

Food for Thought – the amount spent on food. Has it changed?

Problem/ Plan:

Eating of food and buying of food is a vital part of New Zealand culture to how we live to how we interact with each other. The Minister of Primary industries in New Zealand wants to be able to predict the spending on food in different outlets in the next couple of years.

When did the recession start? The recession started at about December 2007 and ended in June 2009.¹ The economy was falling; less people were employed and hence had less available cash. Businesses were struggling and many were becoming bankrupted. How did this effect our food buying?

People were spending less at cafes and restaurants and more at the supermarkets and takeaways. The prices in the Supermarkets went higher so people resorted to the store branded products, which were cheaper.² More people are cooking meals at home rather than eating out. However, meals become rushed and more people are resorting to faster takeaways than meals at restaurants.³ People are resorting to fatty foods, because it is cheaper than healthy food.⁴ During the recession, people looked for cheap food. So they bought store branded goods, which were cheaper. Or they would buy more takeaways, as they were busy. Rather than buying out, they cooked at home. This pattern stayed the same after the recession.⁵

The purpose of this investigation is to see how the recession has changed the amount spent on food in Supermarkets. To be able see whether we have resorted to other outlets to eat food to save money or whether we still cook and eat mostly in our homes. Where do we spend the most of our food bills?

Data:

The food sales data is the amount of sales in the different outlets calculated from the Retail Trade Survey (RTS) undertaken by Statistics New Zealand. The values are deflated to December 1995 quarter and Population figures are estimates to the nearest 1000.

The response variable I am choosing is Supermarket sales, in millions of NZ dollars and the explanatory variable is years, recorded quarterly throughout the year.

¹ When Did the Great Recession End? <http://usgovinfo.about.com/od/moneymatters/a/When-Did-The-Great-Recession-End.htm>

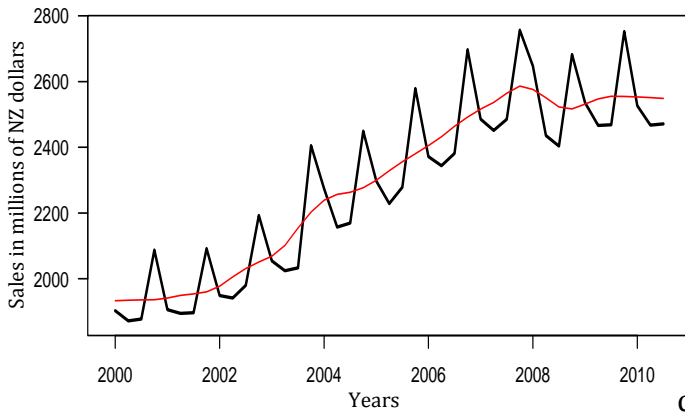
² http://www.ers.usda.gov/media/187072/err129_1.pdf

³ <http://www.baxterstorey.com/news/recession-s-impact-on-gb-s-food-choices-are-revealed-in-a-major-new-survey-by-wsh>

⁴ <http://www.guardian.co.uk/society/2012/nov/18/breadline-britain-nutritional-recession-austerity>

⁵ <http://www.guardian.co.uk/lifeandstyle/wordofmouth/2013/feb/04/rise-of-the-own-brand>

Time series plot for Supermarkets



Analysis:

On average, the overall trend is increasing. It is increasing at a rate of \$65 millions of NZ dollars per year (from 2000 to 2010). However, looking at the time series graph for Supermarkets it seems to plateau at 2008. So it is increasing at \$81.30, 4sf, millions of NZ dollars from 2000 to 2008,

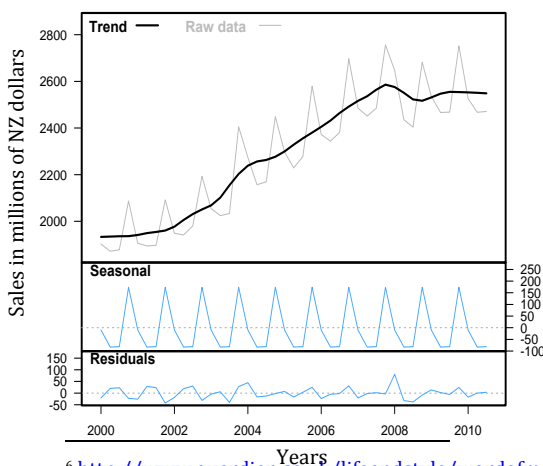
but then levels out until 2010. This could be caused by the recession, which increase food prices. This started in December 2007 and ended in Jun 2009, which lines up with the peak to the trough. Also the increase after the recession ended is due to the fact that people were buying store branded goods as they were cheaper and than other main streamed brands.⁶

In mid 2009 there is a trough decreasing from \$2 550 to \$2 500 millions of NZ dollars. This could be caused by the end of the recession. It ended in June 2009 and caused the increase in store branded goods, increasing the Supermarket sales. The growth rate after the recession period is not the same as before the recession. This could be caused by the fact that people got smarter. They would be on a budget so by cheap food, which is why the increase is not at the same rate as before. In 2004 there is a peak rising from \$2 100 to \$2 250 millions of NZ dollars. This could be caused by the government looking at the importing foods and upping their policies to ensure healthy food. Thus, prices went up which increased the supermarket sales.⁷

Relative contribution - decomposed data

	Min NZ\$	Max NZ\$	Range NZ\$	Approx. Contribution
Raw Data	1800	2700	900	
Trend	1900	2550	650	72.2% (3sf)
Seasonal	-75	175	250	27.8% (3sf)
Residual	-25	25	50	5.56% (3sf)

Decomposition of data: Supermarkets



The relative contribution of residuals to the raw data is 5.56%. This increases my confidence with my forecasts that the residuals are not big enough to cause my forecasts to be too inaccurate.

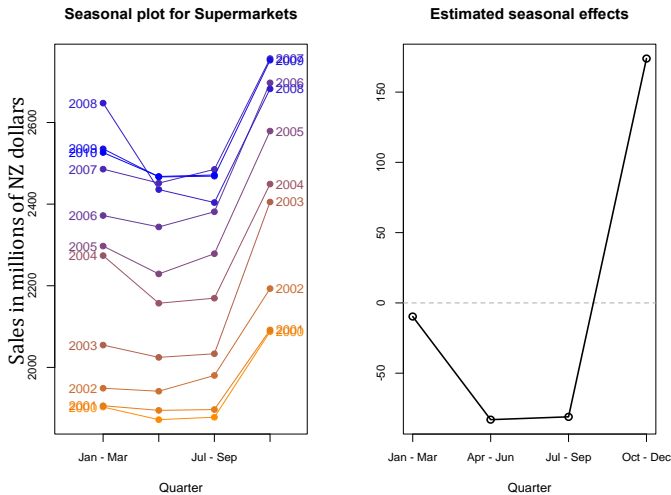
Around 72% of the overall variation in the sales in Supermarkets relates to the trend. This could be caused by the increasing trend in the food prices

⁶ <http://www.guardian.co.uk/lifeandstyle/wordofmouth/2013/feb/04/rise-of-the-own-brand>

⁷ http://www.pecc.org/resources/doc_view/395-new-zealands-changing-retail-food-sector

increasing and more people buying food from supermarkets.

Seasonal effect and residual components account for the remaining variation in the Supermarket series.

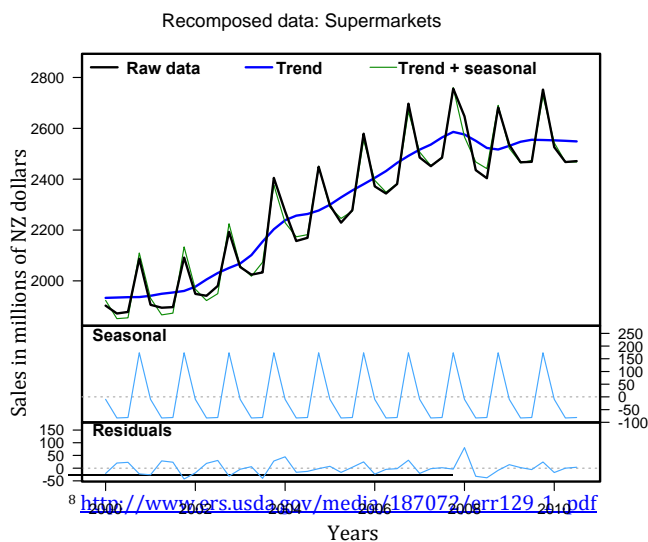


Seasonality

The individual seasonal effect graph for Supermarket sales shows the peaks and troughs in the decrease and increase in the sales for Supermarkets during the course of they year. The year is split into quarters, so 3 months per quarter.

Looking at the average seasonal effects graph, in the Oct-Dec quarter it is the highest peak. This is because it is a Christmas sales and everyone is buying food and gifts for

Christmas dinner. But during Apr-Jun quarter and Jul-Sep quarter there is a trough as it is a middle of the year and people are just doing their normal shopping for food and groceries. However, the Apr-Jan quarter is the lowest trough but there is not much of statistical difference between the second and third quarter. Also the Jan-Mar quarter is also a peak to a trough as it is the New Year sales and once people have over spent they just buy the necessary items. However, the Jan-Mar peak has not always been a peak as shown in the individual seasonal effects graph. It started peaking more in 2005 compared to 2000. Therefore it is not consistent so I will be less confident with my forecasts. This could be caused by New Years celebrations increasing and thus more sales in food at Supermarkets. However, compared to the Oct-Dec quarter it has always been a peak for people buying their Christmas dinner items. It is a time for everyone to indulge themselves. Therefore, I will be more confident with forecasts as it is consistent pattern compared to the Jan-Mar quarter.



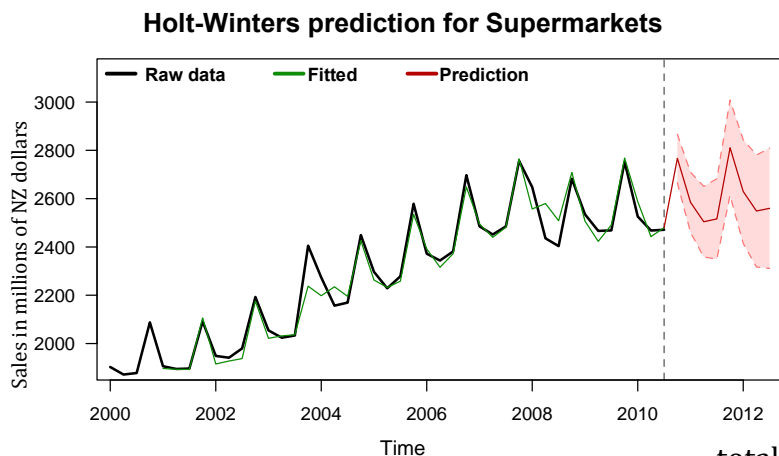
Recomposed Data

For the Jul-Sep quarter in 2008 the Supermarket sales in millions of NZ dollars was more than expected as shown on the recomposed graph (trend + seasonal < raw data). This could be caused by the recession and the increase in people buying cheaper food from supermarkets than the more expensive brands.⁸

⁸ http://www.ers.usda.gov/media/4187073/err129_1.pdf

For the Oct-Dec quarter, in 2001 the Supermarket sales in millions of NZ dollars were less than expected as shown on the recomposed graph (trend + seasonal > raw data). This could be caused by the Supermarket stores merging and people didn't know what was sold where so they bought the cheap food they knew well. As well as a price war going on, causing cheaper prices.⁹

Forecasts



	Fitted	lower 95% bound	upper 95% bound
2010 Q4	2766.709	2666.014	2867.403
2011 Q1	2585.166	2460.512	2709.821
2011 Q2	2504.615	2358.444	2650.785
2011 Q3	2515.880	2349.637	2682.123
2011 Q4	2810.887	2613.583	3008.191
2012 Q1	2629.344	2414.550	2844.139
2012 Q2	2548.793	2316.765	2780.821
2012 Q3	2560.058	2310.966	2809.150

For Oct-Dec quarter 2010 it should be about \$2 767 (nearest whole dollar) millions of NZ dollars. But, because it is a prediction I am not totally confident that this will be the exact

value but it should be range between \$2 666 (nearest whole dollar) to \$2 867 (nearest whole dollar) million of NZ dollars of Supermarket sales. The dark red line, which is the actual prediction, shows this as well as the light pink shaded area as the range of prediction on the Holt-Winters graph for Supermarkets.

However, the further away we get from the historical data the less confident I will get in my predictions.

Jan-Apr quarter 2011 – prediction range: \$249 (nearest whole dollar) millions of NZ dollars
 Jan-Apr quarter 2012 – prediction range: \$430 (nearest whole dollar) millions of NZ dollars. Therefore the bigger range for Jan-Apr quarter 2012 justifies my statement, which the amount of error in the predictions will increase the further away we get from the historical data.

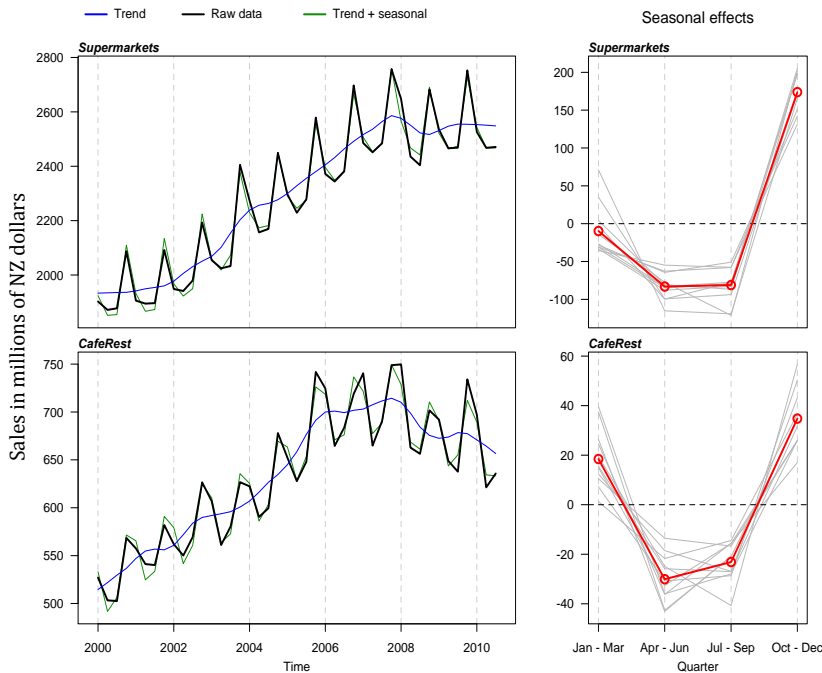
Also we will have different levels of confidence in predictions for different seasons (quarter of the year).

Oct-Dec 2010 (Q4) – prediction range: \$201 (nearest whole dollar) millions of NZ dollars
 Jan-Apr 2011 (Q1) – prediction range: \$249 (nearest whole dollar) millions of NZ dollars. I have slightly less confident in making predicting for quarter 1 than quarter 4 as it has the bigger range. However, the range of millions of NZ dollars is only about \$48 millions of NZ dollar, which is not that different, so I have similar confidence in making predictions for both of these quarters, as the ranges are similar. Also the range for Jan-Apr being high

⁹ <http://www.otago.ac.nz/law/research/journals/otago036288.pdf>

could also be due to the fact that the further away you get from historical data the bigger the range gets as the less accurate it will become, but it is not that far from the historical data so I have more confidence in making predictions for Oct-Dec quarter as it is more constant than the Jan-Apr quarter.

Comparing Variables



Looking at both of these graphs for Supermarket and Cafe and restaurants sales the overall trend for both of them is increasing. But, the trend for both of them seems to be increasing until 2008. After then the Supermarkets decreases slightly before increasing again compared to the Cafe and restaurants, which continues to decrease. However, it is not a perfect linear trend and there are a few peaks and troughs. So from 2000 to about 2008 the Cafe and restaurants is increasing at a rate of about \$23.8 (to the nearest

whole dollar in millions of NZ dollars) and then decreases at a rate of about \$50 millions of NZ dollars. It does have a big peak at 2006 rising from \$675 to \$690 of millions of NZ dollars before decreasing slightly and rising again to 2008. This could be caused by the recession. The economist Justin Wolfers thinks that, based off of a different measure than typically used, it began in late 2006. He used an income-based measure showing that on average peoples income was decreasing and more were becoming unemployed.¹⁰

Also the Cafe and restaurants has another peak at about late 2009 rising from \$660 to \$675 millions of NZ dollars. This is similar to Supermarkets also having a peak in late 2009. This could be caused by the end of the recession. So some people started eating out again to celebrate maybe getting a job or the economy rising.

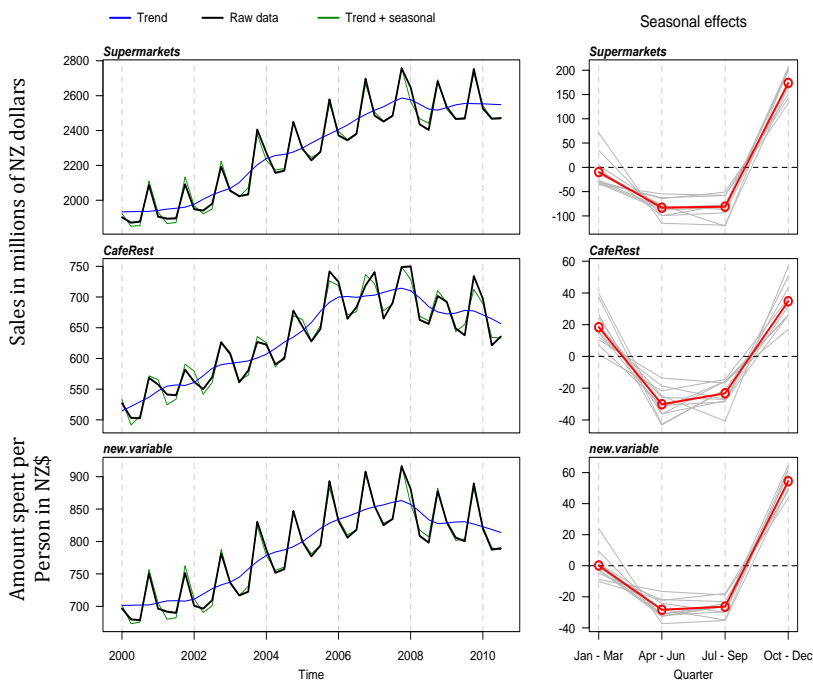
However, looking at the overall trend for Cafe and restaurants after the recession in 2008, it has consistently decreased compared to Supermarkets, which has increased. This could be caused by more people are cooking meals at home rather than eating out because it was cheaper.¹¹

¹⁰ When Did This Recession Begin? <http://spectator.org/blog/2011/06/09/when-did-this-recession-begin>

¹¹ <http://www.baxterstorey.com/news/recession-s-impact-on-gb-s-food-choices-are-revealed-in-a-major-new-survey-by-wsh>

Looking at the Average seasonal effect graphs for both of them, they seem to have a similar pattern of a 'u' shape. However, for the Cafe and restaurants, the peak in Jan-Apr quarter is almost at the same height as the Oct-Dec peak compared to the lower peak in the supermarkets. This could be due to people deciding to eat out and celebrating the New Year with friends and family. So they have a nice meal out, therefore, increasing the sales in the Jan-Apr quarter.¹²

New Variable - Total spending per capita



The Total spending per capita is all the food outlets (Supermarkets, Fresh Food stores, Takeaways and cafes and restaurants) divided by NZ's population in millions.

Looking at the Total spending per capita time series graph, the overall trend is increasing until 2008, and then it decreases. It increases at about a rate of \$18.8 from 2000 to 2008 and then decreases at a rate about \$15 millions of NZ dollars per capita until 2010. However, it is not a smooth linear trend and

has a few peaks and troughs. There is a faster decrease from 2008 to mid 2009 dropping from \$850 to \$825 millions of NZ dollars per capita. This could be caused by the recession and people buying cheaper food to spend less.¹³

Also looking in 2004 there is a peak, rising from \$25 to \$760 millions of NZ dollars per capita on food spending. This could be caused by the same reason for the increase in Supermarkets.¹⁴

Looking at the average seasonal effect graphs for all the variables, the Total Spending per capita is in a similar pattern to Supermarkets, however, the Jan-Oct peak is slightly less on Supermarkets and is pushed up in the Total Spending per capita by the Cafe and restaurants. This could be caused by the fact that the Supermarkets data is more weighted and has a bigger range of millions of NZ dollars hence causing the same pattern.

¹² https://en.wikipedia.org/wiki/New_Year's_Eve

¹³ http://www.ers.usda.gov/media/187072/err129_1.pdf

¹⁴ http://www.pecc.org/resources/doc_view/395-new-zealands-changing-retail-food-sector

However, the overall trend for the Total Spending per capita is increasing until 2008 due to the recession and it is now decreasing. This could be due to people spending less on food, as they still want to save money as they are still recovering from the recession. Thus, they buy food in bulk at the Supermarket than at Cafe and restaurants, which is more per person.

Limitations

With using these time series graphs there are some limitations to the model. These are that when I am forecasting, the Holt-Winters time series only uses the actual values for the past 5 years or so to predict. This means that the past historical data does not influence the predictions and it is assuming that the sales will continue to decrease at the same rate into the foreseeable future.

However, this could not be the cause. The time series model does not account for the change in weather patterns to whether people will buy the same food or warmer food that may be more or less expensive. Also if some unforeseen event happens like a volcano erupts or a massive earthquake happens in New Zealand in a major city, or there is another recession or inflation occurs this could decrease or increase the amount in sales for Supermarkets or Total Spending per capita than what is predicted.

Conclusions

So, going back to the purpose of the investigation is to see whether the recession has decreased the amount spent on food in Supermarkets. The answer is yes and no. Yes initially, it did as people were buying cheaper food at the supermarket but this has stayed the same so the sales are increasing due to people being able to afford more/expensive food.

However, to predict what will happen in the future, is not totally accurate the further away we get from the historical food sales data, but it should be in a range that we can predict. But it is subject to the times staying the same, there not being another recession, increase in food prices, or inflation. However, as at 2010, the food sales in supermarkets are increasing due to people buying more now that the recession is over.