

Business Analytics Report

Coursework for

ST2187 Business Analytics, applied modeling and prediction

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1. Executive Summary

“You’re only as strong as your weakest link”, a fairly popular phrase that is tossed around but applicable to us in a sense that by improving that “weakest link”, we can also in turn improve the organisation.

The contents of the report will be discussing with reference to the tableau story consisting of 5 dashboards where we will be analysing data dating from 2017 to 2020. Keeping in mind the key objective of profit maximisation across the various markets, the report will be structured into 4 main parts, operational analysis, market analysis, customer behaviour analysis and profit forecasting.

Operational analysis is a focus on business operations where with the data given to us, we will be analysing two pairings which are “categories and segments” and “order priority and ship mode”. For the former pairing, we have found that Consumers make up most of the purchases with the Furniture category doing poorly when compared to the other two categories. The furniture category doing poorly can be attributed partly to it being the only category with a sub-category, tables incurring losses and when put onto a trend line over the years, we can also see that profitability for Tables decreases every year hence I have inputted a few suggestions in the report in how we can improve it. For the latter pairing, it’s more of how we can further maximise profits if we were to incentivise certain shipping modes for certain order priorities.

Market analysis in this case is a regional study on the different markets being placed into clusters depending on the region’s total profit and sales with a proposal on why we should be investing our resources into Canada. Essentially, if we were to look at the regions based off profit margins, Canada ranks the best amongst all of them. Canada also acts a good starting point and case study for how we can improve the profitability for Tables.

Customer behaviour analysis is where we will be looking for correlation amongst the sub-categories trying to find what customers like to buy in bundles. Since we also have data for discounts, we can check how discounts could affect the profits for these bundles while also serving as a possible answer to further increase the profitability of those sub-categories.

For profit forecasting, we will be assuming *ceteris paribus* for if nothing were to be changed about how we market or sell our products. In general, our long-run profit and sales are likely to gradually increase over the years however for the categorical forecast in terms of profit, the Office Supplies category is likely to face the issue of stagnation hence it is recommended that we perform additional research on improving Office Supplies’ profitability too.

2. Introduction

The report utilises data dating from 2017 to 2020. The task at hand is the extraction of commercially important insights. Therefore, we will look at the overall market performance, then go in-depth by looking at how certain factors affect overall profit and how profits in the long run will turn out if nothing is changed about these factors by performing forecasting.

3. Global Market Performance

A rough idea of how well the market is performing globally can be seen if we were to depict the data through symbol maps.

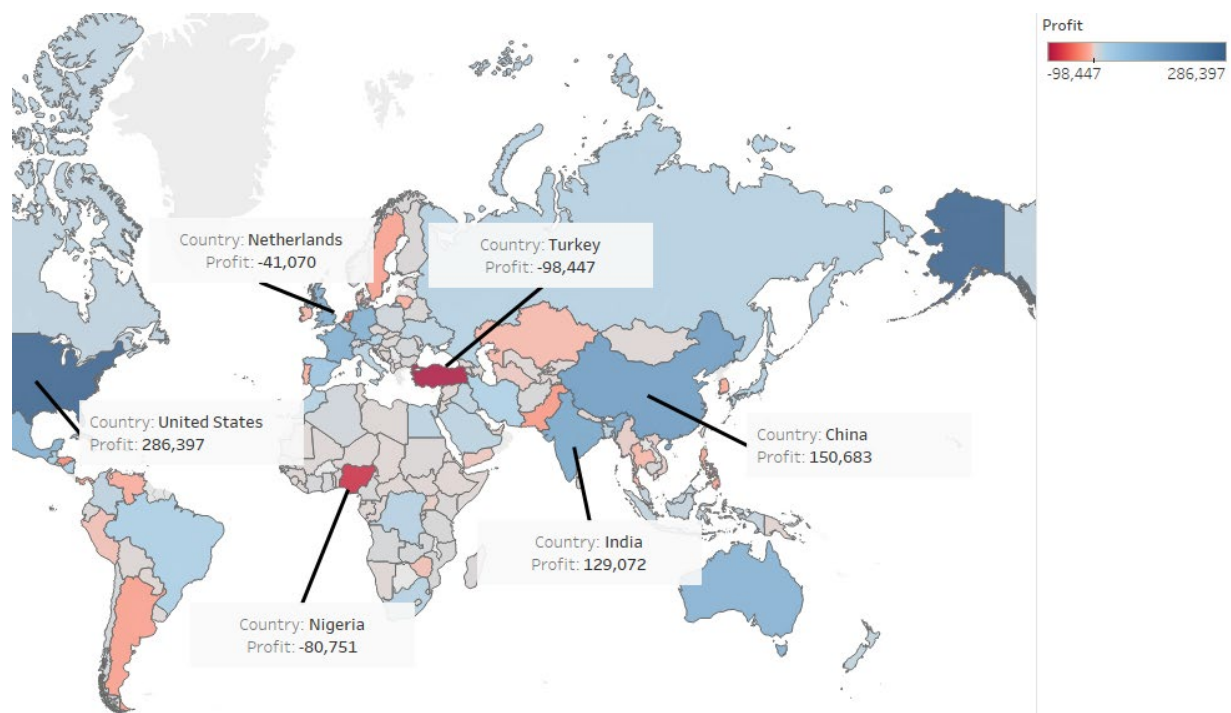


Figure 1. Map of countries, Colour sorted based on profit

As seen from figure 1, the market performance globally leans into more countries being profitable as compared to not profitable. I have highlighted the top and bottom 3 countries in terms of profit with the United States being the most profitable garnering a profit of 286,397 whereas Turkey, least profitable at -98,447.

4. Operational Analysis

For operational analysis, we will go through two pairings in how categories and segments, order priority and ship mode affect profits.

4.1 Categories

We will be taking a look at a pie chart representation for each category.

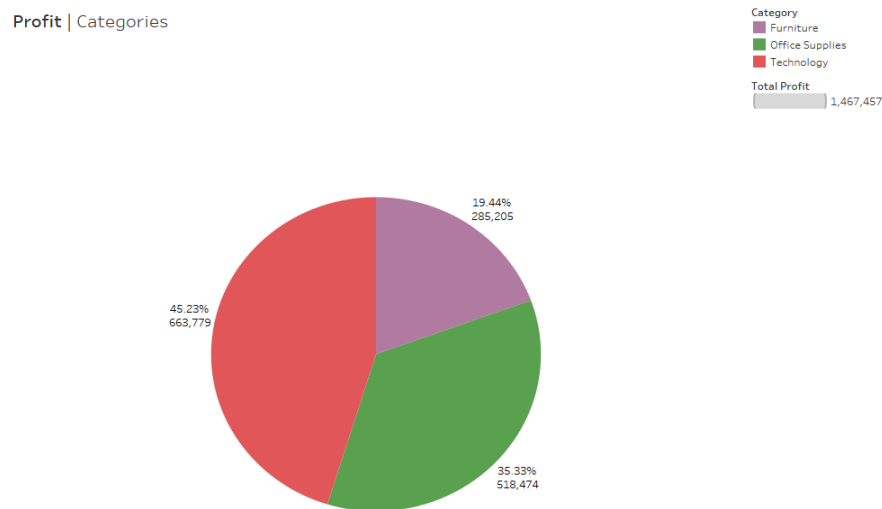


Figure 2. Profit Categories pie chart

Technology garners the highest profits at 45.23% (663,779) of total profit (1,467,457) followed by Office Supplies at 35.33% (518,474) then Furniture at 19.44% (285,205). There is a large disparity in profit when comparing Technology and Furniture hence we will be further analysing the sub-categories in segments, Consumer, Corporate and Home office. By analysing in segments, we can employ more marketing schemes to target the segment that is doing well.

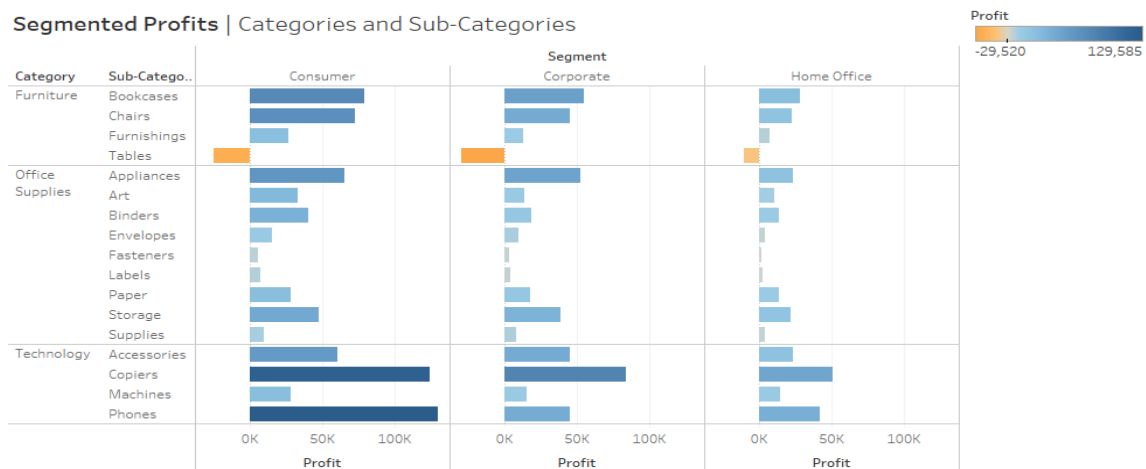


Figure 3. Categorical profit overview

The most popular subcategories are from the Technology category where Copiers and Phones profit the most. For the different segments, we can see that consumers bring the highest amounts of profit hence target marketing towards consumers would be beneficial.

The only sub-category not profiting is Tables which could be a reason as to why Furniture is not doing as well as the other two categories.

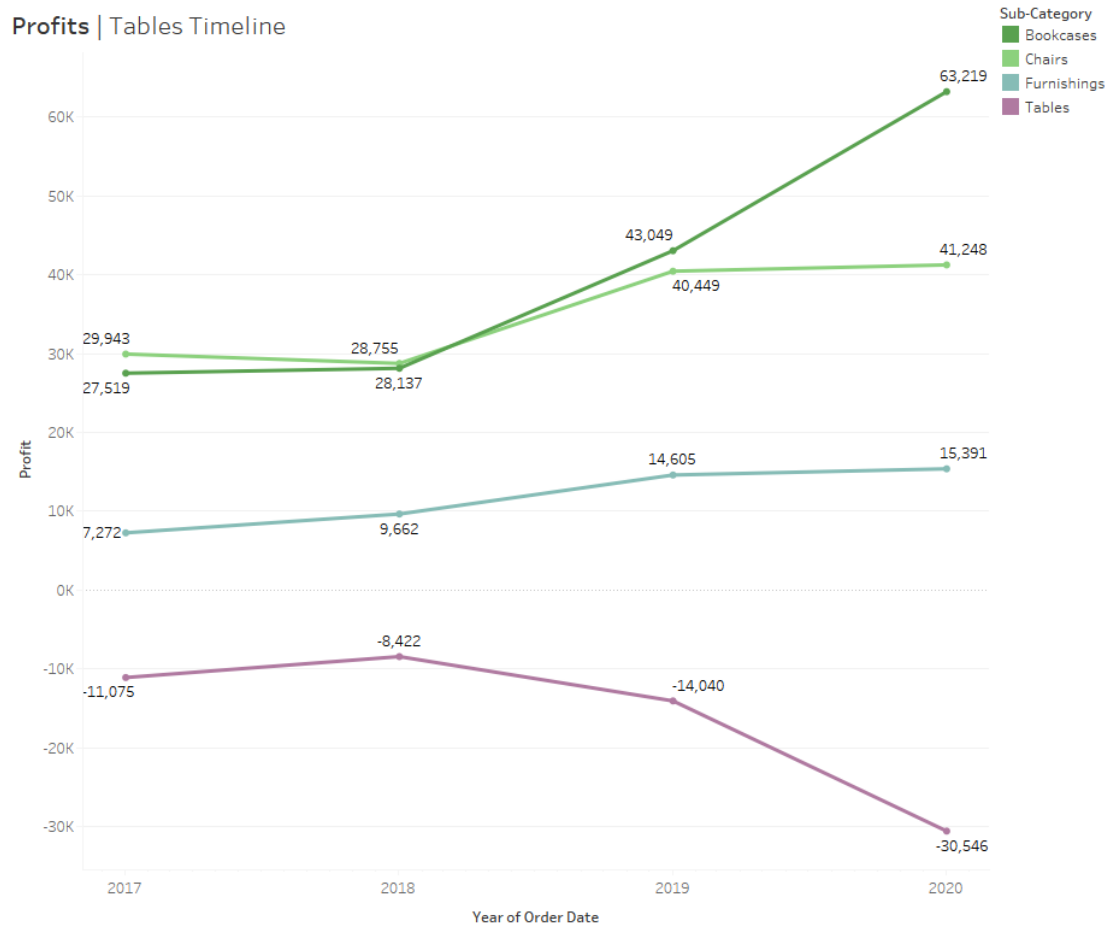


Figure 4. Profit timeline for the Furniture category

Overtime in profitability, tables is the only one that is trending downwards especially seeing its biggest drop most recently from 2019 to 2020. A speculative reason as to why Tables may not be profiting as well as the others could be that for most tables, the total cost of manufacturing, hidden costs and shipping outweigh the price of a table meaning on average, we incur a loss per table sold.

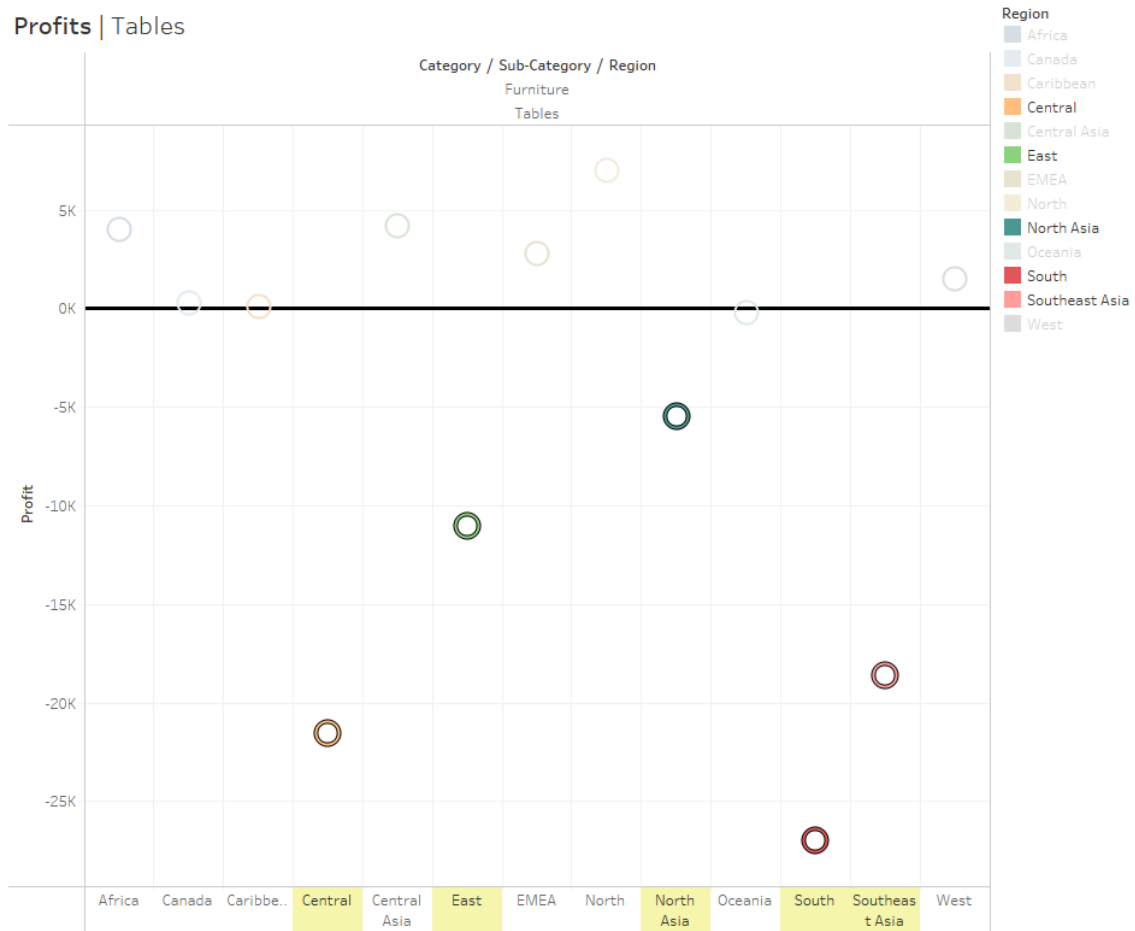


Figure 5. Poor performing regions for Tables

Figure 5 highlights the major regions that are incurring a loss with the South region being the biggest perpetrator. A suggestion to minimise the profit loss could be slowly reducing the number of table orders when delivering to those regions rather than isolate those regions from the sale of tables as there could be correlated items for the possibility of package deals.

4.2 Order Priority

Assuming order priority for each product sold is listed for the customer to see, we will examine how profit is affected depending on the ship mode chosen by the customer for each order priority.

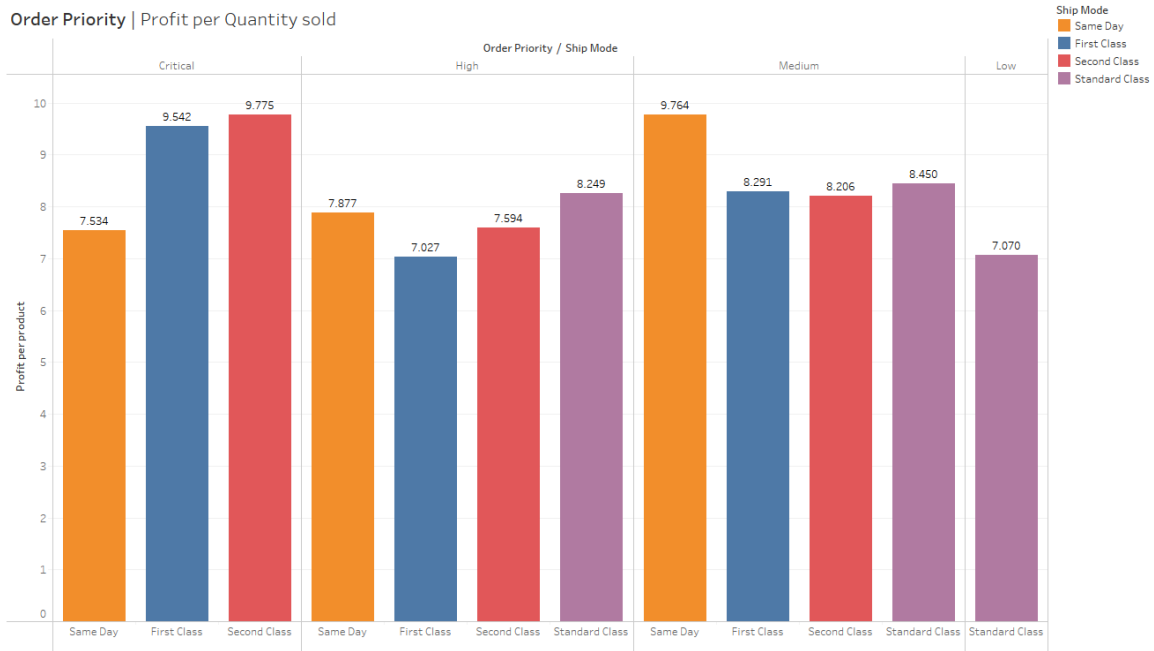


Figure 6. Shipping mode profitability for each Order priority

With figure 6, we can compare profit per product sold for each order priority sections for the different shipping modes. For the critical order priority section, it would be more beneficial for us to incentivise customers to place their shipping mode as Second Class or First class over same day deliveries in order to increase profits as is High priority with Standard Class and Medium priority with Same Day deliveries.



Figure 7. Time taken to deliver

A way to incentivise Second Class shipping mode for Critical Order priority products would be to decrease the average time taken to deliver bringing it much closer to first class however this might be difficult as the average time taken between both classes are already close to each other. However, for High Order priority where we want to incentivise Standard Class shipping mode, it would be easier to implement time saving methods.

For medium order priority, products garner the most profit if customers were to place it through same day delivery where we can incentivise it by offering discounts on delivery to the point where it still maintains a high profit margin.

5. Market Analysis

For Market Analysis, we will be looking at noteworthy regions or country to invest resources into.

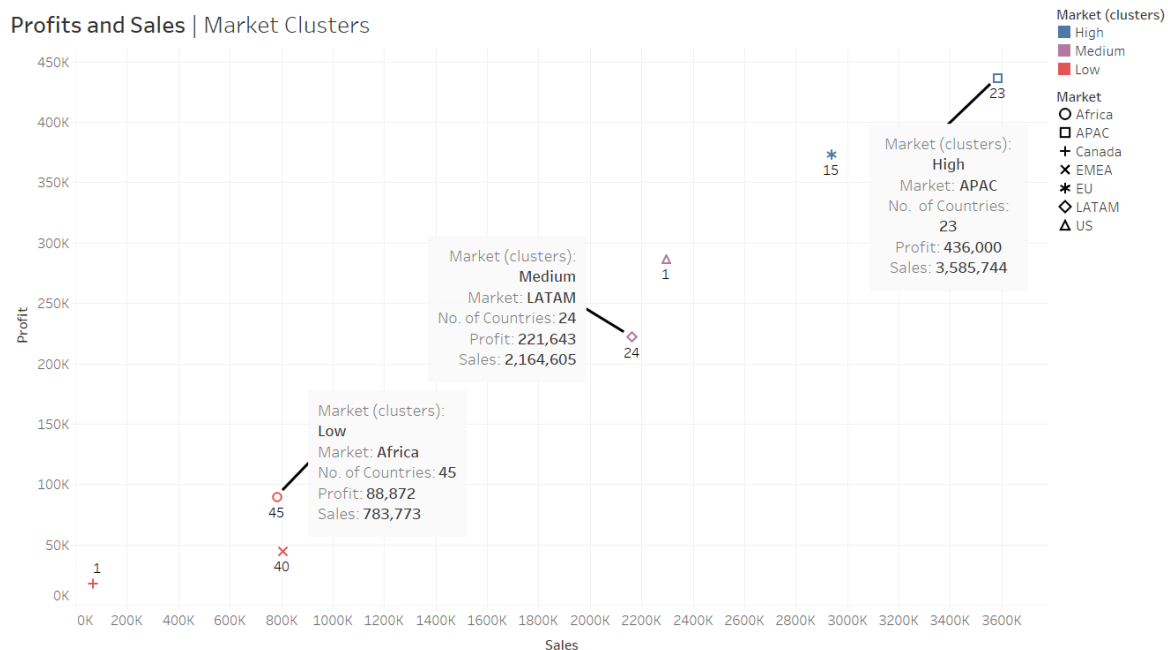


Figure 8. Market clusters

From figure 8, we can highlight three separate clusters in terms of sales and profit, High, Medium and Low. Although the APAC region is the highest in sales and profit when compared to other regions, it is also a region made of 23 distinct countries likewise the case for Canada being the lowest in both is that it has only 1 country. Overall, this gives a good insight on how each market is doing, notably regions with large numbers of countries yet low sales and profit hence I will segue into why we should invest resources into Canada.

5.1 Regional Performance

Profit Margin

Market (..	Market	Region	Profit Margin
High	APAC	Central Asia	17.60%
		North Asia	19.52%
		Oceania	10.91%
		Southeast Asia	2.02%
	EU	Central	12.53%
North		14.68%	
South		11.07%	
Medium	LATAM	Caribbean	10.66%
		Central	9.35%
		North	16.51%
		South	4.55%
	US	Central	7.92%
		East	13.48%
		South	11.93%
Low	Africa	Central	14.94%
		East	11.33%
		West	26.62%
	EMEA	EMEA	5.44%

2.02%

26.62%

Figure 9. Profit Margin

We can use profit margins to gauge the degree to which each region profits as profit margin represents the percentage of sales that turn into profit. In this case although Canada ranked the lowest, it has the highest profit margin amongst the other regions hence it is worth investing resources into Canada since the returns are high.

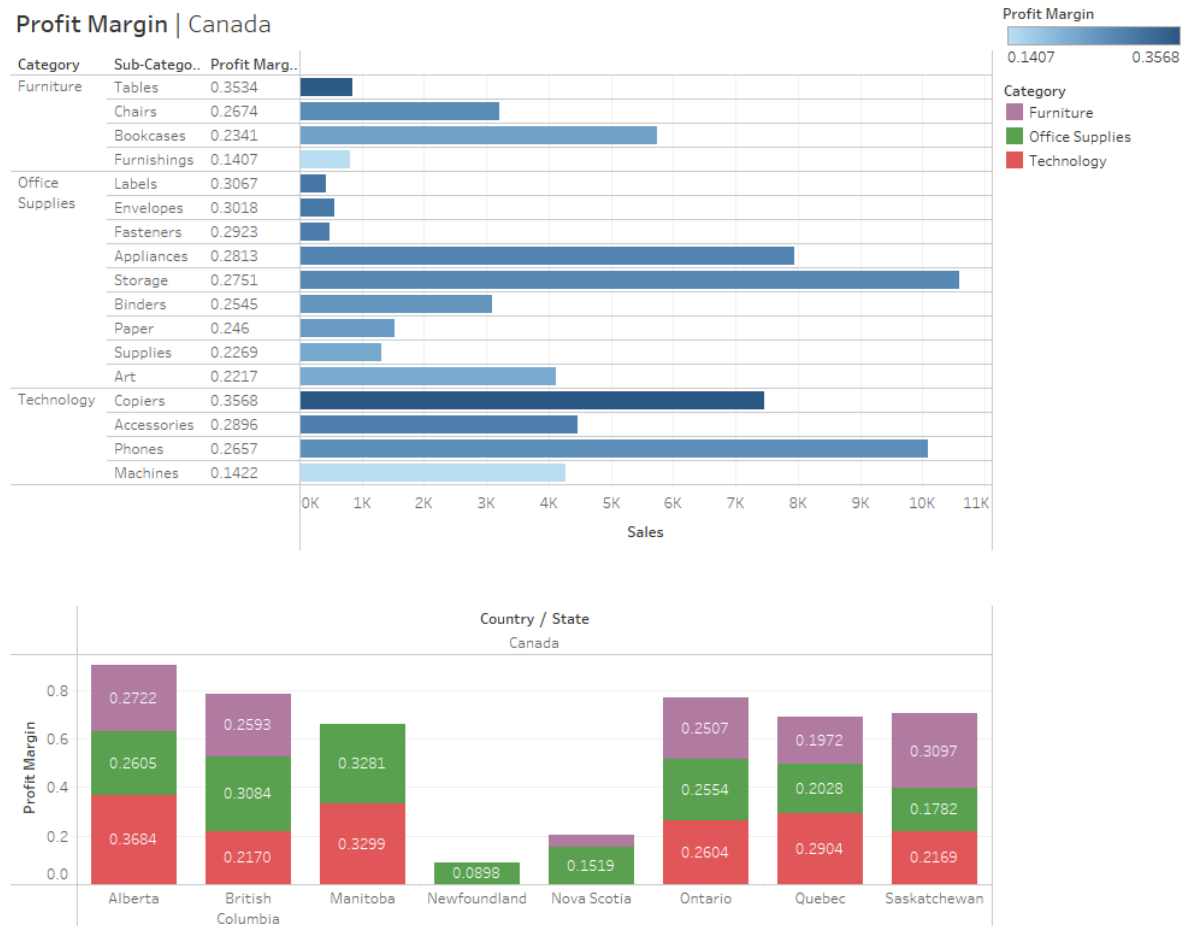


Figure 10. In-depth Profit margins for Canada

In Canada's case, none of the sub-categories have a negative profit margin with Tables, Labels and Copier having the highest profit margin for each category. As noted in our operational analysis, the sales of Tables globally resulted in losses hence this is a good opportunity to redirect those sales to Canada. Given more data, we might be able to replicate these results globally for tables. Besides sub-categories, knowing which state benefits more from what category of products is also helpful for understanding what to market and for which state. Like how Nova Scotia benefits more from Office supplies than Furniture.

6. Customer behaviour Analysis

For customer behaviour analysis, we will use Market Basket analysis, a process that looks for relationships among objects that frequently appear together which is applicable as we are interested in what Customers like to buy in bundles. As for how we can increase profits with these bundles, we will analyse how discounts can play in the Market Basket analysis.

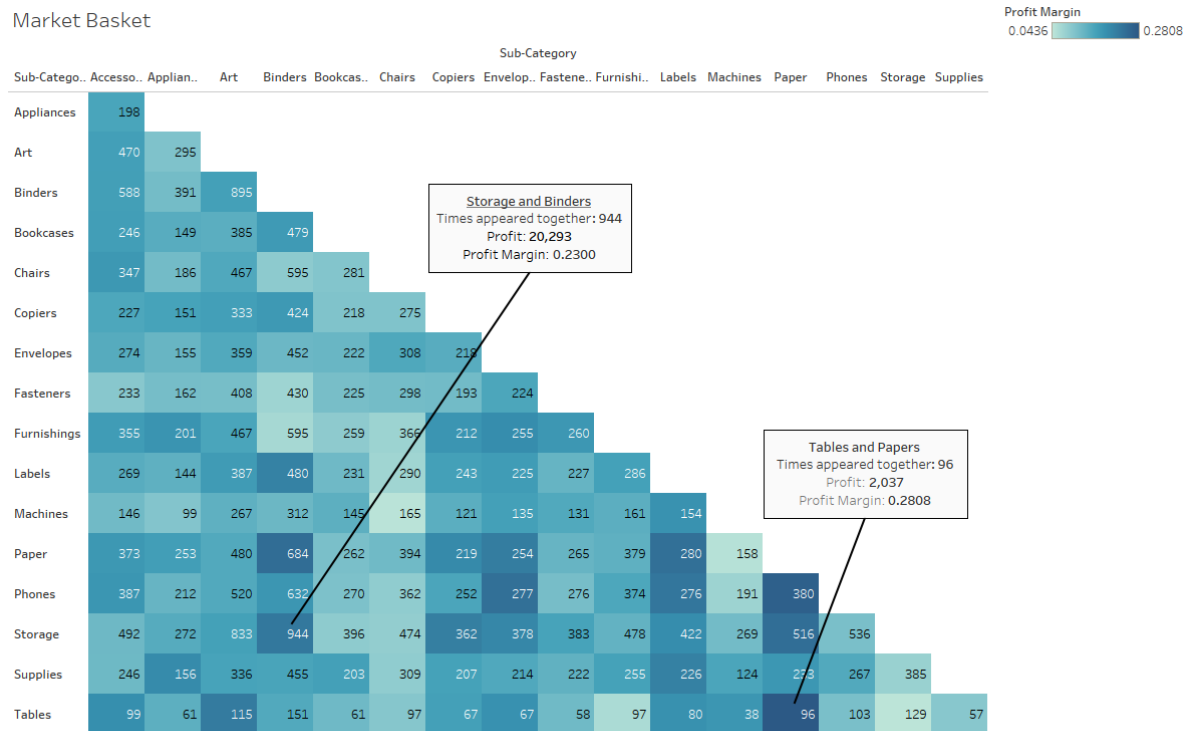


Figure 11. Market Basket in terms of Profit margin and distinct order count

For figure 11, the number in each intersection represents the distinct number of times the combination has occurred and the colour coding from blue to teal represents how high the profit margin is for each combination.



Figure 12. Market Basket in terms of Discounts and distinct order count

Figure 12 can be interpreted in the same way as figure 11, the key difference being the colour coding is dependent on how high the discounts are. We have highlighted two cases in particular,

1. Storage and Binders

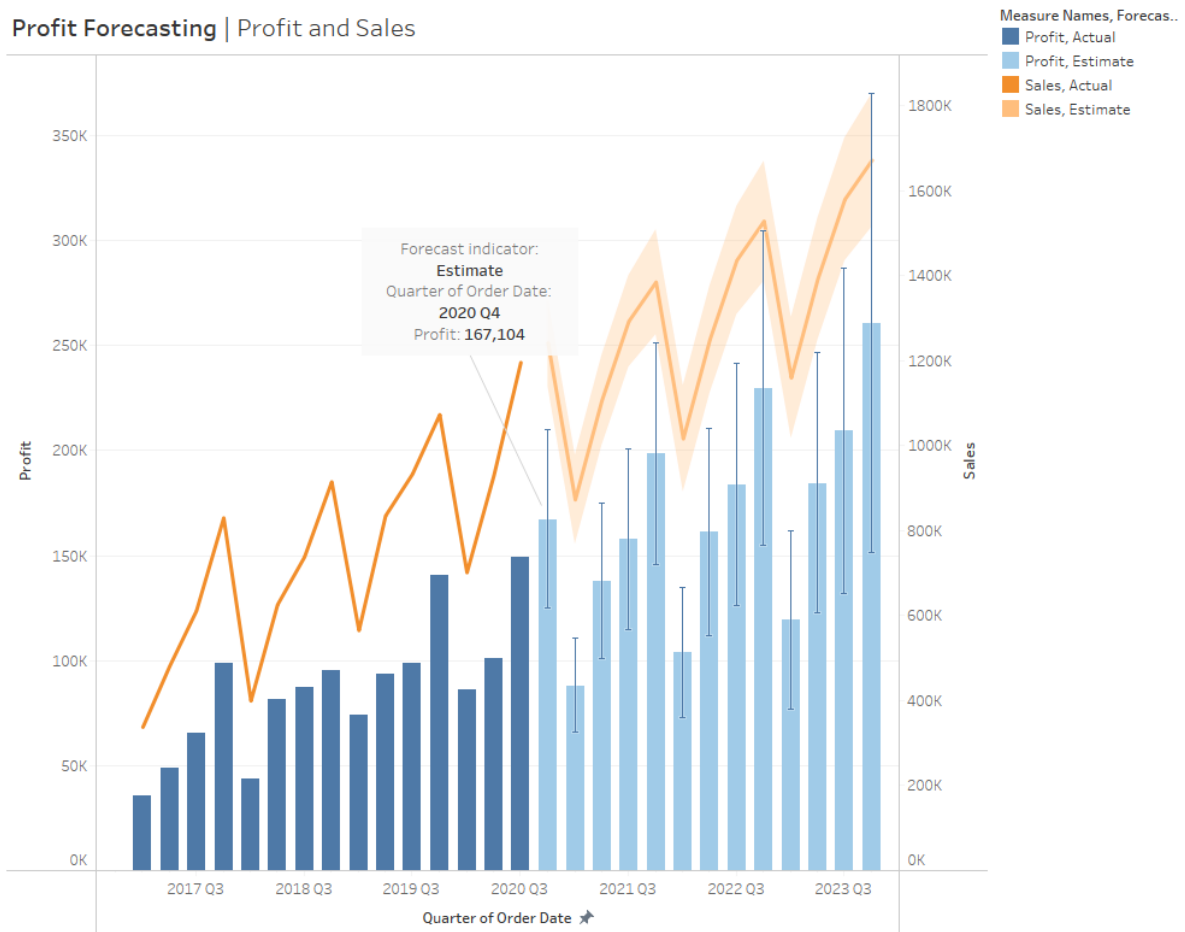
The most common bundle, appearing 944 times while having a high profit margin at 0.2300. This could be attributed to it also having the highest amount of discounts when compared to the rest of the combinations hence we can increase the profit margin if we reduce the amount of discounts given to a point where the price elastic of demand for the bundle does not heavily weigh in on the profits loss.

2. Tables and Papers

Another way in which we could market Tables to increase its profitability is through discounts if we pair it with Papers, as seen on Figure 11, the combination already has a high profit margin even with the low number of discounts given to it. Therefore, it would be beneficial to introduce more discounts to this set to further increase profits.

7. Profit Forecasting

Profit Forecasting | Profit and Sales



Sum of Profit

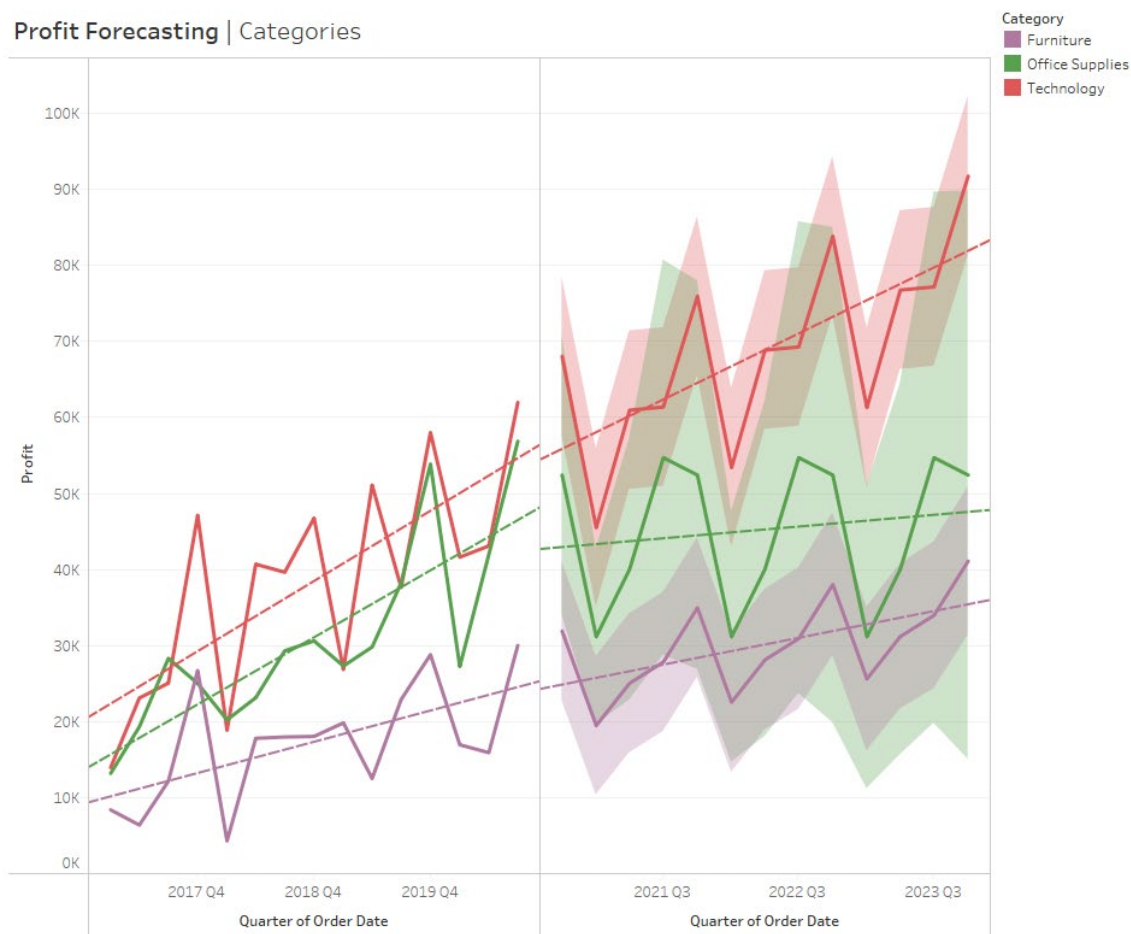
Initial 2020 Q4	Change From Initial 2020 Q4 – 2023 Q4	Seasonal Effect		Contribution		Quality
		High	Low	Trend	Season	
167,104 ± 25.4%	55.8%	2023 Q4 0.0%	2023 Q1 0.0%	100.0%	0.0%	Good

Sum of Sales

Initial 2020 Q4	Change From Initial 2020 Q4 – 2023 Q4	Seasonal Effect		Contribution		Quality
		High	Low	Trend	Season	
1,241,294 ± 8.3%	34.7%	2023 Q4 12.1%	2023 Q1 -16.2%	42.2%	57.8%	Good

Figure 13. Forecasting for sales and profits

Assuming ceteris paribus, long-run profit and sales are likely to increase over the years with seasonal dips. Quarter 1 generally experiences the lowest amount of sales and profit gradually increasing as the year approaches quarter 4 where the sales and profit will peak before dropping in the following year's quarter 1.



Sum of Profit

Color Category	Initial 2020 Q4	Change From Initial 2020 Q4 – 2023 Q4	Seasonal Effect		Contribution Trend	Season	Quality
			High	Low			
Technology	68,036 ± 15.3%	34.8%	2023 Q4 16.6%	2023 Q1 -15.8%	40.6%	59.4%	Good
Office Supplies	52,427 ± 35.1%	0.0%	2023 Q3 0.0%	2023 Q1 0.0%	0.0%	100.0%	Ok
Furniture	31,891 ± 28.6%	28.9%	2023 Q4 22.2%	2023 Q1 -18.3%	25.5%	74.5%	Ok

Figure 14. Forecasting in terms of categories

Forecasting for categories displays a new problem, the stagnation of office supplies in terms of profit albeit the prediction is not accurate with wide error margins, it does highlight that something must be done to improve its profitability. Overall, the other categories have positive increases in profits and as discussed earlier, the Furniture category can be further improved.

8. Conclusion

The overall outlook for profit and sales are positive for the years to come assuming ceteris paribus, it is to be expected that the first quarter of each year is to plateau with the fourth quarter at its peak for profit and sales.

Data shows Furniture as the only category in which a sub-category, Tables is incurring losses. It is advised the production and sales of tables be cutback for regions stated earlier in the report with emphasis put into marketing Tables in Canada instead. Package deals with Paper topped with additional discounts would also work to increase profitability of Tables. Further references can be taken from the market basket analysis. These are more short-run measures, however.

In the long-run, we can investigate further relations between shipping mode and order priority. Figuring out ways in which we could incentivise the highest profit margin shipping mode for each order priority. We could also investigate why certain countries are incurring losses for us preferably by starting with Turkey, the least profitable country.

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