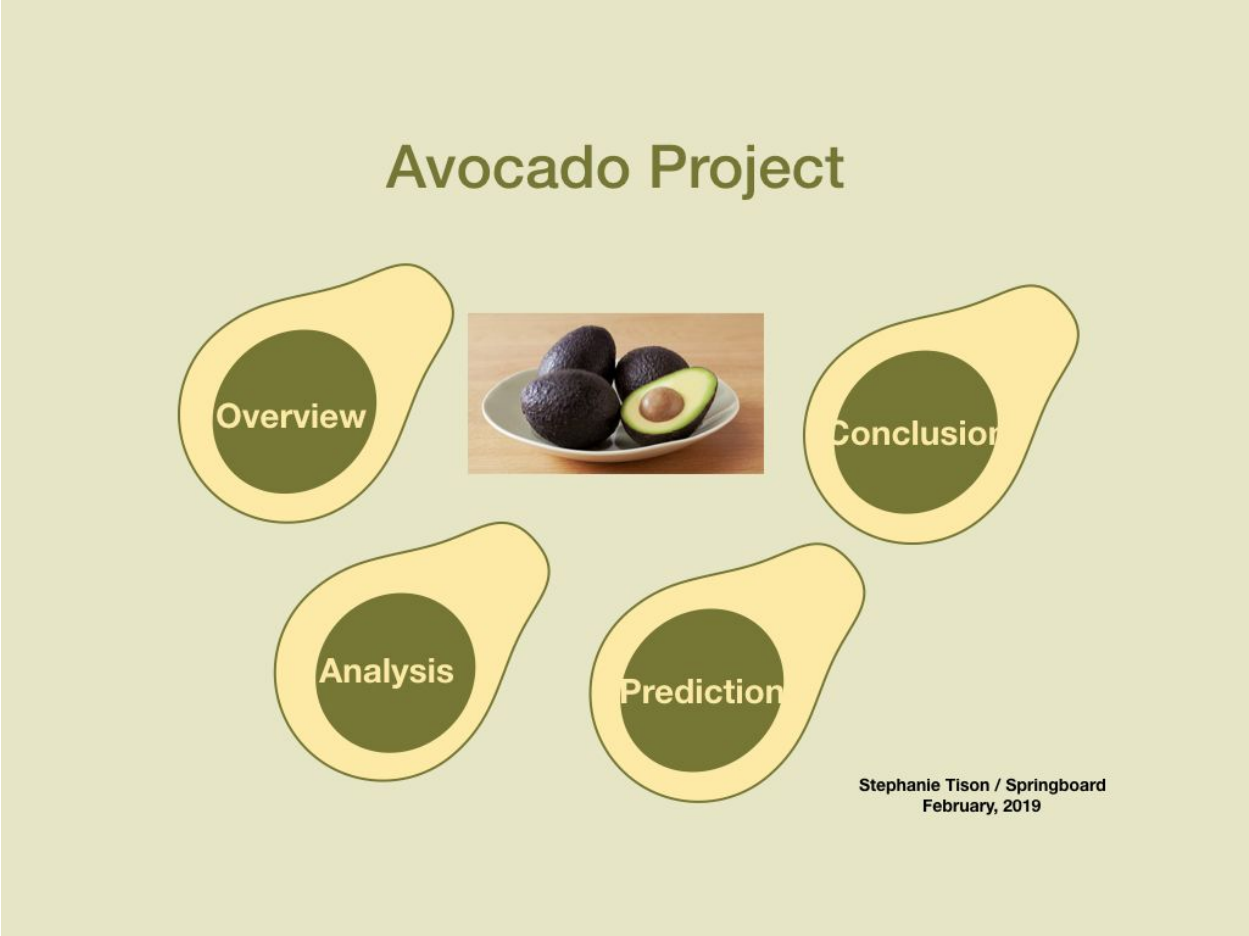
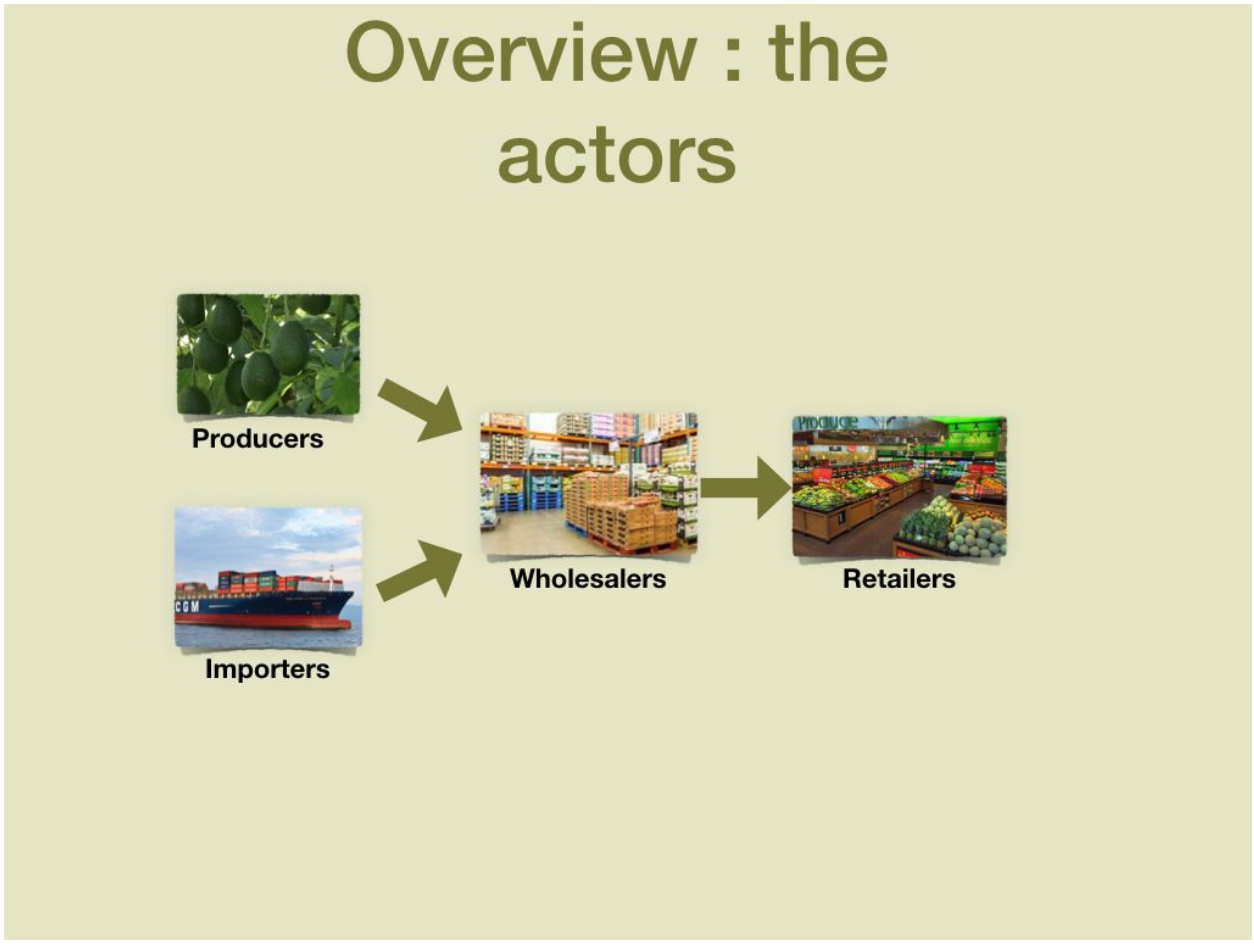
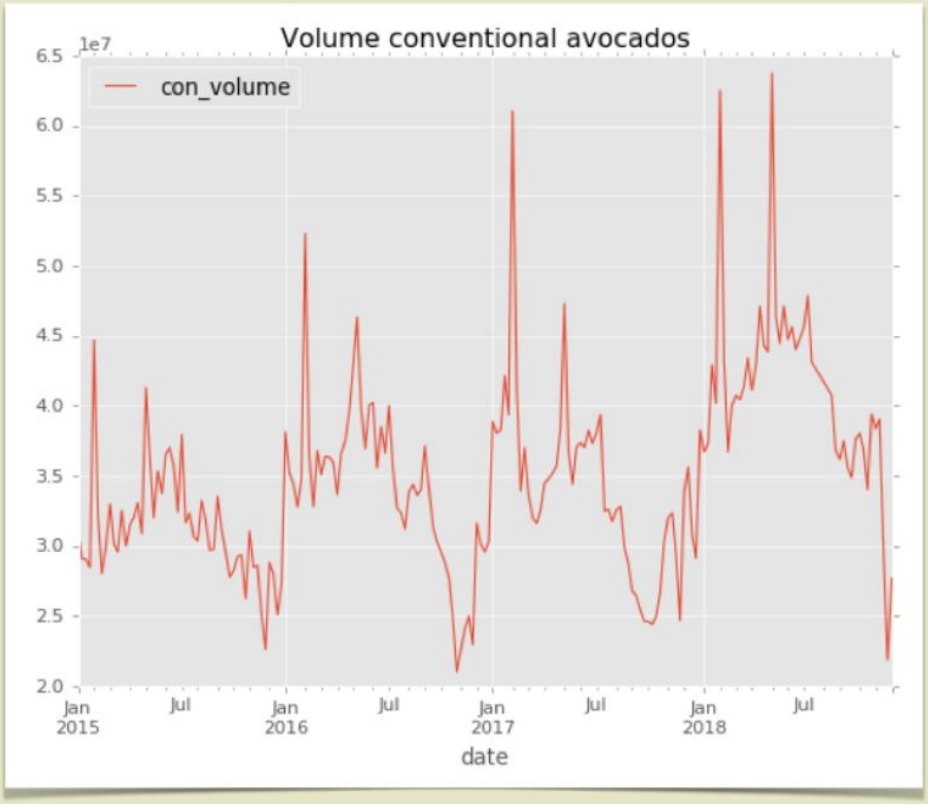


Avocados are fruits we can buy on the markets or in stores all year round.
The objective of this project is to analyze the sales of avocados in the US over the last years and try to predict the volume of avocados sold each week.



I will use data collected from the retailer's cash registers every week.
All actors of the avocado industry are interested in the analysis and prediction of the sales.
So producers can prepare for the next harvest,
Importers can anticipate the next shipments from Mexico, Central or South America,
Wholesalers can stock the right volume and avoid waste of this perishable good,
retailers can adjust their orders and sale price.

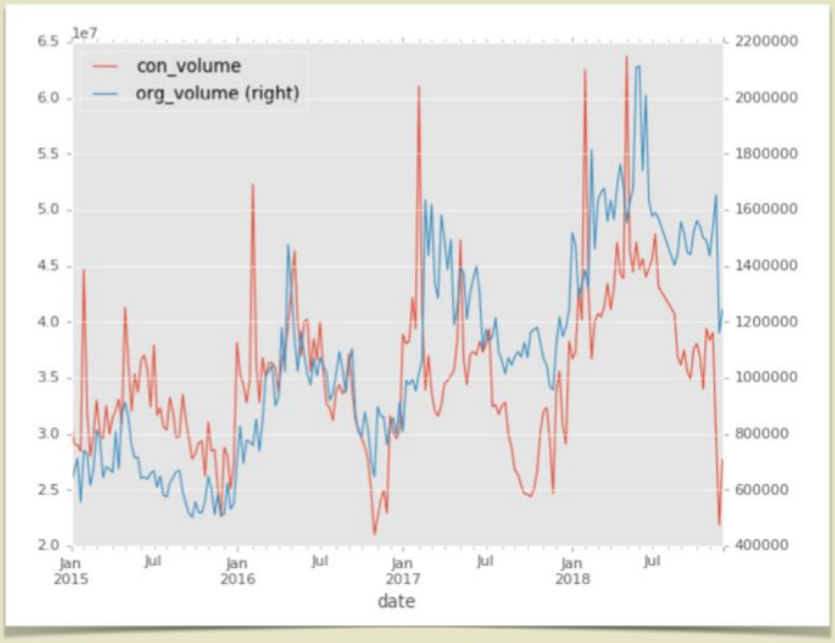
Analysis : volume



Here is the evolution of conventional avocados sales.
The volume of avocados rises year after year.
Although avocados are sold all year round, there is seasonality, with fewer avocados being sold in winter months.
We can also notice 2 peaks at the beginning of February and at the beginning of May. My assumption is that these peaks are due to the Super Bowl and Cinco de Mayo, which both are festive occasions to eat avocados.

Analysis : conventional vs. organic

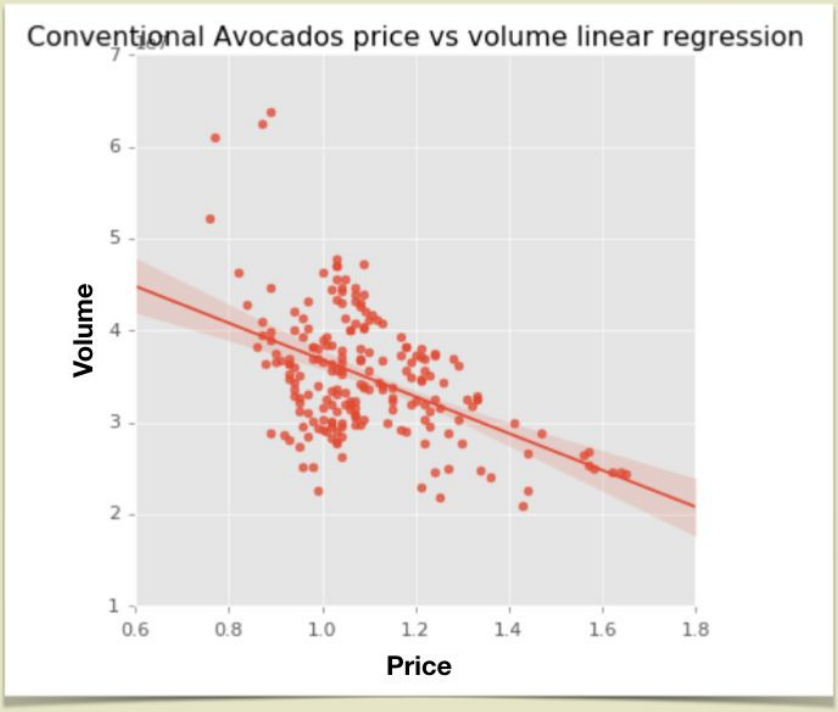
Average conventional sales: 36 million/w



Average organic sales: 1.1 million/w

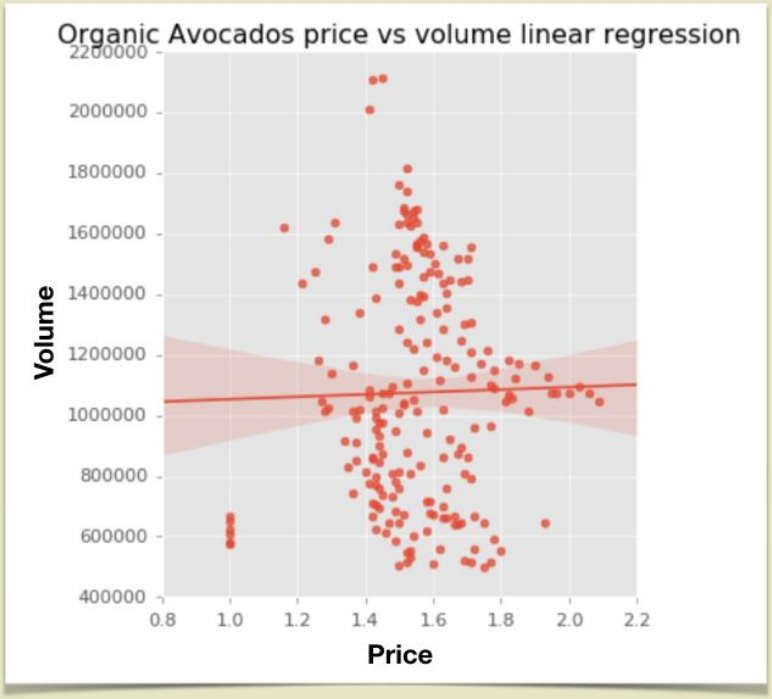
Conventional avocados represent the vast majority of avocados sold (36 million per week in average for conventional and 1.1 million per week in average for organic).
Conventional and organic avocados follow the same increasing trend over the years.
They follow the same seasonality with fewer avocados in winter, but organic avocados sales are less sensitive to events like Super Bowl and Cinco de Mayo.

Analysis : conventional avocados price

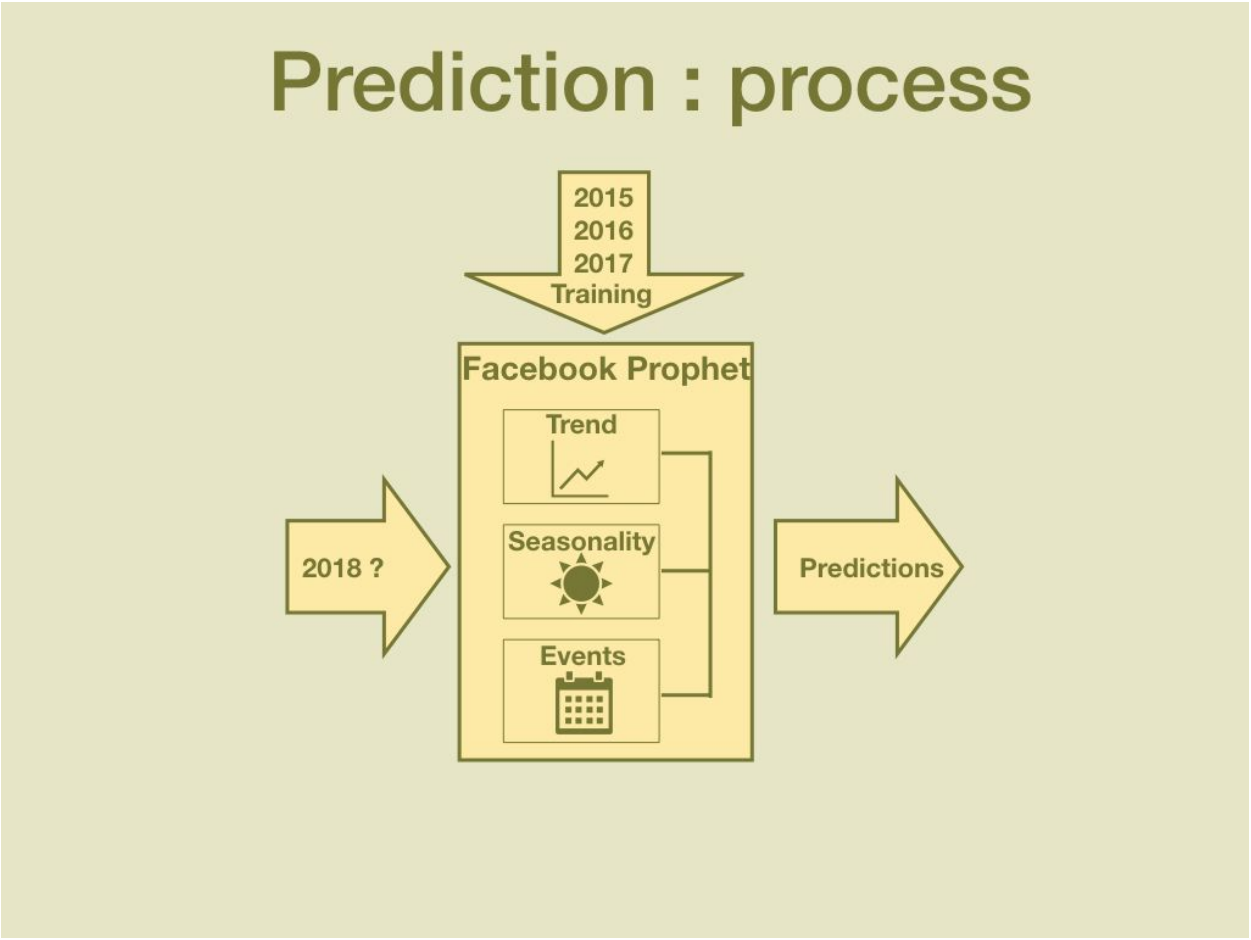


Avocados customers are very sensitive to price. When the price increases, they buy fewer avocados. This could explain the seasonality because prices are higher in winter and sales are less.

Analysis : organic avocados price

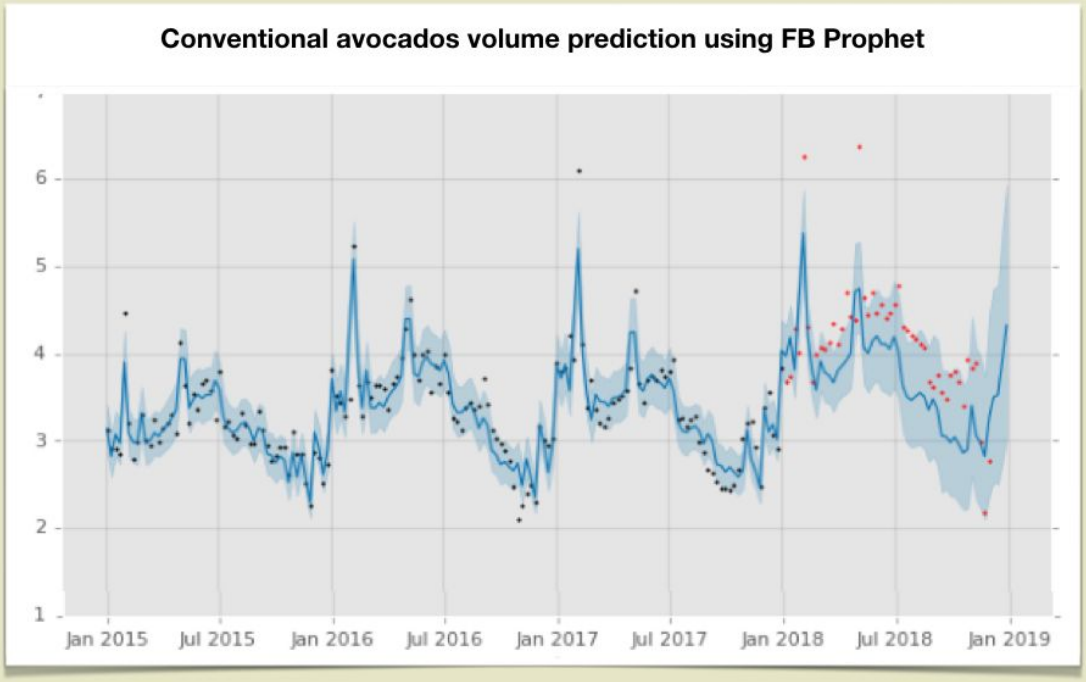


Organic avocados customers are less sensitive to price, but a deeper statistical analysis shows there is a correlation between price change and volume change also for organic avocados.



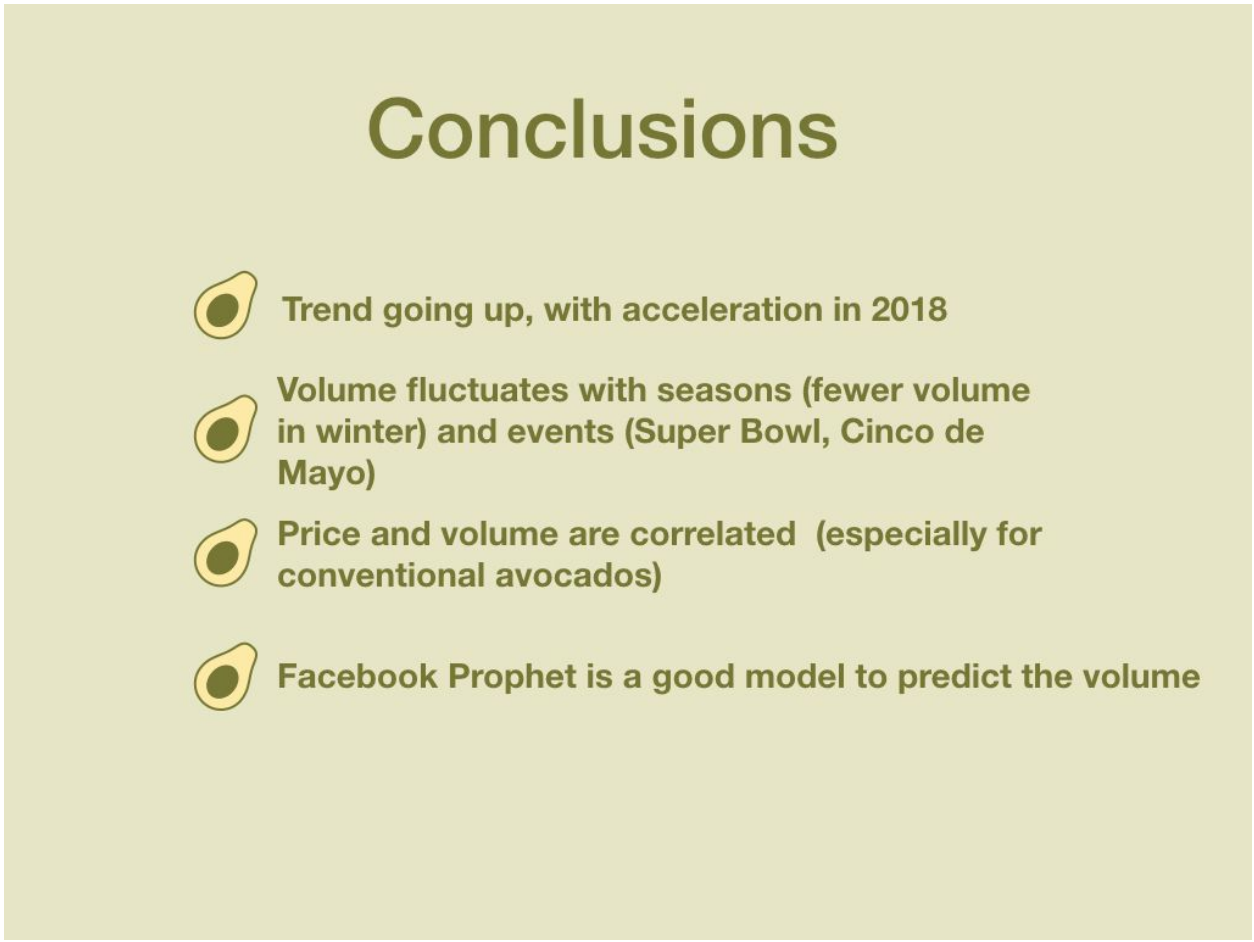
I chose to use Facebook Prophet to predict the volume of conventional avocados sold.
I chose this model because it predicts 3 components: trend, seasonality, and events, and add them to make the prediction.
I trained the model with volume data from 2015, 2016 and 2017.
Then, I queried it to predict the volume of conventional avocados for 2018 weeks.

Prediction : results



≤10% error within 22 weeks horizon
<20% error within 52 weeks horizon

Here is a plot of the results.
The blue line represents the prediction, with the 80% confidence interval in lighter blue.
The black dots are the 2015 to 2017 data points used to train the model.
The red dots are the real 2018 data points that the model tries to predict.
We can see that 2018 volumes are higher than forecast, but they follow the seasonality and events.
The prediction error remains under or around 10% for a horizon up to 22 weeks, and under 20% for a horizon up to 52 weeks.
This model can be further tuned to improve these results.



To conclude this project:
- The trend for avocado sales is going up, with an acceleration in 2018. Avocados are more widely appreciated because they are tasty, healthy, and are a good vegan alternative in many recipes. Congratulations to all avocado professionals for promoting them!
- The volume of avocados fluctuates with the seasons, with fewer avocados sold in winter. There are also sales peaks for festive events like Super Bowl in February and Cinco de Mayo in May.
- Price and volume are correlated, particularly for conventional avocados. This could explain the fewer sales in winter when the prices are higher.
- Facebook Prophet is a good model to predict the volume of avocados sold because it includes trend, seasonality, and events in its predictions.