	75	146	22	93	31	8	8	2	216

Source: CIE analysis based on Exchange for Change data.

Also of relevance is the magnitude of supply changes over the range of suppliers over the year. As can be seen in chart 5.3, 21 per cent of suppliers supplied no beverages (or had not yet reported to Exchange for Change) in the month of January 2018. Excluding these suppliers, the distribution of supply changes year on year are fairly symmetric, with just as many suppliers increasing and decreasing supply by the same magnitude. It is important to note however that the supply changes observed could relate to specific business characteristics such as inventory and warehousing management. This is particularly relevant for those suppliers that supplied no beverages in January 2018, since beverage supply may not occur on a monthly basis, but rather, at a lower frequency. Also, these indicators do not distinguish between the size of beverage suppliers.

5.3 Distribution of annual supply changes – Total beverages January 2017-2018



Note: Excludes outliers with supply changes greater than 100 per cent.

Data source: CIE analysis based on Exchange for Change data.

Market share of beverage suppliers

Taking into consideration the fact that different sized suppliers may respond differently to the cost increases caused by the CDS, it is important to understand the overall level of market concentration for beverage supply in NSW. The level of market concentration

differs by alcoholic and non-alcoholic beverages, and analysing changes in market share should take this into consideration.

Non-alcoholic beverages

Given that changes in beverage supply involves a degree of volatility, changes in market share utilising this data will also be volatile. In order to be able to make a robust judgement on whether market share has truly changed since the introduction of the CDS, the natural variance in beverage supply must be accounted for.

The CIE performed significance tests for market share in the non-alcoholic beverages market. These tests were unable detect any evidence of changes in market share between different sized suppliers, irrespective of container type. (For the purposes of this exercise, large suppliers were assigned as having a share of total beverage supply of at least 10 per cent, whilst other suppliers had less than this amount.)

Alcoholic beverages

After accounting for the natural variation in the beverage supply data, the significance tests for market share in alcoholic beverages also shows weak evidence to suggest any change in beverage supply between different sized suppliers. This is the case for all of the different beverage container types, noting that alcoholic beverages using PET containers were too few to estimate robustly.

A Full econometric results and sensitivity checks

This report estimates the impact of the CDS on household consumption and expenditure using Nielsen Homescan Data and a fixed effects econometric model. However, when running econometric analysis, there are typically a number of modelling assumptions that need to be made. In this project, the main modelling decisions were:

- whether to use Victorian households as the ‘control group’ in the regression, or include all Australian states and territories.
- whether to allow seasonal trends that vary by state.¹⁰
- whether to fit a linear or logistic model.

In each case, there are arguments for and against each modelling decision. While the CIE believe that the main specification of the model is the best single estimate of the impact of the CDS, it is still informative to test whether the main results are robust to different modelling choices. To that end, this appendix contains the results from five alternative model specifications:

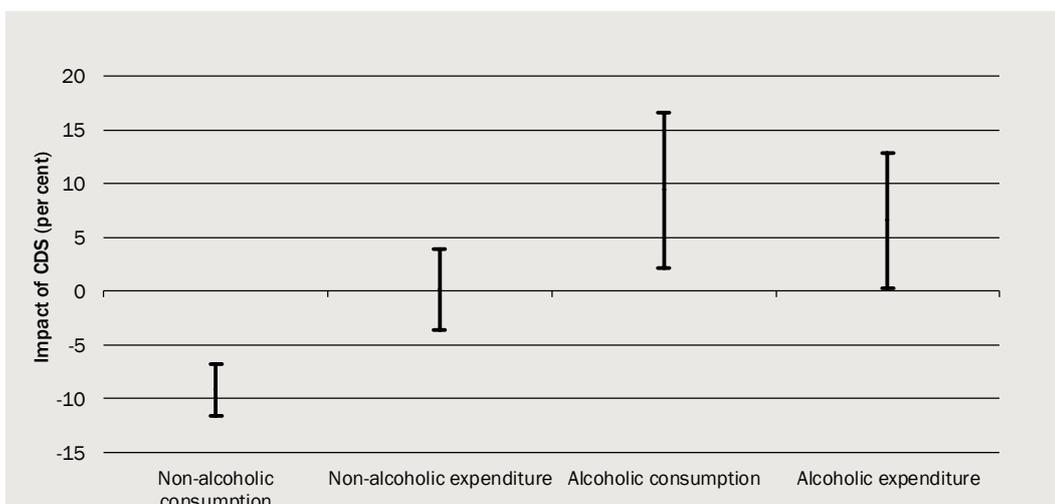
- Model 1 is the main model used in the report. It includes time and household fixed effects, and is estimated using data from NSW and Victoria.
- Model 2 uses the same specification as model one, but includes data from households in all Australian states and territories.
- Model 3 uses data from NSW and Victoria, but uses a state specific seasonal trend to account for potential variation in seasonality across states.
- Model 4 uses data from all states and territories, and state specific seasonal trends.
- Model 5 estimates the impact of the CDS using a log model, which estimates the impact of the CDS as a percentage change. This is converted to an absolute change in the table below to allow for a comparison between models.
- Model 6 is a log model using data from all states and territories

In each case, the models were run for the aggregated categories of alcoholic beverages (beer, wine and spirits) and non-alcoholic beverages (water, soft drink and juice).

A summary of the point estimates from the alternative model specifications are shown in chart A.1. It should also be noted that this chart only shows the point estimate from these models, and does not show associated estimated confidence intervals. Adding this ‘within model’ variation would further increase the range of possible estimates generated by the models.

¹⁰ There data appears to show different seasonal trends in different states. However, allowing different seasonal trends in the model runs the risk of ‘overspecifying’ the model.

A.1 Estimates of the impact of the CDS under different model specifications



Data source: CIE Calculations.

Chart A.1 shows that:

- The result that the CDS has reduced consumption of non-alcoholic beverages is robust to options of model specification
- Expenditure on non-alcoholic beverages is slightly positive in some specifications and slightly negative in other specifications. However, the qualitative conclusion that the CDS has not had a large impact on household expenditure on non-alcoholic beverages is robust to model specification.
- The results regarding alcoholic beverages are highly sensitive to model specification.

This interpretation is strengthened by observing the extended output from the 6 models in tables A.2-A.5. This shows that the impact on non-alcoholic beverage consumption is negative and statistically significant in all most models, while the impact on expenditure on non-alcoholic beverages, volume of alcoholic beverages and expenditure on alcoholic beverages are not statistically significant.

A.2 Impact on consumption of non-alcoholic beverages using different models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Litres	Litres	Litres	Litres	Litres	Litres
Nov 2017	-1.61***	-1.4***	-1.89***	-1.21***	-1.74***	-1.57***
Dec 2017	-0.78*	-1.71***	-1.96***	-2.38***	-1.55***	-1.90***
Jan 2018	-1.05**	-1.21***	-1.14**	-1.18***	-1.46***	-1.09***
Feb 2018	-1.11***	-1.03***	-1.79***	-1.51***	-0.75**	-0.62**

Source: CIE Calculations.

A.3 Impact on expenditure on non-alcoholic beverages using different models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Nov 2017	-1.98***	-1.85***	-0.28***	-1.54**	-1.57***	-1.58***
Dec 2017	1.29***	-0.32	-0.43	-1.38**	0.05	-0.77
Jan 2018	0.85*	-0.87*	0.16	-0.49	-0.05	0.27
Feb 2018	0.10	0.36	-0.71	-0.23	0.32	0.46

Source: CIE Calculations.

A.4 Impact on consumption of alcoholic beverages using different models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Litres	Litres	Litres	Litres	Litres	Litres
Nov 2017	0.23	0.12	-0.01	-0.03	-0.07	-0.03
Dec 2017	0.54**	0.34**	-0.06	-0.16	0.04	0.09
Jan 2018	0.43	0.10	0.32	0.09	0.08	0.04
Feb 2018	0.33	0.15	0.65**	0.40**	0.05	0.05

Source: CIE Calculations.

A.5 Impact on expenditure on alcoholic beverages using different models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Nov 2017	0.76	0.71	-1.06	-0.38	-0.03	0.07
Dec 2017	3.16*	2.33*	0.316	-0.34	0.89	0.32
Jan 2018	2.70**	0.81	2.76	1.09	0.00	0.01
Feb 2018	1.80	0.69	3.70	2.33**	-0.01	-0.18

Source: CIE Calculations.



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