Exemplar for Time Series

Spirit Sales in New Zealand

In recent years there has been a major increase in spirit sales in New Zealand, driven by the popularity of RTDs ("ready to drink" pre-mixed drinks). Their popularity is expected to continue to rise[1] in the next few years as more interesting varieties are made. The main driver is young women, who prefer them or wine rather than beer.[2]

This is despite alcohol sales per person decreasing in recent years.[3]

Purpose

Many people are interested in alcohol consumption.

- The breweries want to make what people prefer, so they take particular interest in trends, particularly among young people.[4] They need to plan production each year on what is likely to be sold the next year.
- Others are interested in issues around problem drinking. There's always someone out there wanting to make sure no-one enjoys themselves. This is particularly true when something new appears in a culture which young people like, but which older people are not yet used to. Never mind you can easily mix your own similar drinks, there are calls to ban the stronger ones.[5]
- Various governments change drinking laws in line with changing attitudes and pressures.[6] [7]
- Finally, alcohol is heavily taxed in NZ, bringing in well over a billion dollars a year and increasing.[8] [9] So the government wants to track what is being drunk in order to predict its future revenues.

All in all, the amount of spirits sold in NZ is of great interest.

Units

The variable I will be using is the **quantity of alcohol made for sale in the form of spirits** in NZ for each quarter. Very little alcohol is wasted, so the difference between the amount made and the amount sold will be very low. Home production is minor, so can be ignored.

That takes no account of the form the spirits are sold as, so this study mixes straight spirits alongside those sold in mixed forms. This is for historical reasons, as NZ has for a long time put different duties on beer, wine and spirits, and the RTDs are still a relatively new phenomenon.

The units in this report, including the graphs, are all in millions of litres (ML) of alcohol.

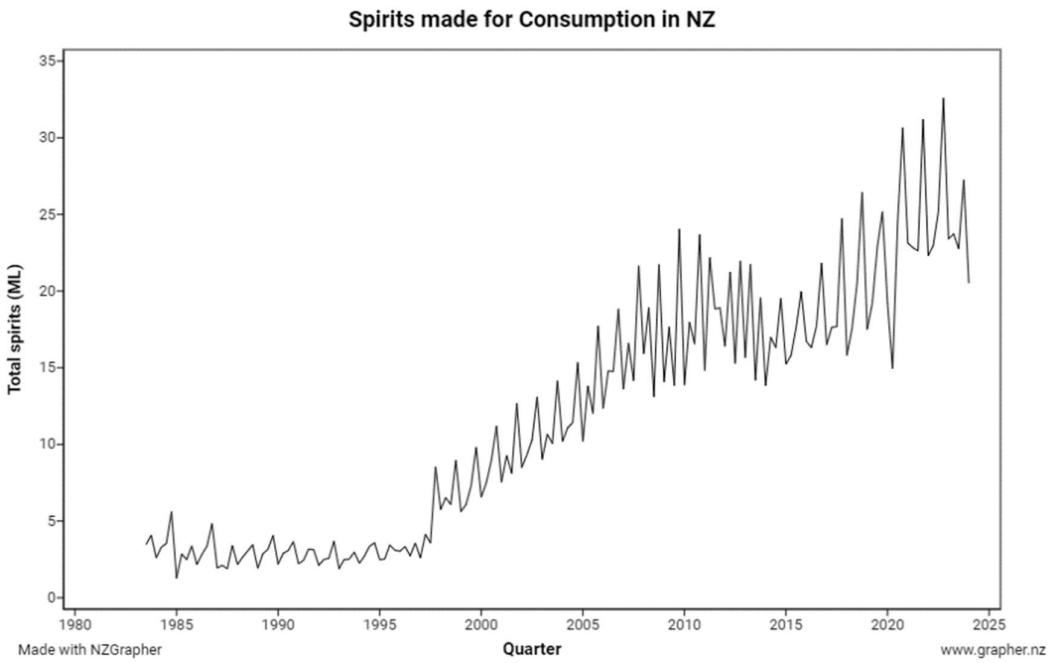
The data comes from the StatisticsNZ website (https://infoshare.stats.govt.nz). Given how much money is raised by this method, the government is very careful to ensure this data is accurate.

Data Selection

Below is the entire data set available at StatisticsNZ.

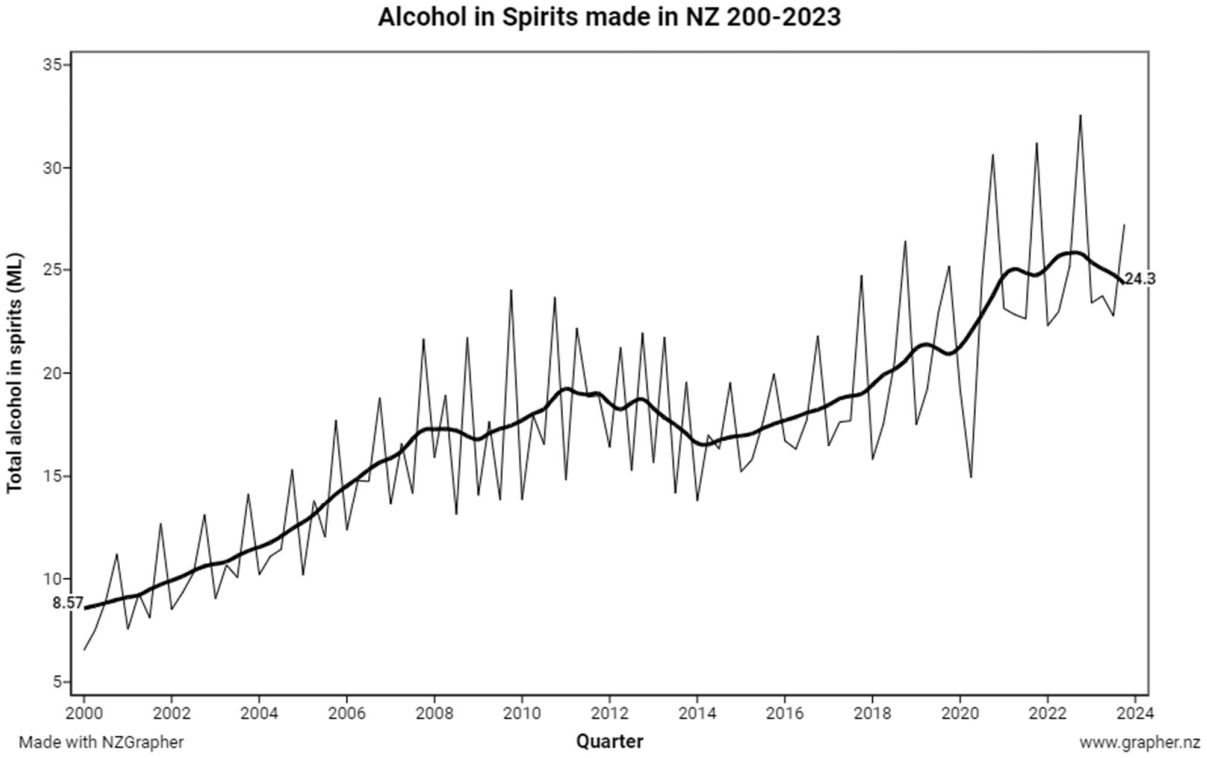
---

1 https://www.theshout.co.nz/rtds-are-finally-mainstream-according-to-prospirits-2024/
2 https://www.newshub.co.nz/home/health/2017/04/young-women-drink-up-to-24l-of-rtds-a-year-study.html
3 https://www.stats.govt.nz/news/decline-in-alcohol-available-domestically/
4 https://getollie.com/blog/rtds-are-on-the-rise-what-should-i-do-as-a-brewery
5 https://www.stuff.co.nz/national/7533042/Government-criticised-for-dropping-RTD-liquor-ban
6 https://www.nzherald.co.nz/nz/alcohol-reforms-watered-down/DICE2EPEOBEQOZ5VSU5MKAI3LQ/
7 https://www.1news.co.nz/2022/11/17/booze-you-can-use-how-our-alcohol-laws-are-changing/
8 https://nzabc.org.nz/consumers-facing-significant-increase-in-beer-wine-and-spirits-excise-tax/
9 https://www.customs.govt.nz/globalassets/documents/tariff-documents/wtd-2023/excise-duties-1-july-2023.pdf



We can see that the trend up to 1998 or so was flat, then there was a major change and the trend became strongly positive. That is because 1996 was when RTDs first entered the market in NZ.[10]

I have chosen to limit my analysis to from 2000 onwards because the period before so completely different it is irrelevant to what is likely to happen in the future.



[10] https://teara.govt.nz/en/alcohol/page-4

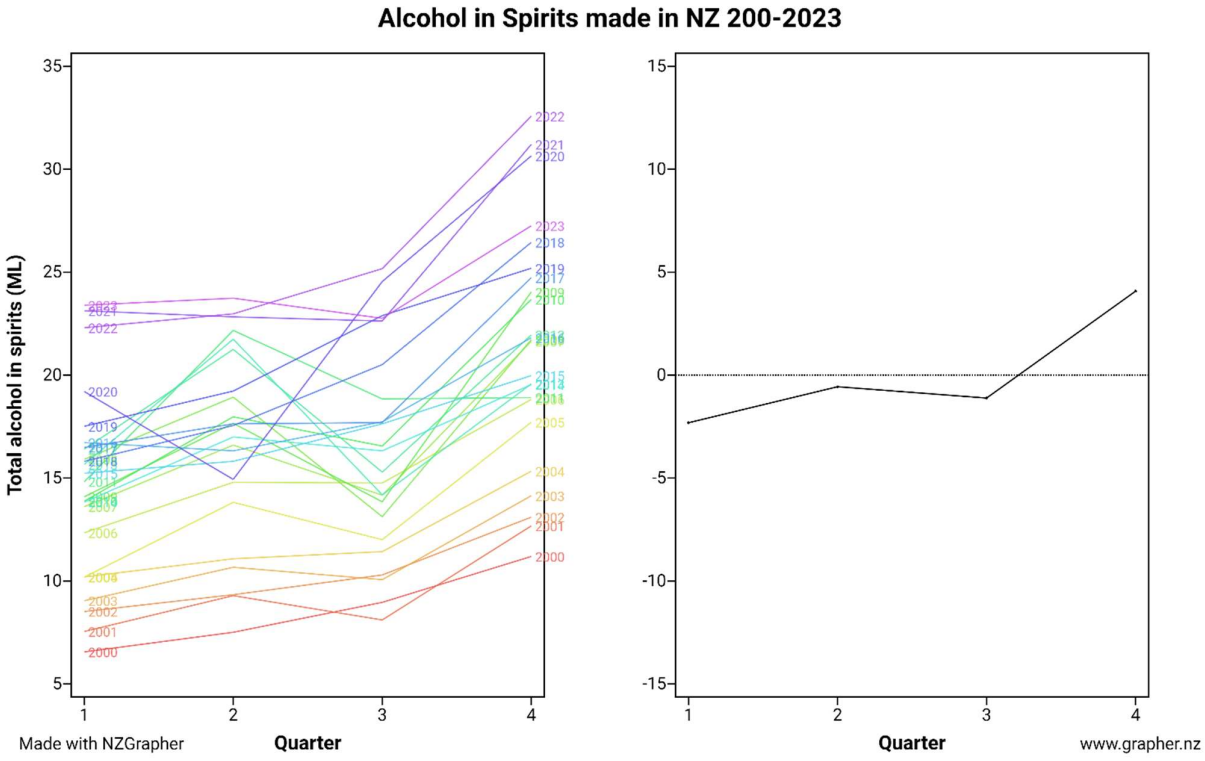
Analysis

Trend

- The trend is fairly consistently positive. There was a minor dip from 2012 for a couple of years, but it quickly resumed at about the same gradient. I do not know why there was this dip – perhaps it was related to major changes in the legislation around alcohol sales around that time.[11]
- The average gradient is (24.3 – 8.57) ÷ 96 = 0.164 ML per quarter.
- That means that the increase averages out at 164,000 more Litres sold each quarter – or typically that every year 655,000 Litres more is sold than the previous year.
- Another way to look at it is that over the last twenty years the average person now drinks over 2.5 L more alcohol in spirits per year than they did in 2000. Allowing for those that don't drink at all or drink other products, some groups of Kiwis are drinking a lot more spirits than they used to.
- In the two years the trend flattened, but my research shows no reason to suspect that the long term upwards trend won't resume. Some people are putting the slump down to inflation being high and pressure on incomes in households.[12] If inflation is brought back, as is predicted, then the long term trend is likely to resume.

Seasonal pattern

- We can see from the original series that there is a lot of seasonal movement. I have averaged that, below.



- This shows that the production of spirits in Quarters 1 to 3 are slightly below the trend, which Q1 being the lowest at –2.3 ML.
- Quarter 4 production is above the trend, typically 4.1 ML above. This is unsurprising as people are known to drink more over the summer holiday period, and especially for end

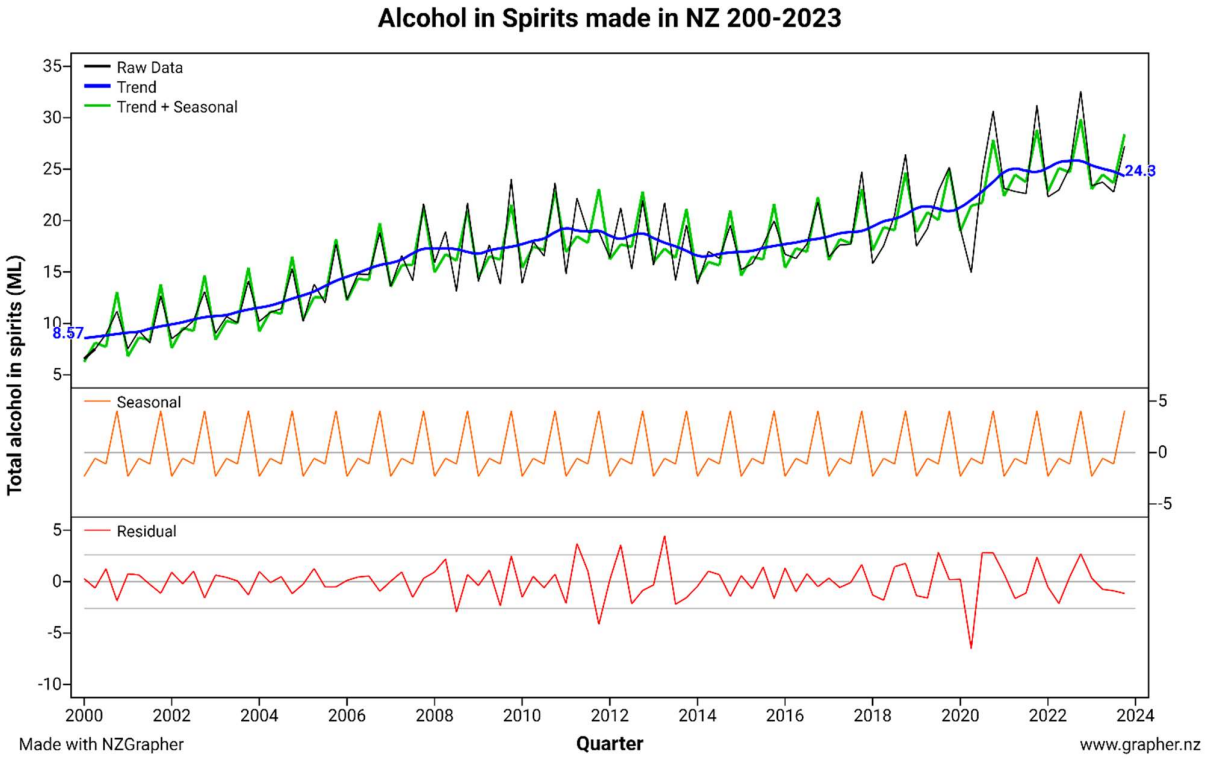
[11] https://www.justice.govt.nz/justice-sector-policy/key-initiatives/sale-and-supply-of-alcohol/alcohol-regulations/
[12] https://nzabc.org.nz/high-inflation-impact-on-producers-hospo-consumers/

of year parties, Christmas and New Year's Eve. (As these are production figures, they will take place earlier, so more consumption in January will be reflected in more production in Q4.)

- Not every year follows the same pattern though. Some years show a small spike in production in Q2 (e.g. 2005 and 2011) while others show production increasing through the year (e.g. 2004 and 2019).
- Overall, while Q1 and Q4 are nearly always the bottom and top, the seasonal pattern for Q2 and Q3 are far less reliable.

Other Features

Below is my model of trend + averaged seasonal pattern compared to the actual data. The residuals show two periods of interest



- The biggest feature is the drop in Q2 of 2020, caused by the Covid shutdown.

  People were not able to drink together. The result was particularly strong for spirits.[13]
- The residuals around 2011-2013 are also much larger than either side of that period, both higher and lower.

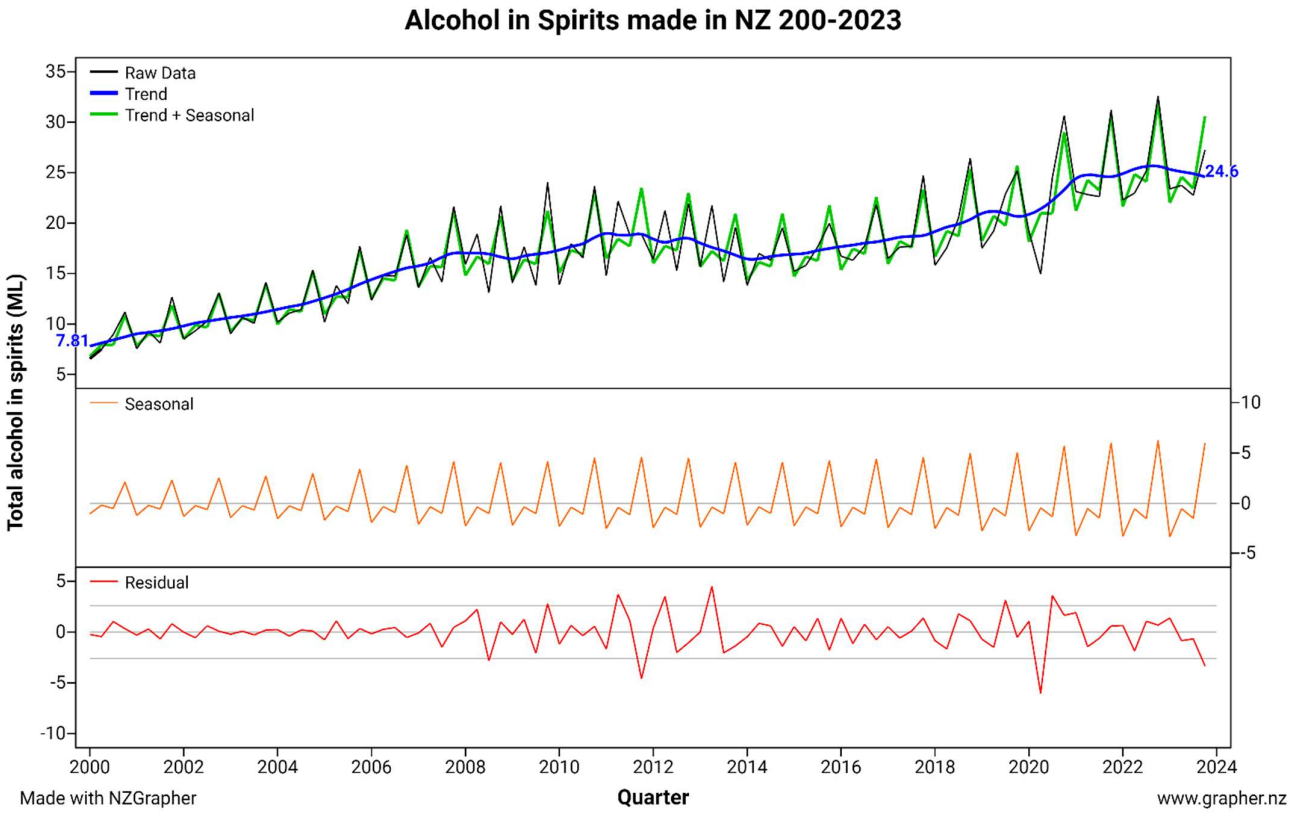
  This is just before the dip in the trend that started in 2012, so I assume they are related. I cannot find a reason why.

[13] https://berl.co.nz/economic-insights/alcohol-supply-dropped-over-lockdown

Quality of Model

- The model is a good fit through most of the period. There are only a couple of times when the peaks and troughs don't align (as noted, 2011-2013 and 2020 Q2).
- However the early period has most of the peaks lower in the model that in the data, and the reverse for the later period. This will be a particular problem for my predictions if the model is always has too small seasonal effects.

I have tried to see if the multiplicative model is a better fit.



- This model is a far better fit for the peaks and troughs. It was a particularly good fit from 2000 to 2007, as the residuals are almost flat. Then a less good fit until 2014, which is true of both models. It resumes being a good fit until 2020. Ignoring the Covid trough, the fit is OK until the very last data point, which is quite low.
- As this is a better model, I shall use it for my predictions.

Predictions

My table of predictions is below

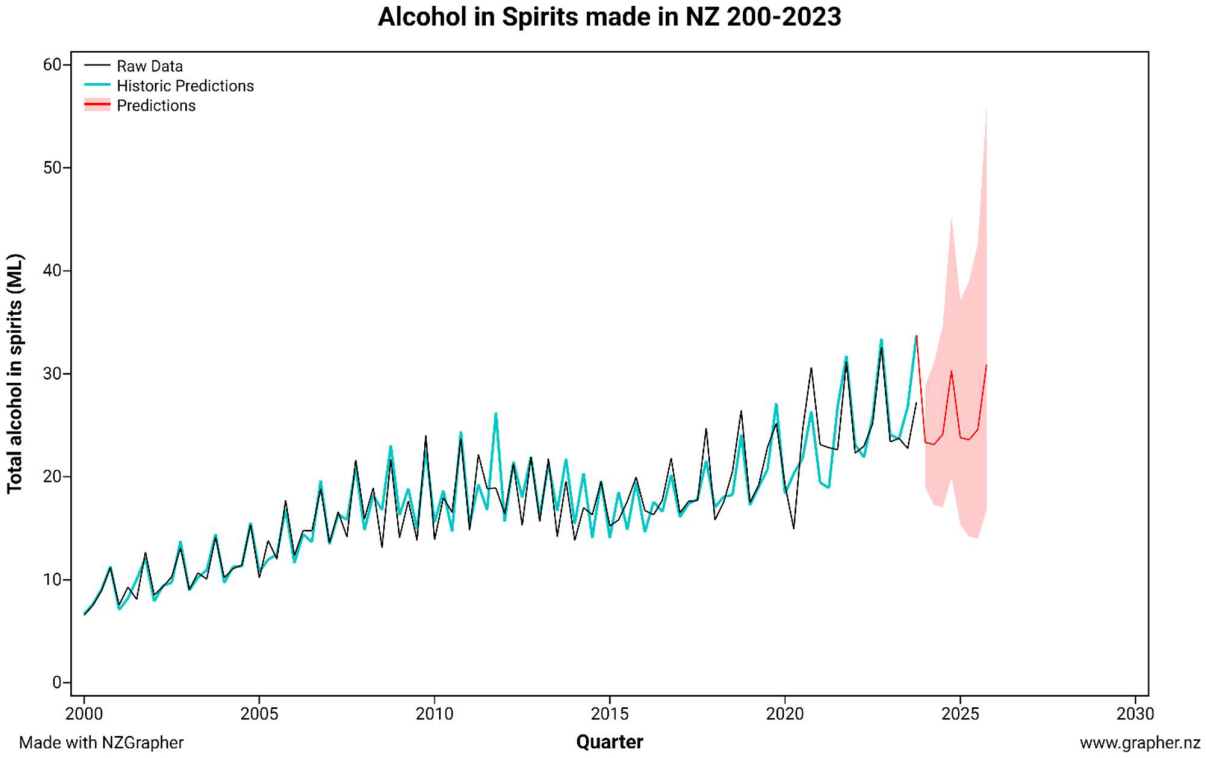
Time	Min	Prediction	Max
2024Q1	19.281	23.342	28.516
2024Q2	17.279	23.138	30.422
2024Q3	17.351	24.123	33.554
2024Q4	20.412	30.316	46.351
2025Q1	15.378	23.801	37.465
2025Q2	14.75	23.592	39.03
2025Q3	14.37	24.597	41.653
2025Q4	17.711	30.912	54.635

So the model predicts that 2024 Quarter 4 production will be about 30.3 ML.

The 95% error range is from 20.4 to 46.4 ML, so it is quite unlikely that production will be outside those boundaries – even allowing for such things as Covid, which caused much smaller variations.

I chose to make a Q4 prediction because the model fits best in Q1 and Q4, whereas the seasonal pattern is less reliable in Q2 and Q3.

Looking at the predictions graphically, we can see that the trend is quite flat. This is because the model used (Holt-Winters) favours more recent data over the slightly older data, and because the graph shows a flat trend at the end the predictions have a smaller trend than the long term one.



My research suggests that sales, and therefore production, are more likely to return to the old trend if inflation is brought under control, so I think that the model's prediction is likely on the low side.

A prediction assuming the old trend resumes (at 0.13 ML/Q) would be more like 3.5 ML. This does depend on the economic downturn ending fairly soon.

Limitations

- The analysis is for the whole of NZ. This is the important figure for the breweries in trying to predict demand for the next few years. It is also the figure that is relevant for the excise tax being gathered.

  However those interested in the patterns for health reasons are not really interested in the total amount drunk, but in the amount per person. An analysis for them would usefully have the data indexed to population.

- The data does not differentiate between RTDs and straight spirits. As these are very different types of drink, drunk by very different types of people in general, it would be better if they were separated.

Conclusions

The amount of spirits produced for sale in NZ has risen steadily over the last two decades, with only very minor deviations from the long term trend of +0.13 ML/Quarter.

There is a seasonal pattern to the data, which shows hugely increased amounts in Quarter 4, which matches end of year and holiday celebrations. Sales in the other quarters do vary a bit but are always much lower.

Producers who think that inflation and the current economic depression are likely to end soon might be wise to increase production in line with the long term trend. If they think the economic bad times are here for a bit longer, then the predictions given seem reasonably reliable, given the lack of major seasonal variations.

Although the data isn't indexed to population, the rate of increase is clearly more than just due to the small population increase in recent years. It is clear that spirits are much more popular than they were, even though alcohol consumption per person is dropping overall.