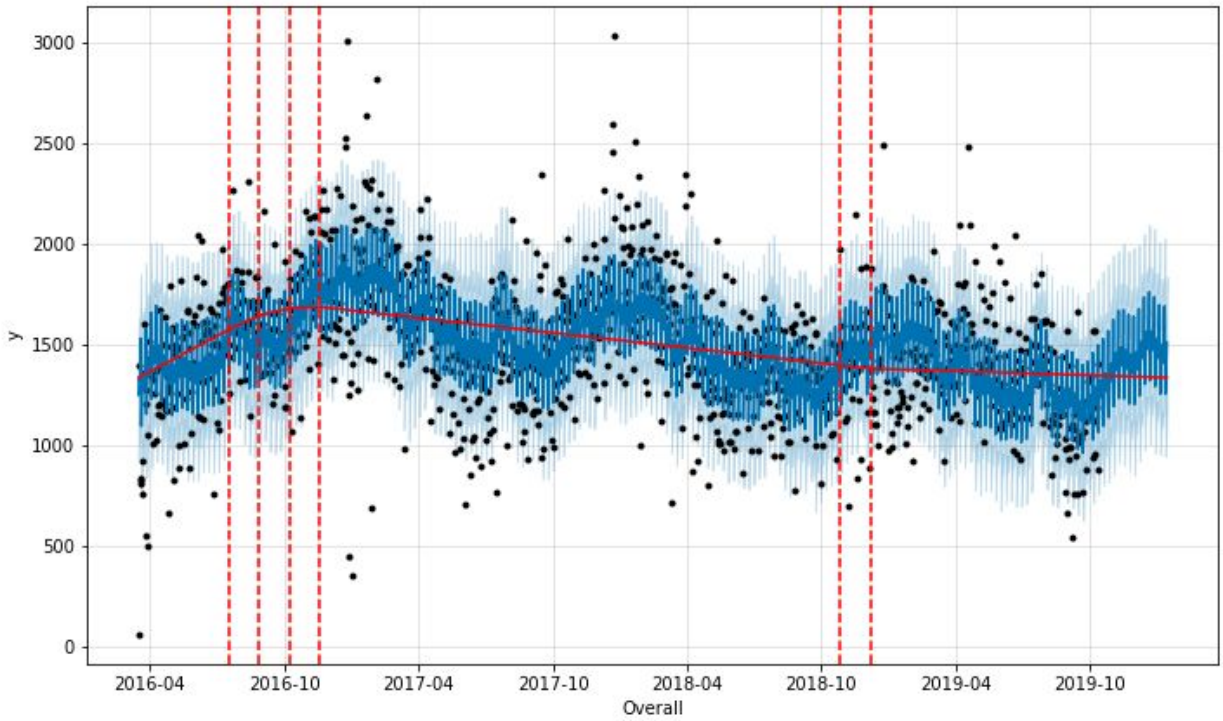
Sales Analysis Report

Team DataSVAP

Sales Forecast

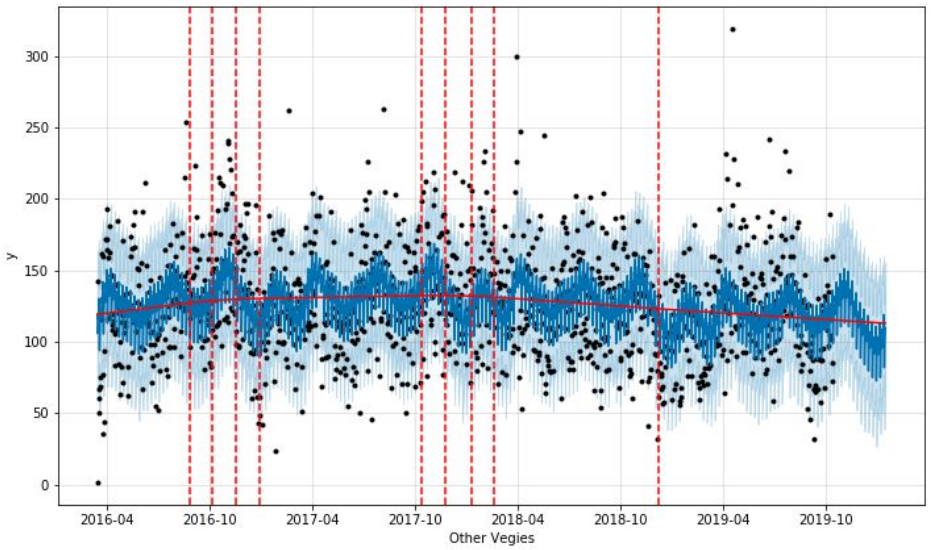
From our data analysis, we suggest the following overall revenue forecast for the next three months.



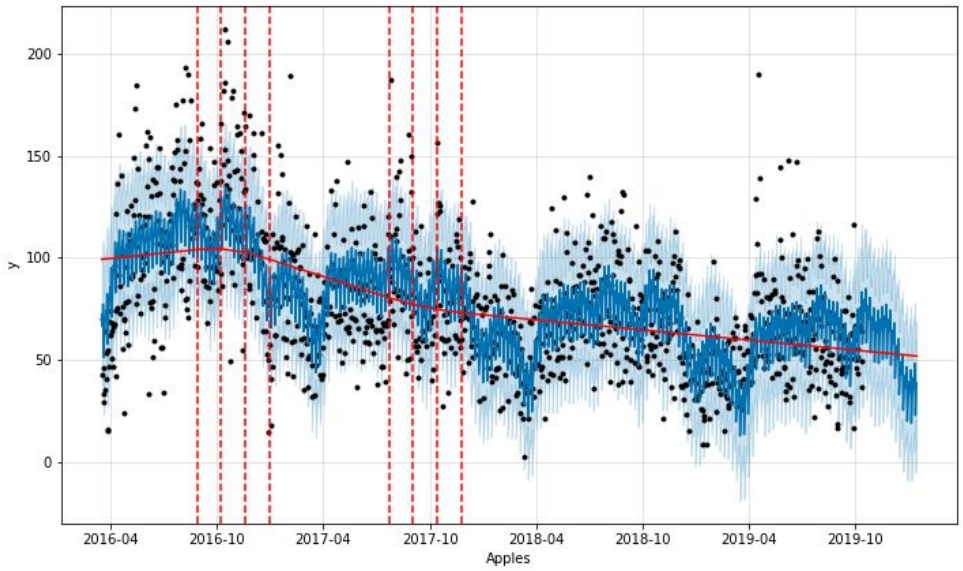
We see a marginal increase in the total sales of the store which can be due to the approaching summer season.

We also forecast the sales of the top 5 categories as follows:

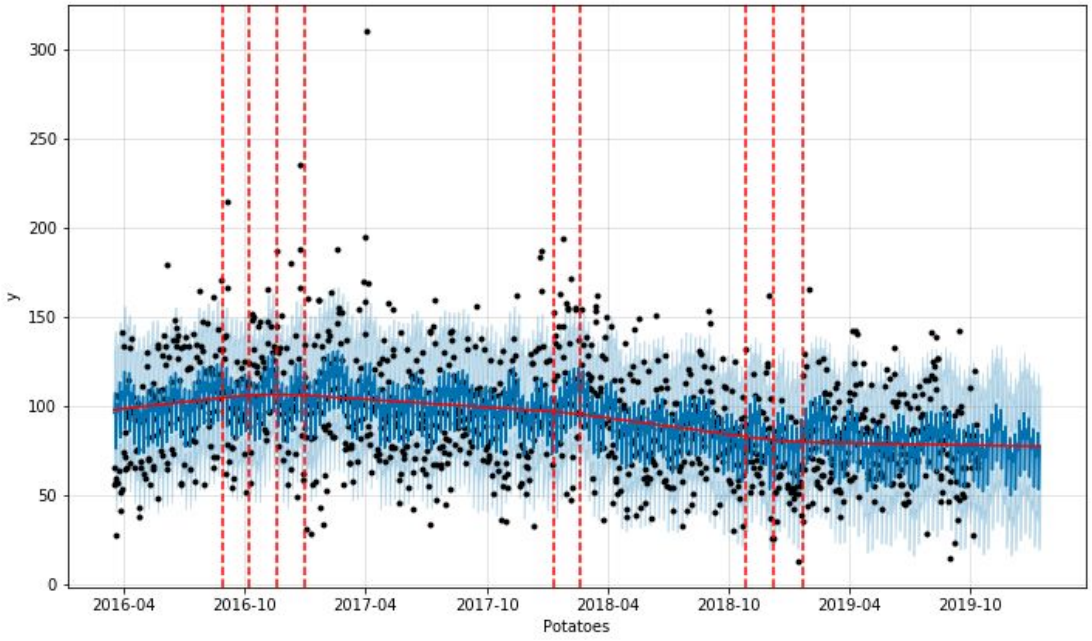
Other Vegies (**RMSE** - 42.42268083717395; **MAE** - 34.81372986389688)
Note: This category is an aggregated category consisting of several items. These items are varied and do not necessarily conform to a pattern, which is why the RMSE score for this category is the highest amongst the ones we calculated



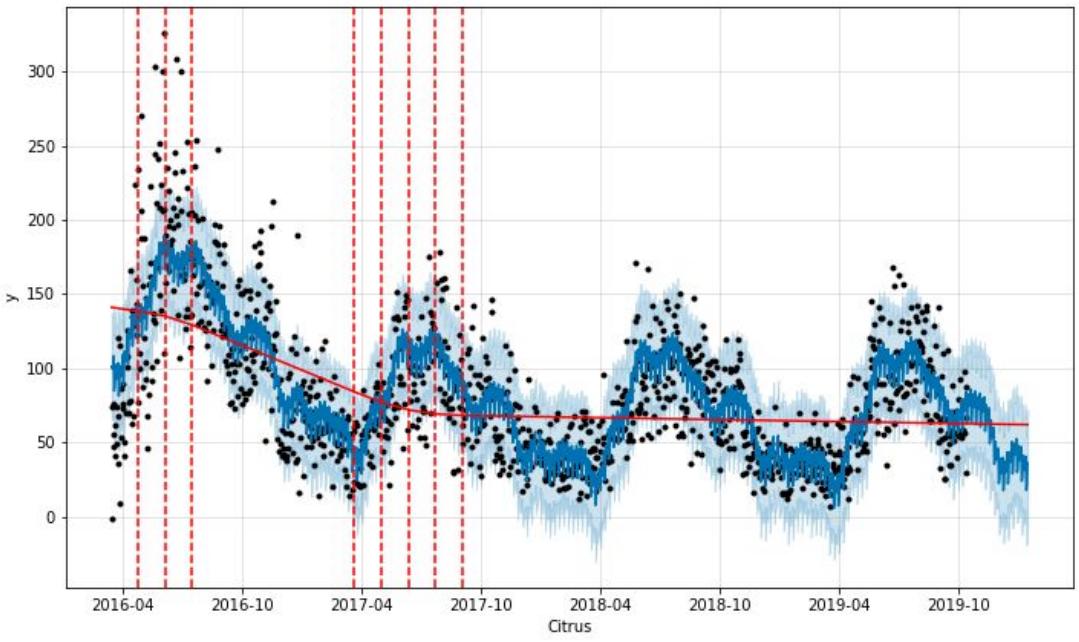
Apples (**RMSE** - 27.947305233745023; **MSE** - 23.08109480126962)



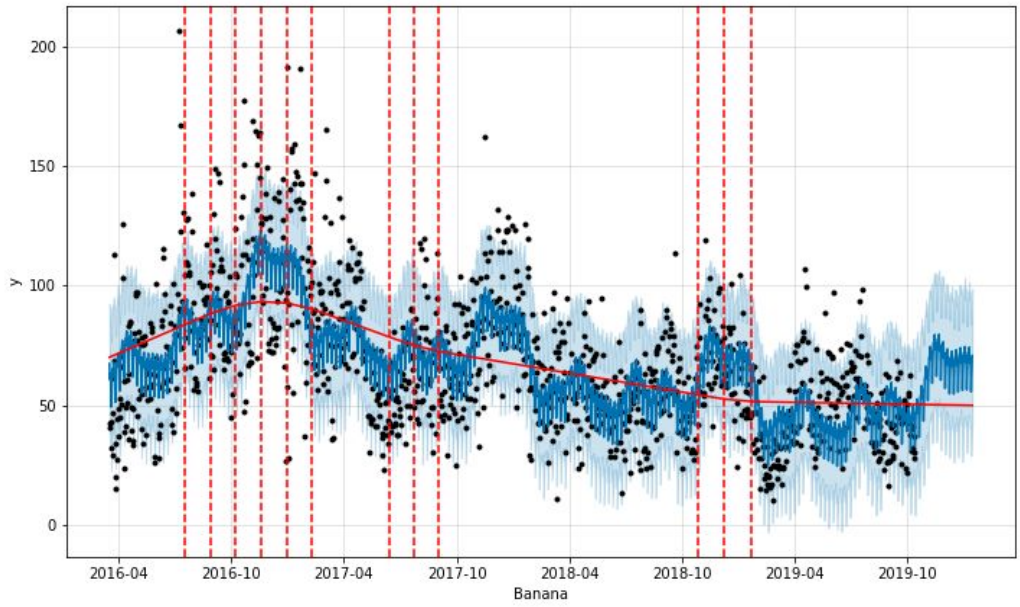
Potatoes (**RMSE** - 30.719972451492232; **MSE** - 24.08254984164611)



Citrus (**RMSE** - 25.636834845541163; **MSE** - 21.295504515410318)



Bananas (**RMSE** - 20.548163822415813; **MSE** - 16.993721754608504)



Checkpoints and Holidays

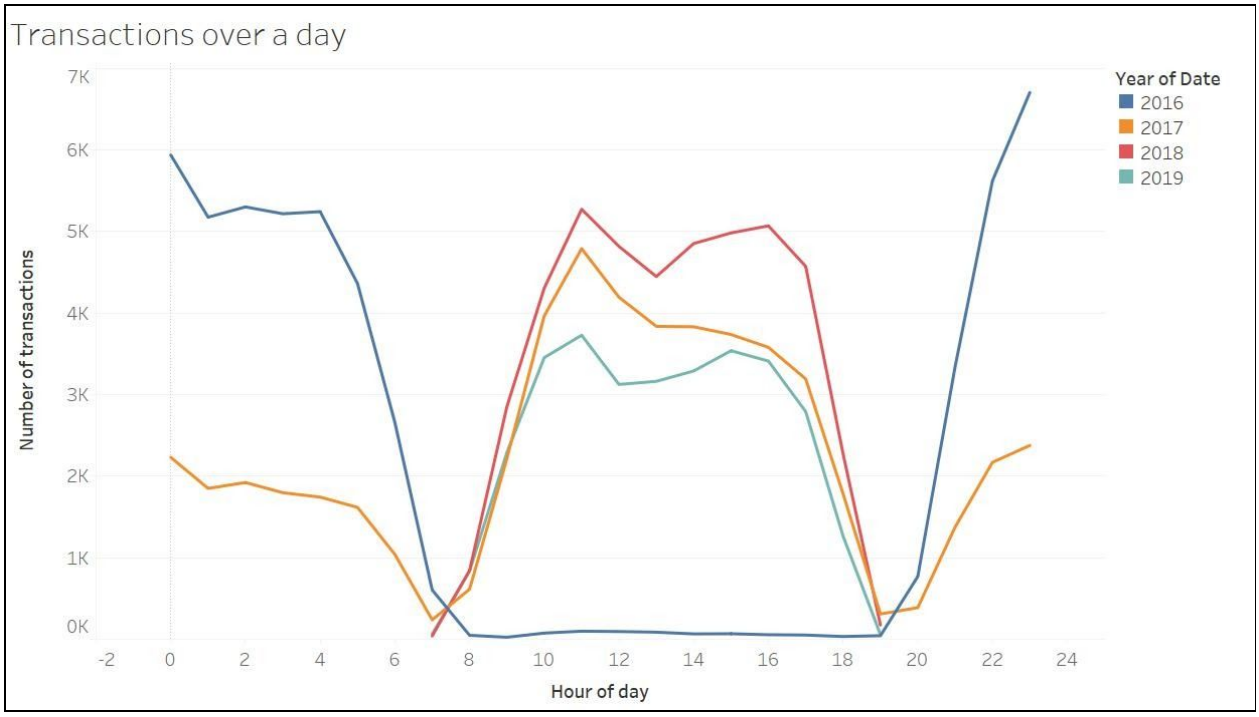
	Overall	Holidays	Link for Reference
41	2016-04-26	Anzac Day	https://www.timeanddate.com/holidays/australia...
82	2016-06-06	Western Australia Day	https://www.timeanddate.com/holidays/australia...
123	2016-07-17	Weekend	http://www.calendar-to-print.com/july-2016-cal...
164	2016-08-27	Weekend	http://www.calendar-to-print.com/august-2016-c...
205	2016-10-07	Norfolk Island Agricultural Show Day	https://www.timeanddate.com/holidays/australia...
246	2016-11-17	First Sunday of Advent	https://www.timeanddate.com/holidays/australia...
286	2016-12-28	New Year's Eve	https://www.timeanddate.com/holidays/australia...
327	2017-02-07	Tu B'Shevat (Arbor Day)	https://www.timeanddate.com/holidays/australia...
368	2017-03-20	Harmony Day	https://www.timeanddate.com/holidays/australia...
409	2017-05-02	Yom HaAtzmaut	https://www.timeanddate.com/holidays/australia...
450	2017-06-12	Queen's Birthday	https://www.timeanddate.com/holidays/australia...
491	2017-07-23	Weekend	http://www.calendar-to-print.com/july-2017-cal...
532	2017-09-02	Hari Raya Haji	https://www.timeanddate.com/holidays/australia...
573	2017-10-13	Simchat Torah	https://www.timeanddate.com/holidays/australia...
614	2017-11-24	Thanksgiving Day	https://www.timeanddate.com/holidays/australia...
655	2018-01-09	Orthodox New Year	https://www.timeanddate.com/holidays/australia...
696	2018-02-19	Chinese New Year	https://www.timeanddate.com/holidays/australia...
737	2018-04-03	Easter Tuesday	https://www.timeanddate.com/holidays/australia...
777	2018-05-14	Ramadan Start	https://www.timeanddate.com/holidays/australia...
818	2018-06-25	June Solstice	https://www.timeanddate.com/calendar/june-sols...
859	2018-08-05	Northern Territory Picnic Day	https://www.timeanddate.com/holidays/australia...
900	2018-09-15	Yom Kippur	https://www.timeanddate.com/holidays/australia...
941	2018-10-27	Halloween	https://www.timeanddate.com/holidays/australia...
982	2018-12-08	Last day of Hanukkah	https://www.timeanddate.com/holidays/australia...
1023	2019-01-22	Australia Day	https://www.timeanddate.com/holidays/australia...

After modeling the data, we collected the checkpoints (times when there was a major change in the revenues) for each category and the overall transactions that take place. We observed 25 dates where there were checkpoints. We were able to correlate these dates with the national/state holidays and with weekends. This helped us to understand that the

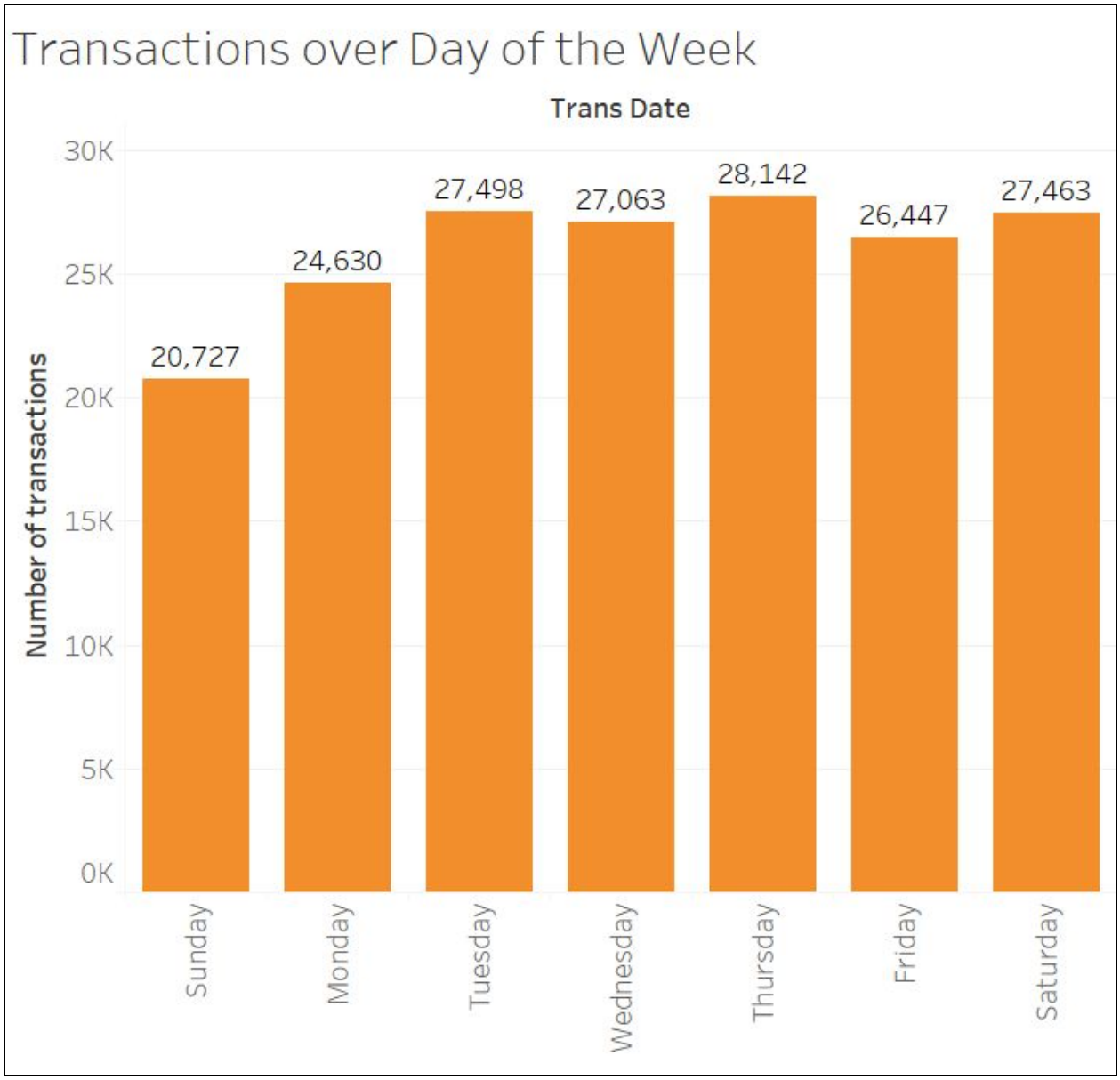
major spikes happened during the holiday season or when people did not have to work. In the future, the store should look at the holidays in advance and capitalize on this opportunity to maximize profits.

Transactions

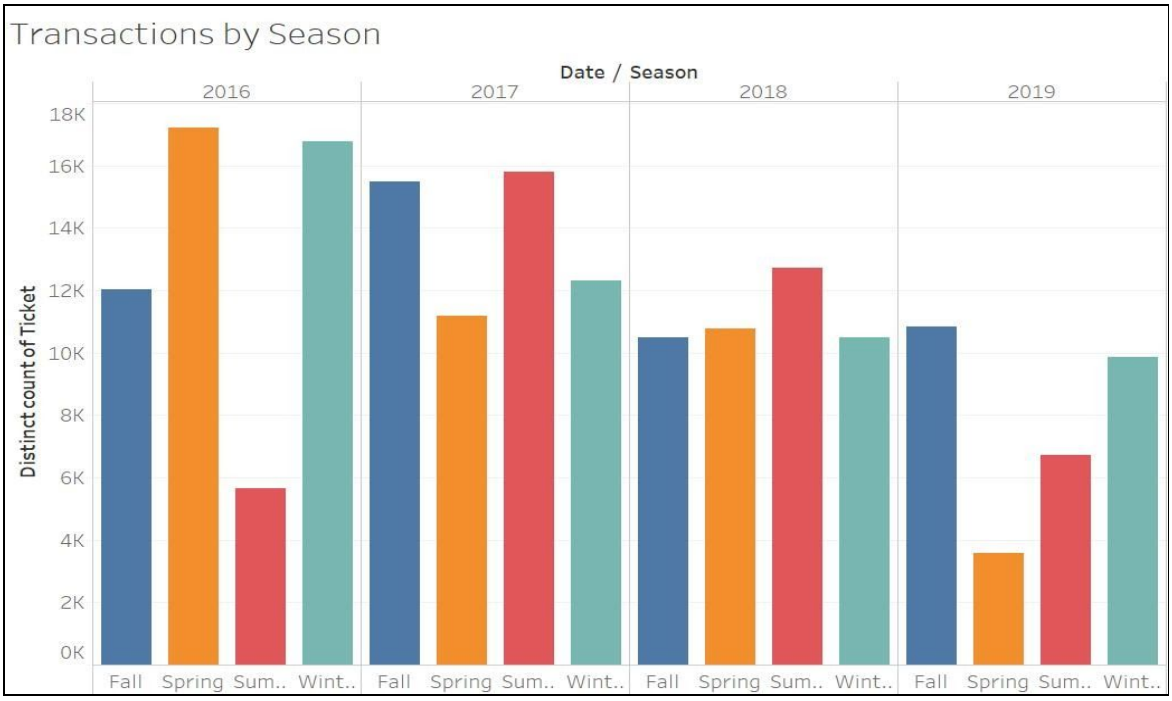
To begin our analysis, we first set out by exploring the transactions taking place in the store.



- Over a day, we find that maximum transactions happen in the time range 9 AM - 6 PM for every year except 2016.
- 2016 seems to be anomalous in this case as it shows an exact opposite trend. In 2016, minimum transactions happened during the day and maximum transactions took place in late-night hours.

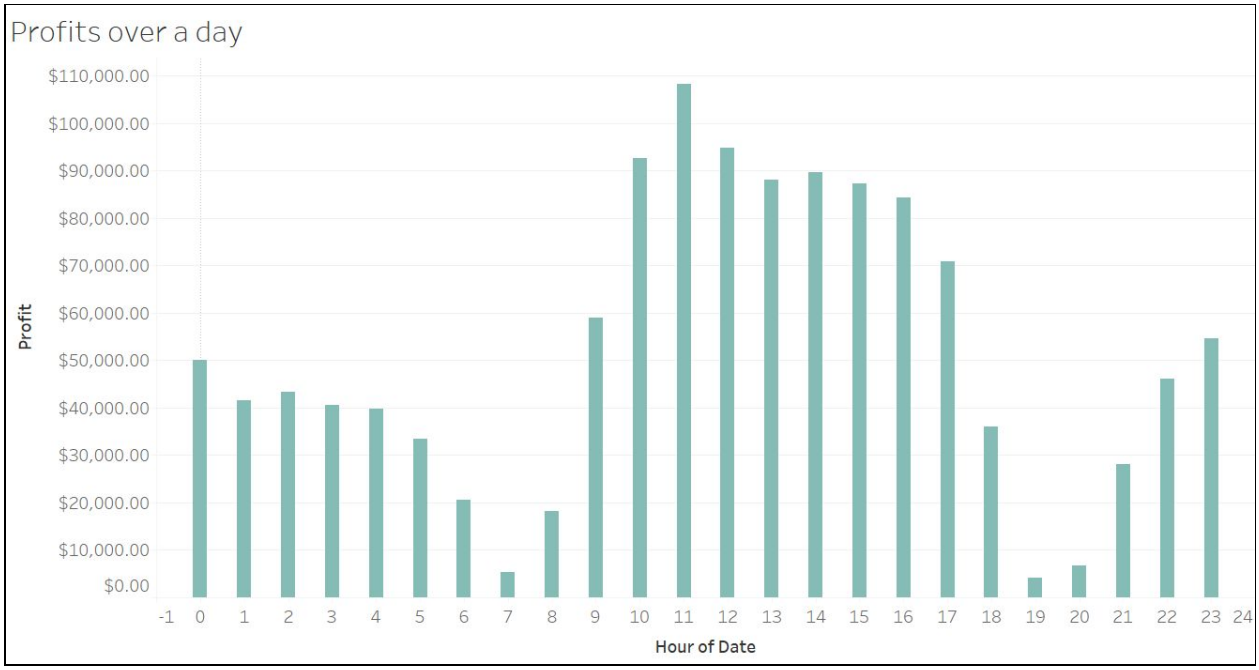


- Analyzing the number of transactions over a week (across all 4 years), we find that the store sees maximum transactions on Thursdays, followed by Tuesdays.
- Saturdays also see a significant number of transactions which can be attributed to the fact that it is the weekend.
- It comes as a surprise that Sunday sees the minimum number of transactions overall, in spite of being a holiday.

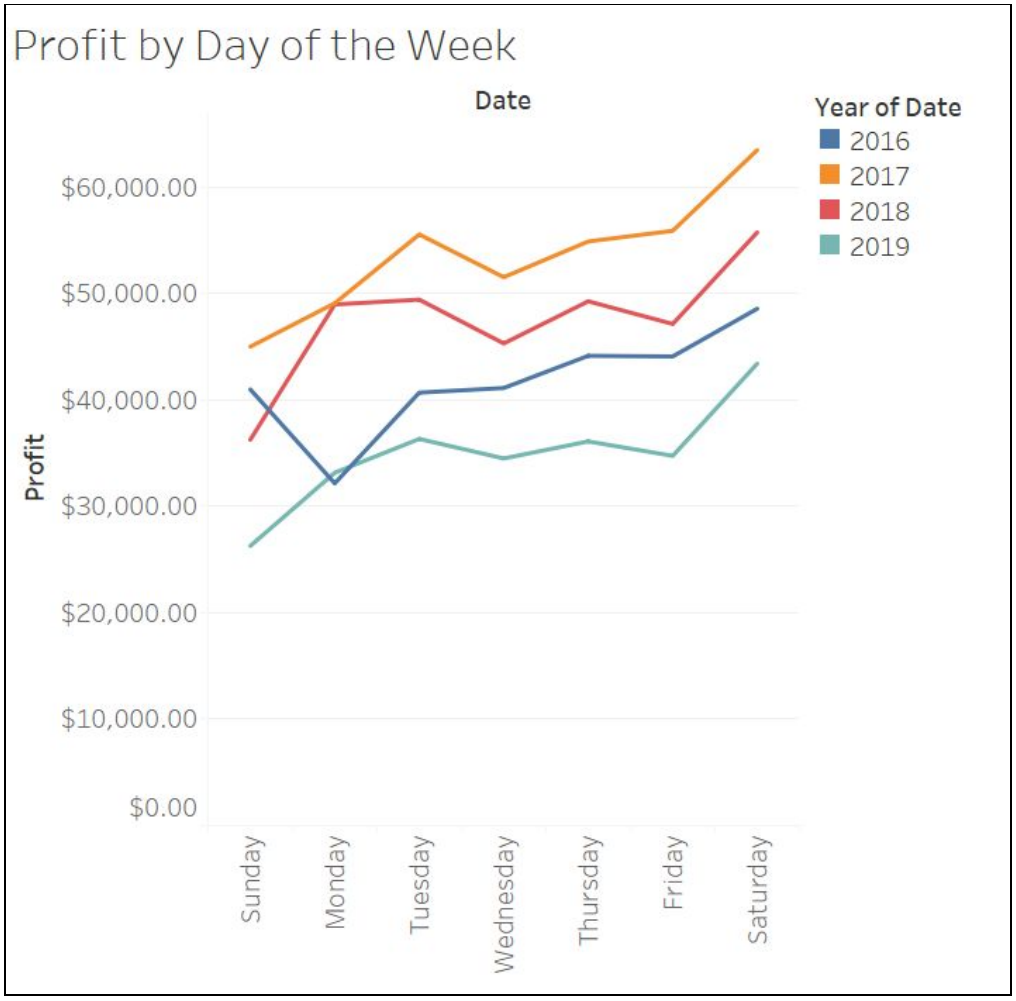


- When we analyze the transactions for each season (across all 4 years), we see a general trend that the number of transactions is high in the summer season.
- The data provided is from March 2016 to October 2019. Transactions of the two months of summer in 2016 and one month of summer in 2019 are thus not included.
- Thus we might be able to attribute the drop in summer transactions for 2016 and 2019 to the fact that we are missing data for summer months for these two years

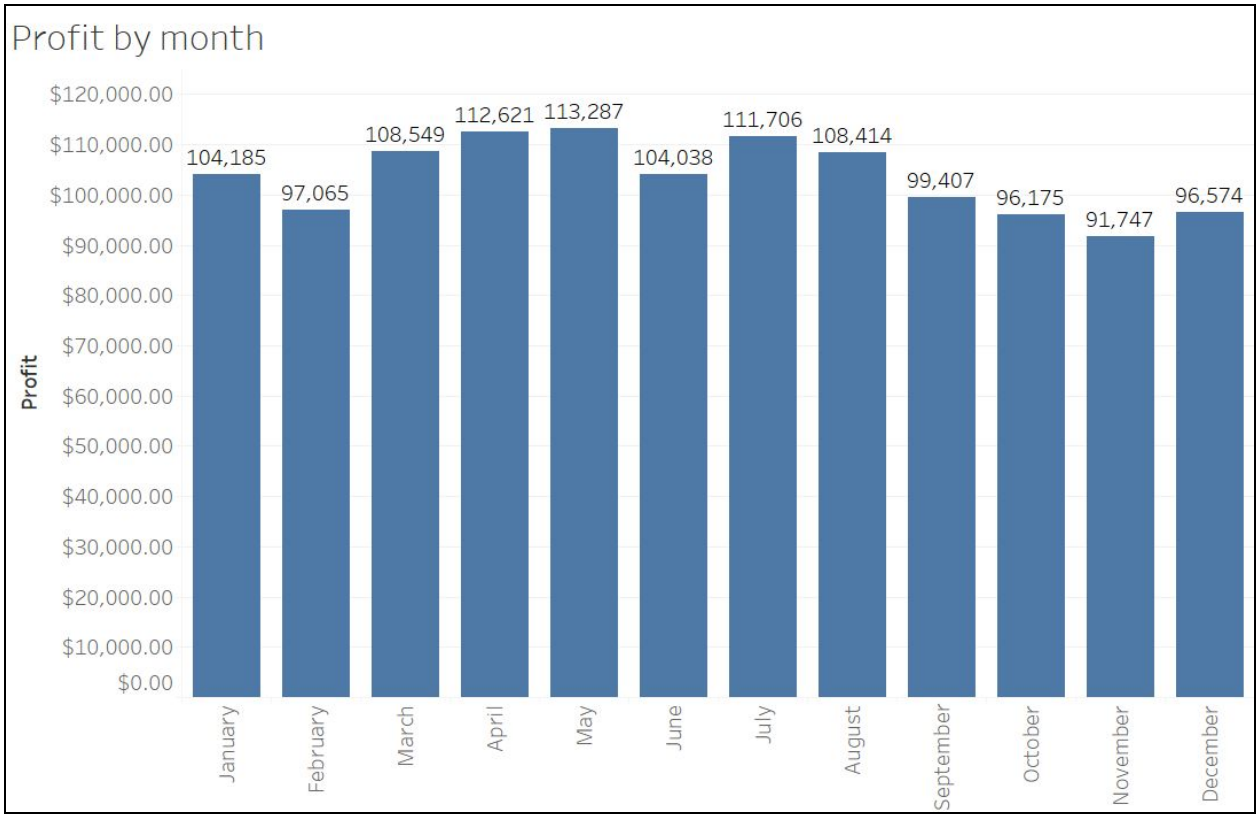
Profit



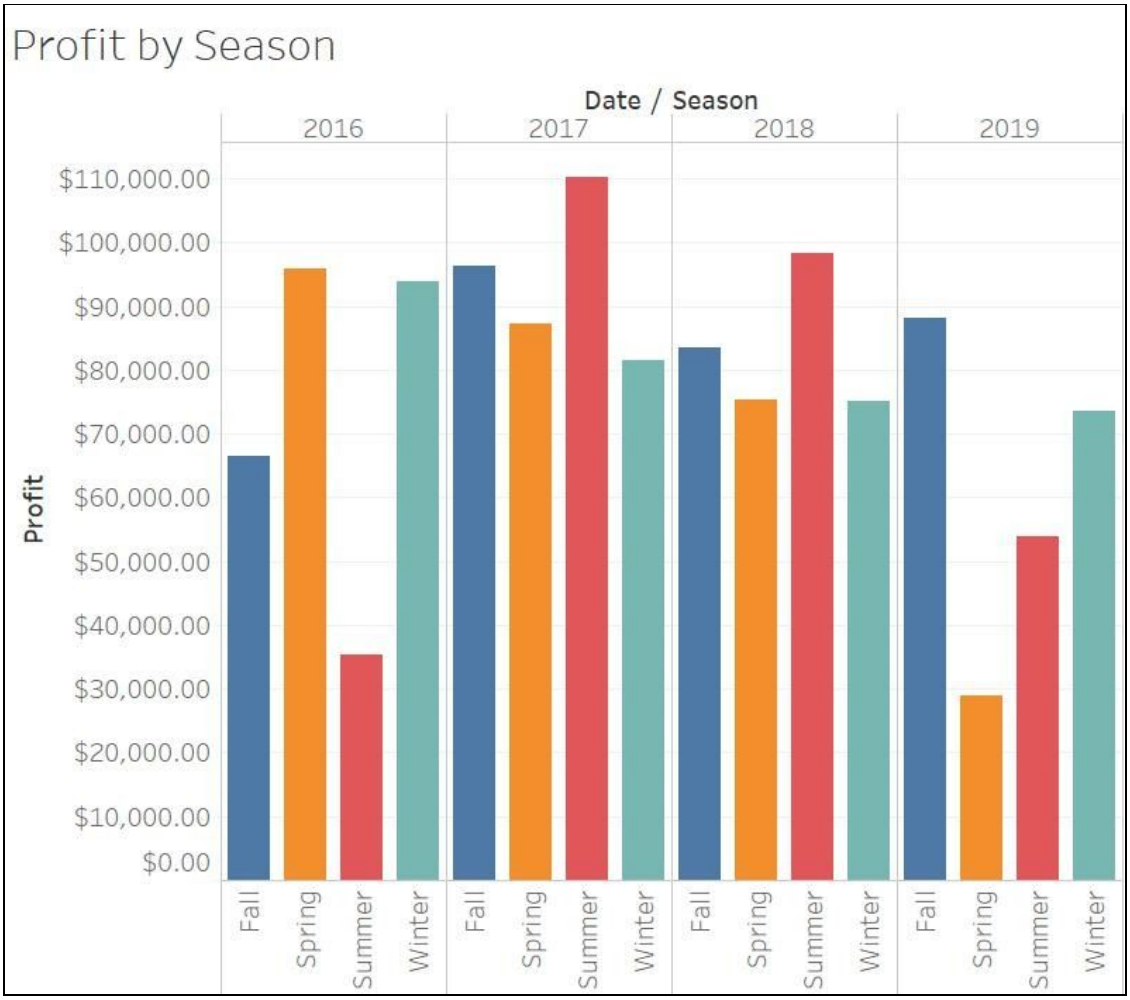
- When we look at the total profit by the hour, we see that the store profits the most in the time period 9 AM - 6 PM, which coincides with the peak time for transactions as outlined above.
- We also see that there is a sharp drop in profits at 7 AM and 7 PM.



- Considering the total profit in the context of the days of the week, we find the store profits more at the end of the week. This trend can be seen across all 4 years.
- This is consistent with the observation that a significant amount of transactions happen at the weekend.
- Thursdays however, which see the maximum number of transactions, are not the most profitable.

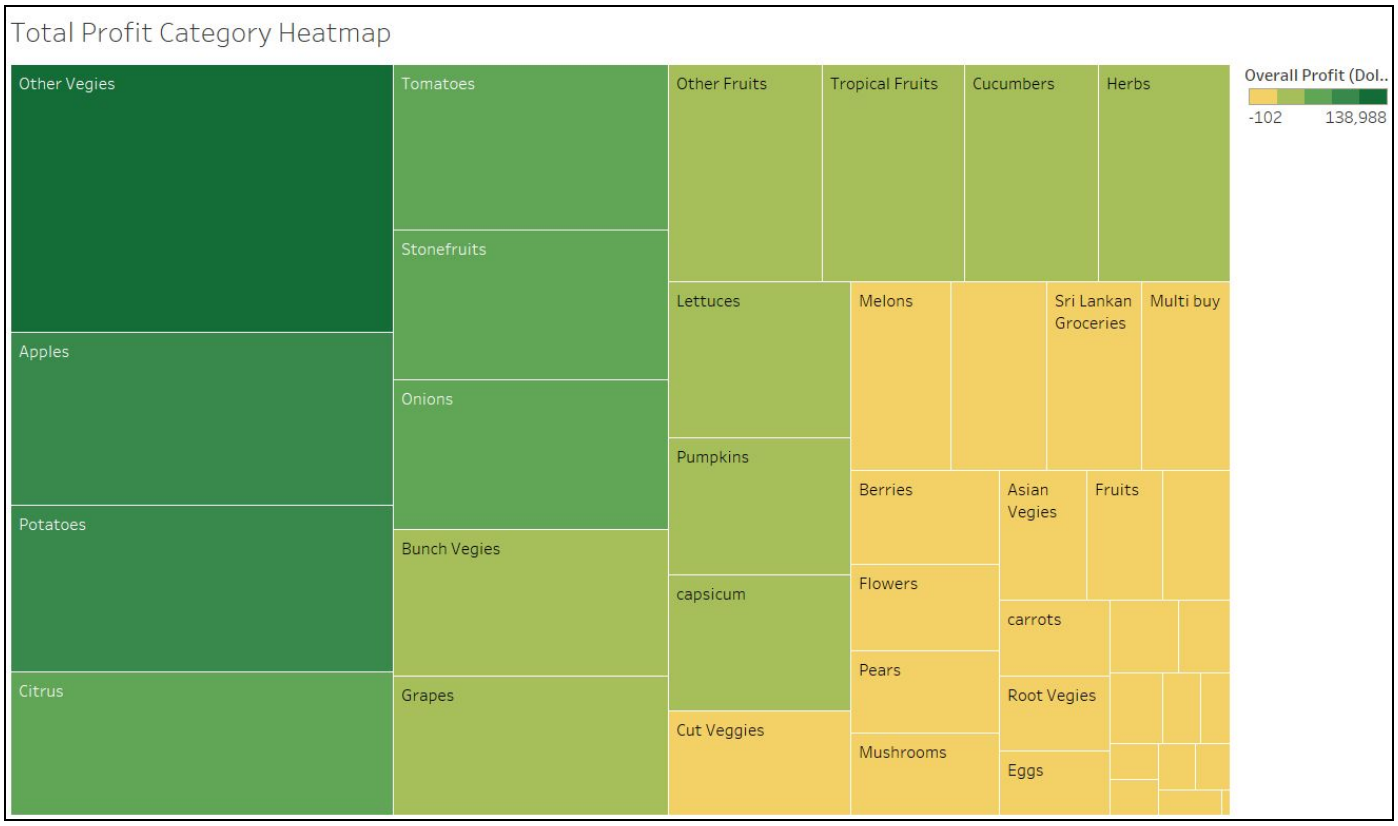


- Considering total profit across the 4-year time period, the month of May has been the most profitable over the years.
- We need to be mindful that the above plot is built using data which excludes the first two months of 2016 and the last two months of 2019

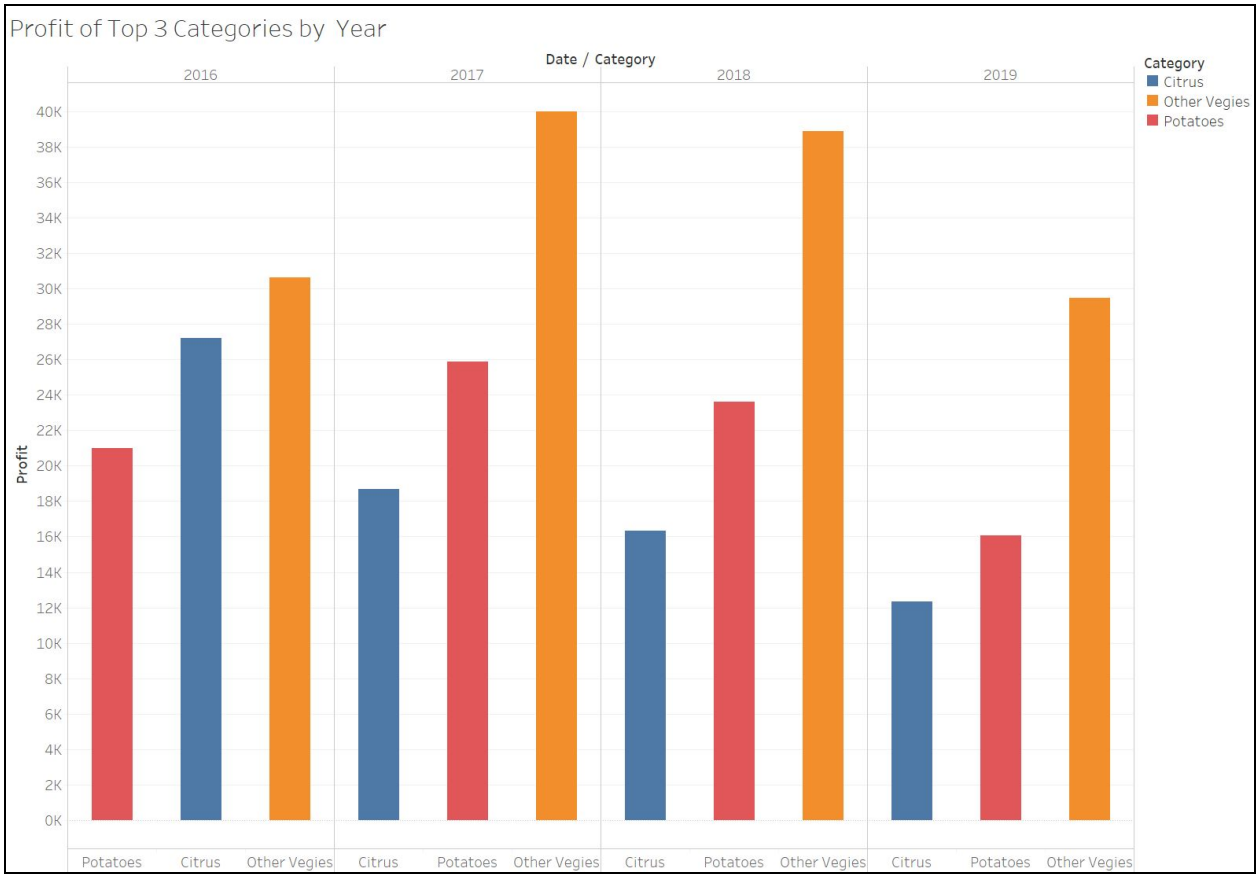


- When we look at a profit over the seasons, summer proves to be the most profitable for most years. This is in line with the observations from the Transaction vs Seasons plot above.
- The data provided is from March 2016 to October 2019. Data for the two months of summer in 2016 and one month of summer in 2019 are thus not included.
- We might be able to attribute the drop in profit for the summers of 2016 and 2019 to the fact that we are missing data for summer months for these two years

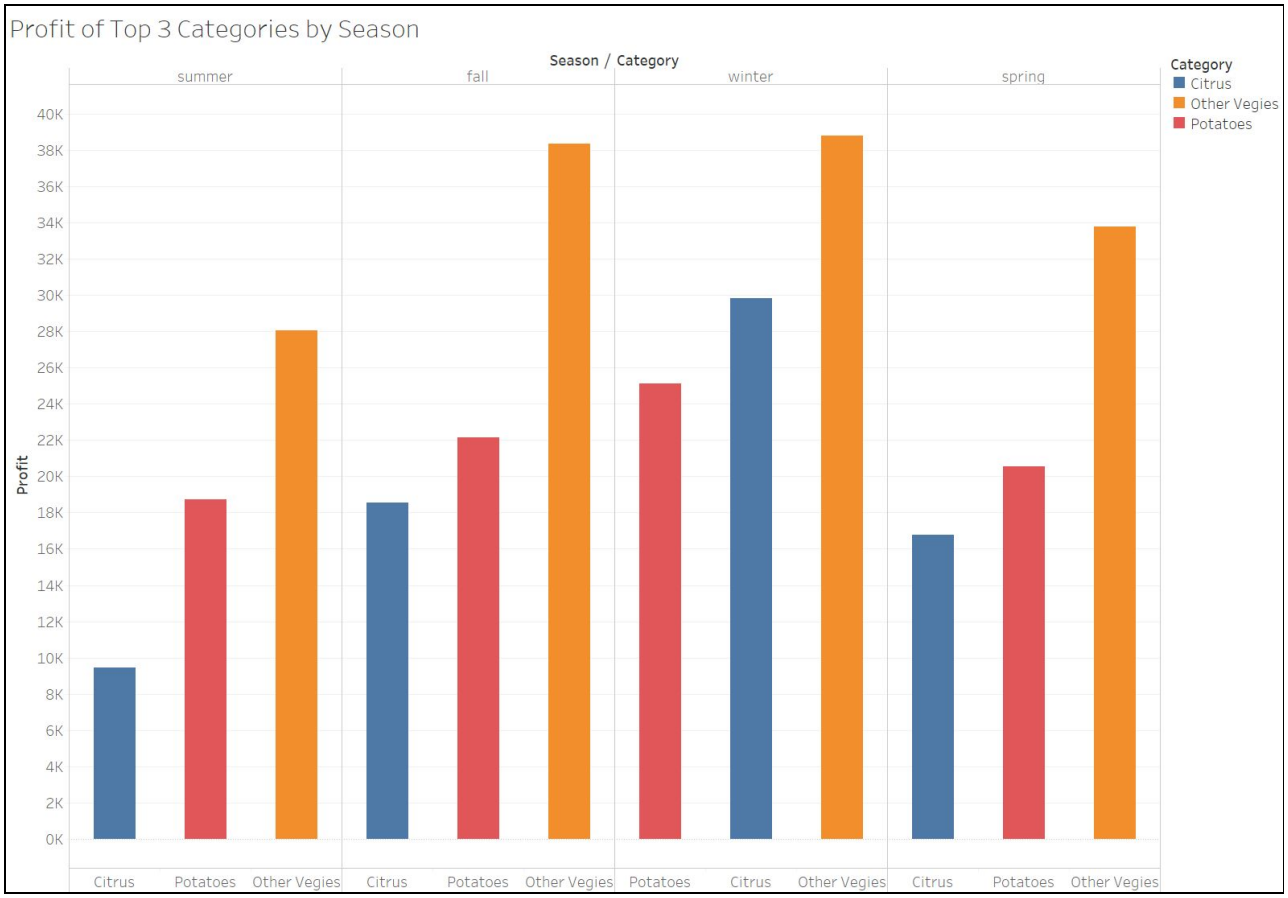
Category and Products



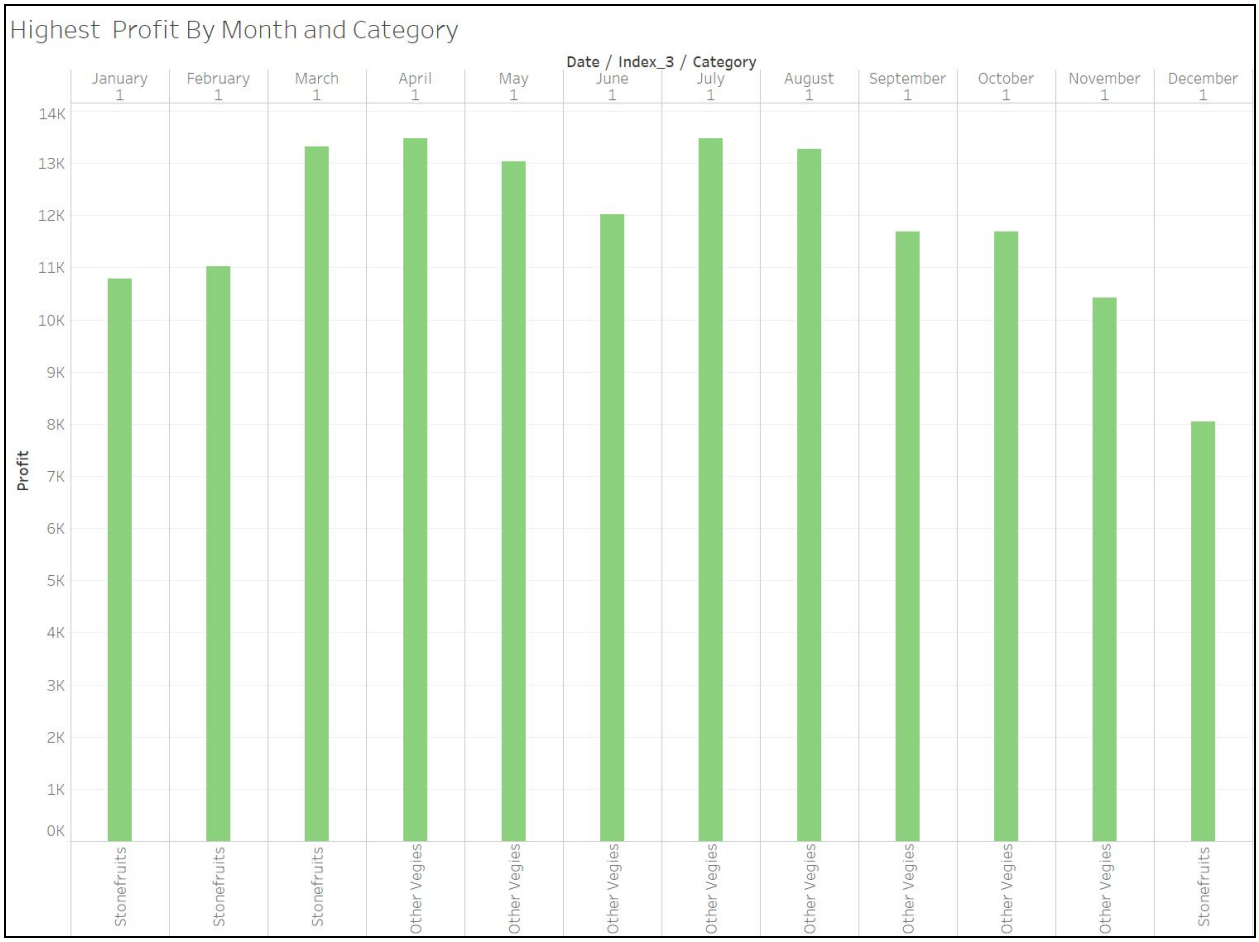
- From the heatmap, we can see that in terms of overall Profit, the Category 'Other Vegies' comes out on top, having accrued $138,988 dollars in profits over the 4 year time period.
- To explore further, we plot the Total Profit by Category, and filter the top 3 Categories in each year:



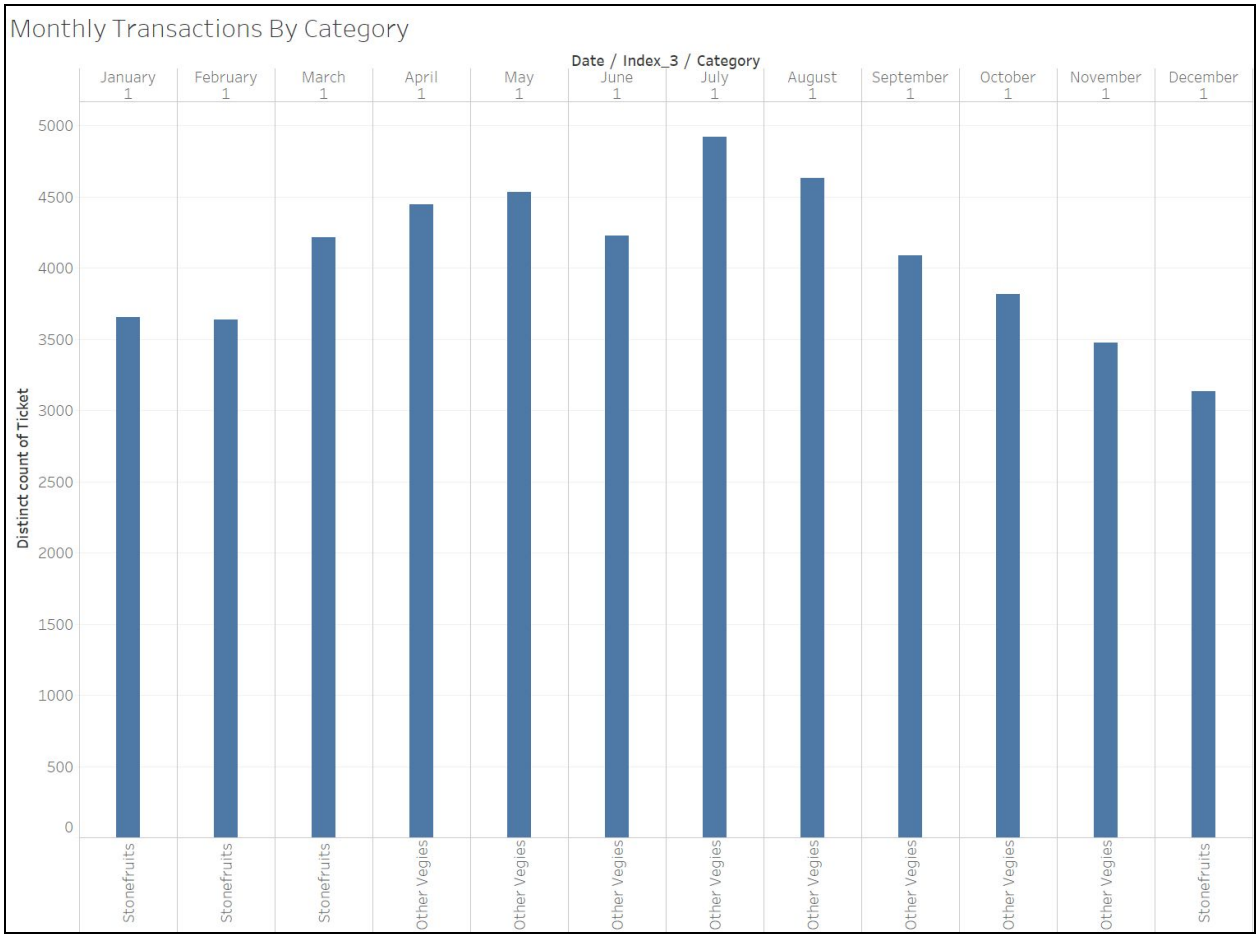
- We can see that the top 3 categories remain the same across the 4-year time period, with profits from 'Citrus' gradually decreasing, and with 'Other Vegies' being the category accruing maximum profits each year.
- It might be interesting to analyze if there is a seasonality amongst these profit trends. We thus plot the Top 3 categories for each season across the 4 year period:



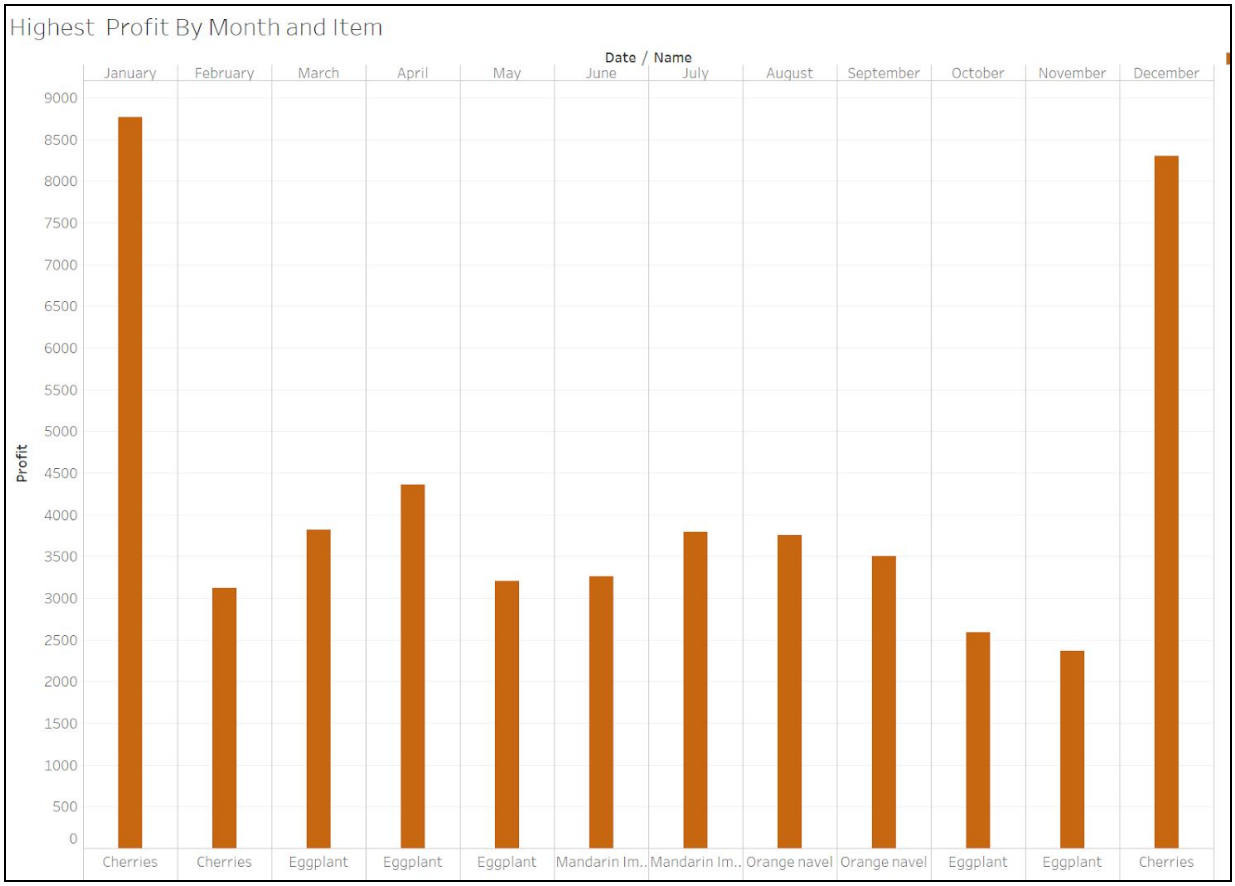
- On comparing the highest profits by season, it doesn't come as a surprise that the 'Other Vegies' category generated the highest profit across all the seasons. However, we observe that 'Citrus' accrues greater profits than 'Potatoes' in the winter season.
- Upon further research into the seasonality of Australian fruits, we found that 'Citrus' fruits are actually in season during Winter, which explains the spike in the above graph (Referenced from https://citrusaustralia.com.au/uncategorised/season)
- To drill deeper, we next explore the category accruing the most profit over each month:



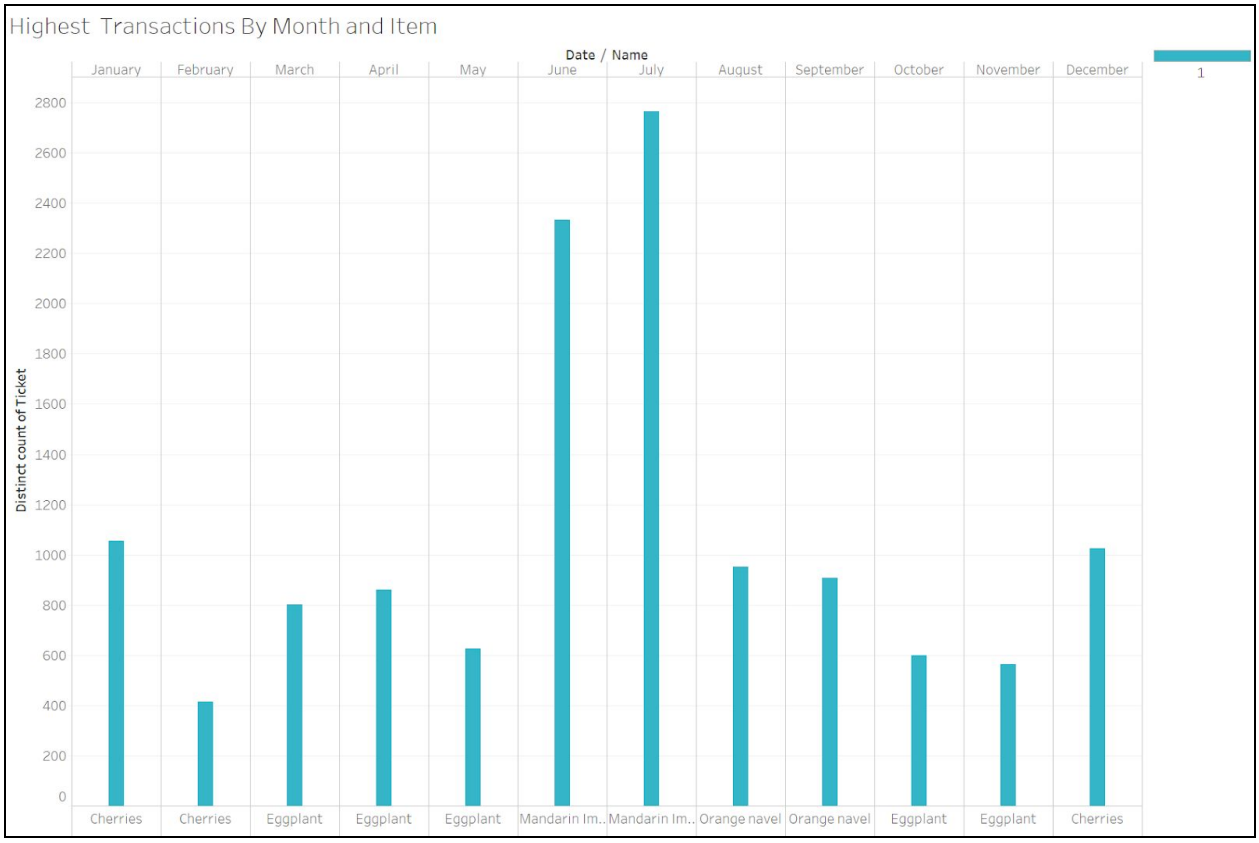
- The above visualization represents the highest profit in each month from 2016 March-2019 October. In the months of January, February, March, and December 'Stonefruits' generated the highest profits, and in the rest of the months, 'Other Veggies' was the category that generated the highest profits.
- Upon further research into the seasonality of Australian fruits, we found that 'Stonefruits' fruits are actually in season during the months of December, January and February (i.e. the Summer), which explains the spike in the above graph (Reference: http://seasonalfoodguide.com/australia-general-seasonal-fresh-produce-guide-fruits-vegetables-in-season-availability.html)
- In accordance with the original prompt, we shall also explore the volume of transactions to find the highest selling category for each calendar month:



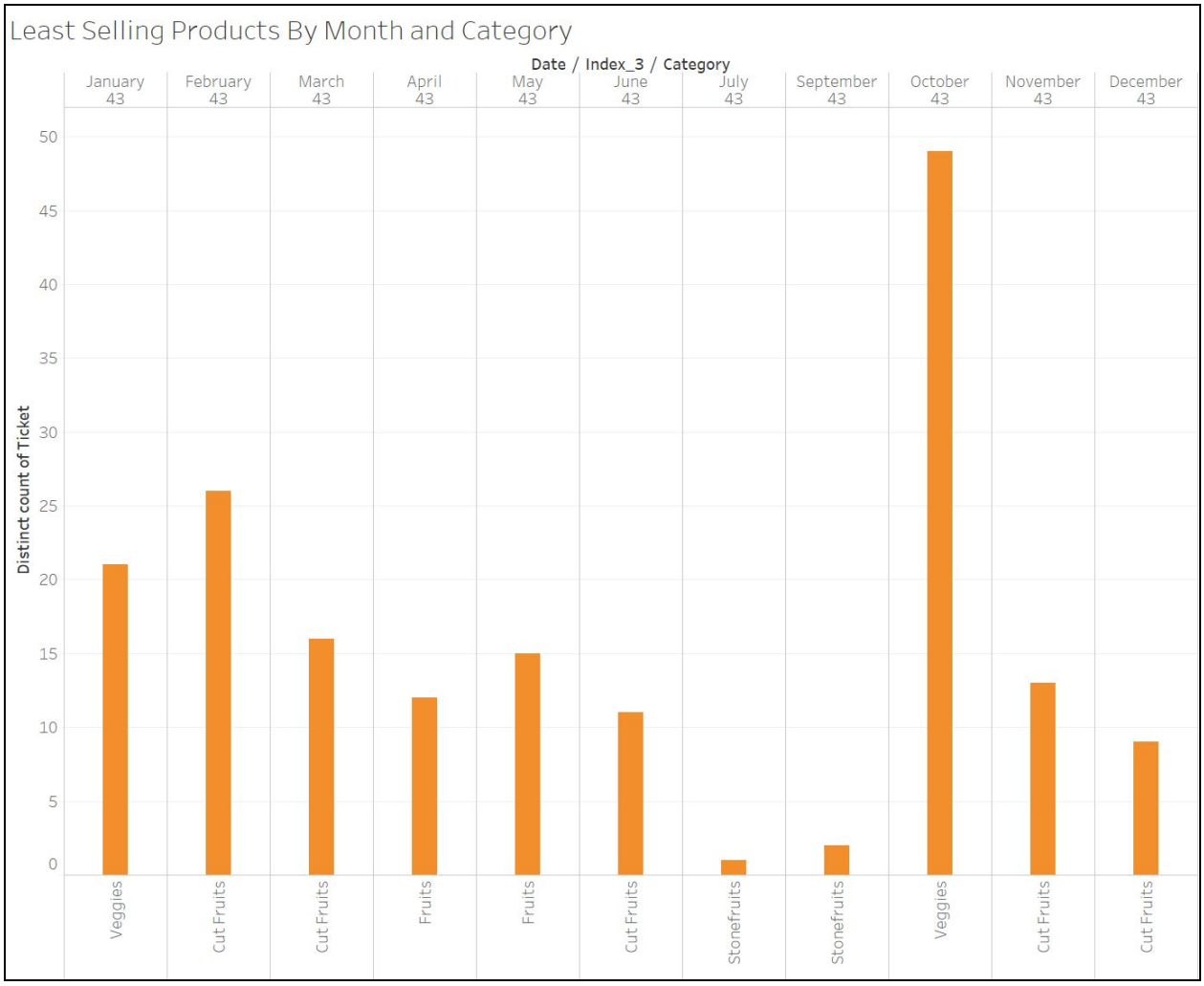
- The pattern here closely resembles the one in the previous visualization where we looked at products generating the maximum profit
- In the months January, February, March, and December 'Stonefruits' was the highest-selling category, and in the rest of the months, 'Other Veggies' was the highest-selling category.
- We shall now drill down to look at the profits for top grossing items for each calendar month:



- From the above visualization, we can observe that 'Cherries' was the highest profit generating item from December-February. This makes sense as 'Cherries' is one of the Stone Fruits (summer season).
- Another interesting insight was that the item 'Eggplant' generated the highest profit in the months of March, April, May, October, November. In fact, 'Eggplant' belongs to the top grossing category 'Other Vegies'.

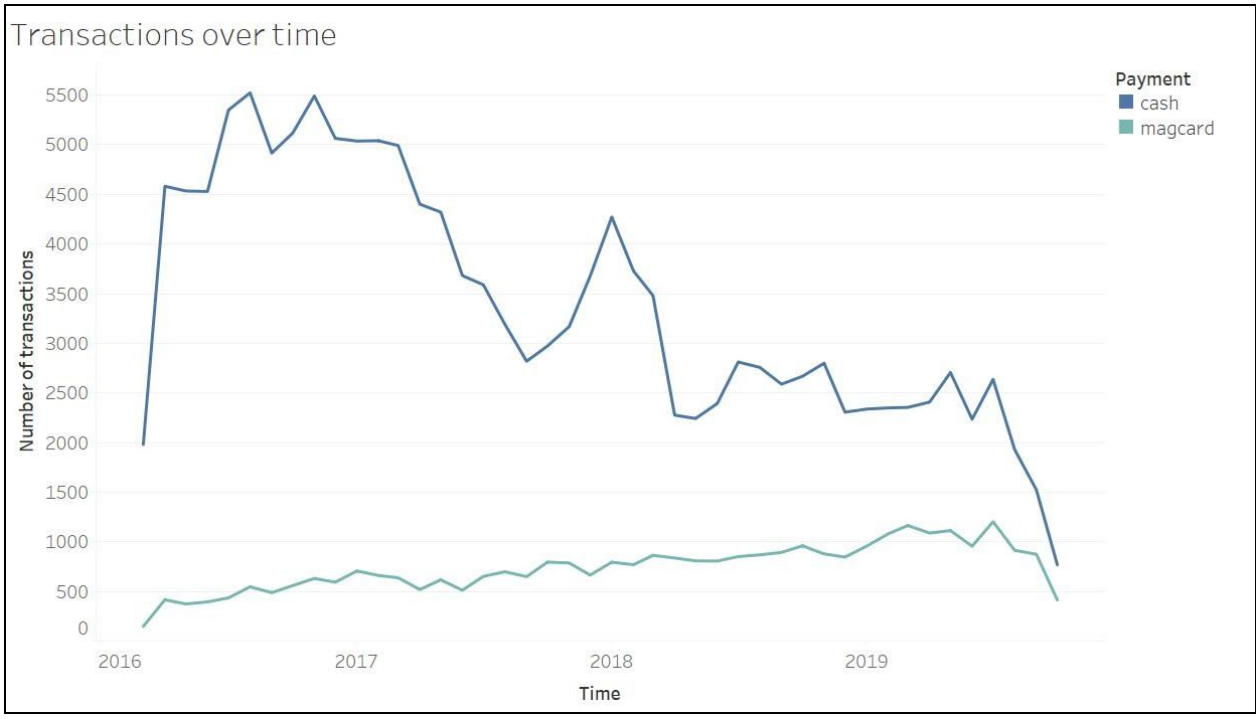


- We now explore the items in each month that had the highest transactions:
- The pattern here closely resembles the one in the previous visualization where we looked at products having the highest profits every month across 2016-2019.
- From the above visualization, we can observe that 'Cherries' was the highest selling item from December-February. This makes sense as 'Cherries' is one of the Stone Fruits (summer season).
- Another useful insight was that the item 'Eggplant', which belongs to the category 'Other Vegies', was the highest selling item in March, April, May, October, November.

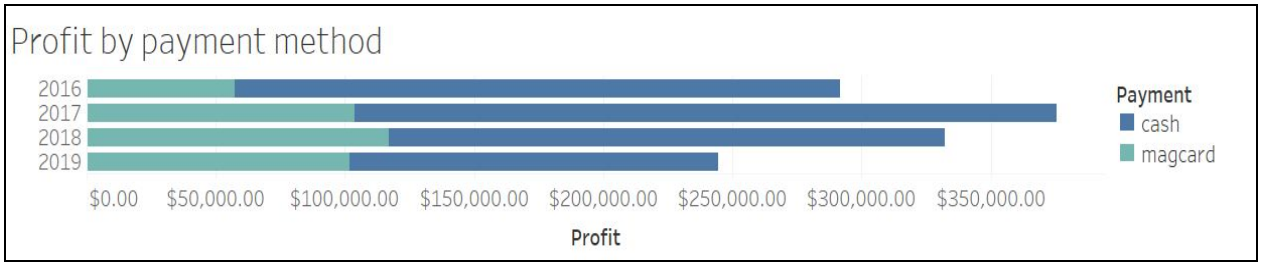


- From the above visualization, we can observe the least selling categories across each calendar month
- It's interesting how Stonefruits, which are the highest profit grossers in December, January and February, are the least profit drivers for the months of July to September.

Payment method



- When we look at the payment method used in the store,, we can clearly see a shift in favor of the magcard payments, i.e., a shift from cash to card payments.
- Cash transactions have rapidly decreased since mid-2016.
- The year 2019 saw a decrease in the number of transactions for both payment methods.

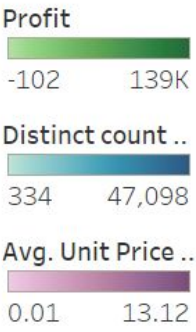


- Additionally, we see that magcard transactions are increasingly contributing to the store's total profit share.

Recommendations

Highlight Table

Category	Profit	Count of Ticket	Avg. Unit Price Margin
Chillies	12,036	8,436	13.12
Other Fruits	45,520	8,612	8.00
Flowers	17,374	1,492	7.09
Mushrooms	16,483	9,067	5.10
capsicum	33,900	15,474	5.06
Tropical Fruits	41,812	8,981	4.89
Other Vegies	138,988	47,098	4.68
Lettuces	38,816	17,793	4.53
Veggies	2,154	1,115	4.01
Melons	25,508	15,585	0.83
Cut Fruits	273	334	0.82
Eggs	9,718	10,829	0.73
Pastas	2,364	2,469	0.54
Avocadoes	3,602	6,925	0.35
Bananas	-102	43,437	0.01



In the above highlight table, we have considered Profit, Total Number of Transactions and Average Unit Price Margin to analyze the products that should be focused to increase the profit.

We can observe that Chillies are high margin items, but have less transactions associated with them. Similarly, Bananas are low margin items but have several transactions associated with them. Therefore, the store should focus on incentivizing Chillies and increasing the selling price of Bananas so as to increase profits.

Future Work

- We can use demographic data to further analyze the trends with respect to the population.
- We can consider getting information about the places where these items are being grown and try to understand if we can reduce the Cost Price.
- We could use an LSTM model for predicting sequential data for the next 90 days.
- We can also consider using data pertaining to fluctuating prices of the items being sold to factor in the environmental factors that affect these prices