Team

Kappa

N BROWN

The aim of this project is to determine the price elasticity of products and estimate the quantity of items we can anticipate selling over the next month if we don’t apply any discounts.

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Key Takeaways

- **Prediction for Jan 2019** - For a given product sold on any day in Jan 2019, mean number of orders in department 0 (the largest department) is approximately 23.3.
- **Price elasticity** - Assuming a base price of £100
- Median - 1.66
- Std deviation - 6
- Range - 53
- correlation between price and volume of orders - -0.2

Introducing Team Kappa

Exploration & Analysis

Akash Marar

Department and seasonality insights

Donald (Tze Thoe)

Price elasticity findings

Introducing Team Kappa

Modelling

Anam Khan

Regression model

Pratamesh Takale

ARIMA, SMA model and Prophet model

Presentation

Introducing Team Kappa

Ben Grime

Presentation and voiceover

Zeerak Khan

Presentation collation and production

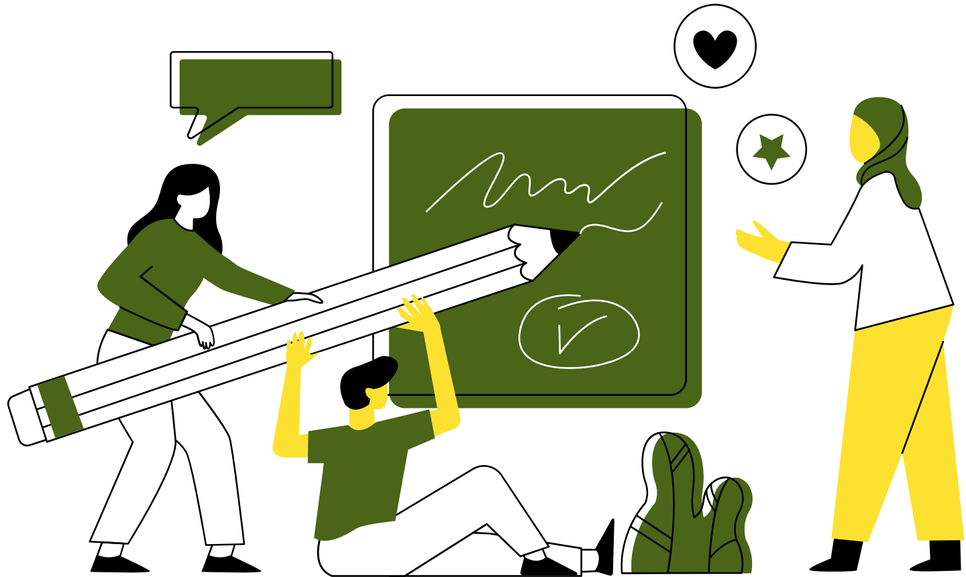
About N BROWN

They’re a top 10 UK clothing and footwear digital retailer who exist to make their customers look and feel amazing.

Their vision is that by championing inclusion, they’ll become the most loved and trusted fashion retailer.

Key research Questions

- How is price elasticity affected by discounts ?
- What is the estimate of the sales with no discounts next month?
- How seasonal trends affect the sales?
- Which department is most significant?



Exploratory analysis

Chronology and seasonality trends

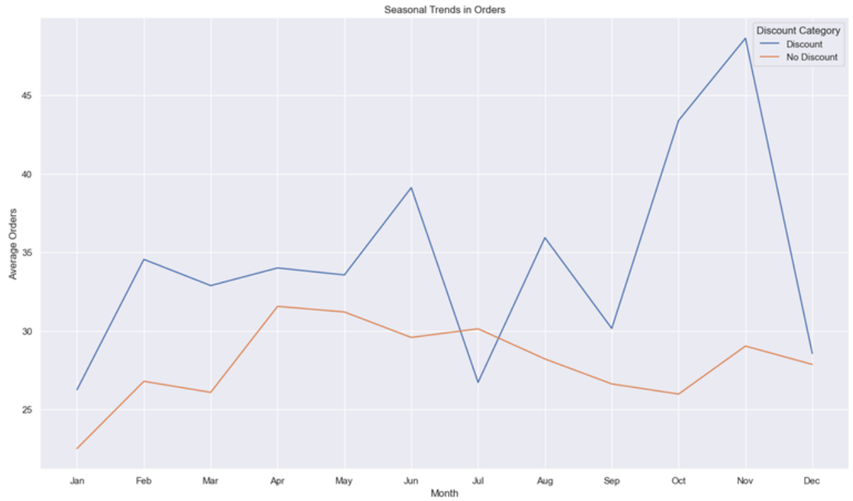


Figure 1.

Order volumes fluctuate significantly with dates, pointing to specific time periods of high and low demand.

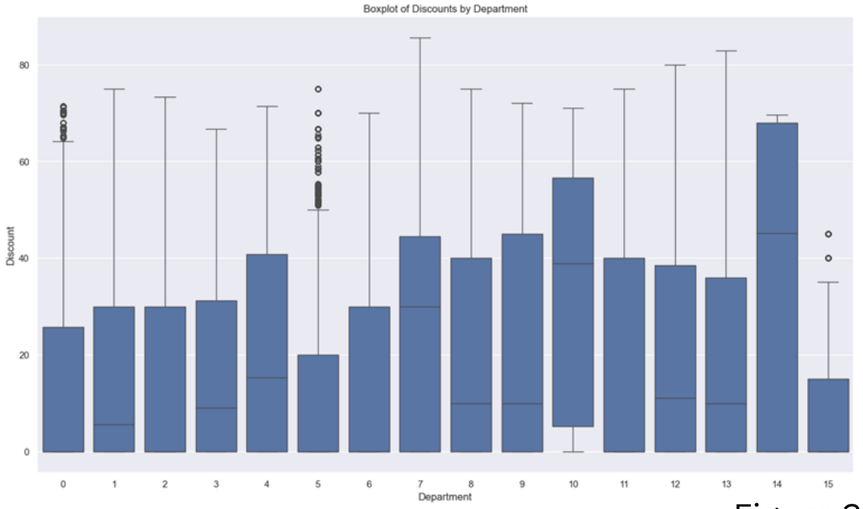


Figure 2.

Median discounts of each department. Department 0 and department 14 of high interest due to inverse relationship of popularity and discounts.

Modelling Preprocessing

- Data for 2019 was removed - *too few values for it to be useful for any meaningful analysis. (see figure 4).*
- Date - each unique day of the year for 2018 data.
- Orders - mean orders across products without discounts. (*see figure 3).*

Total orders across departments

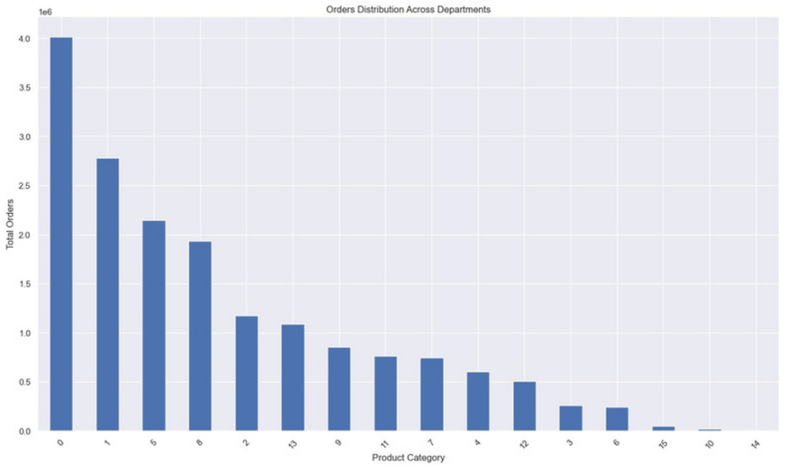
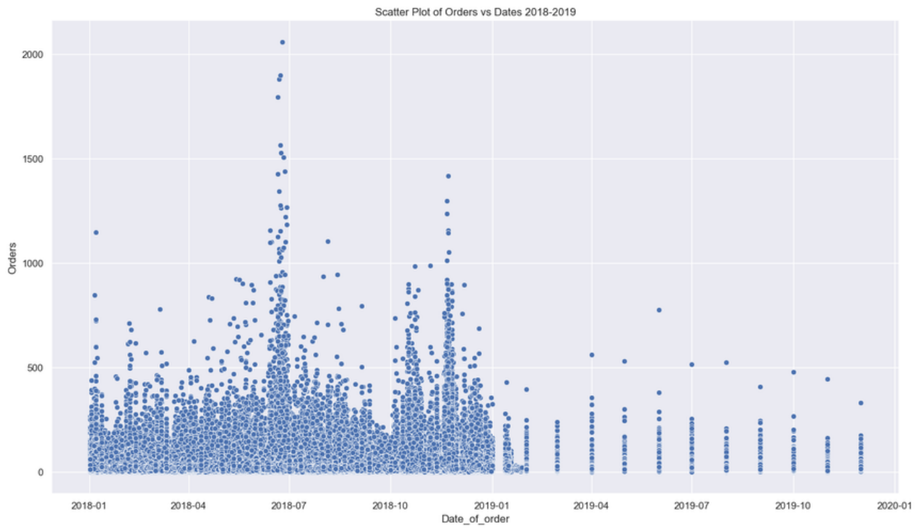


Figure 3.

Department “0” had the largest number of orders of all product categories.



Sparse data from 2019 was not used.

Figure 4.

Modelling Approach

- We focused on department 0, in which we took data as mean number of orders for each day in the year 2018 as this department had the largest volume of order data and would be most useful for modelling.
- **ARIMA (Autoregressive Integrated Moving Average)**

- **Seasonality:** ARIMA models can handle seasonal patterns in sales data, which is particularly relevant for this project.
- **Trend Detection:** It can identify the underlying trend in sales data, allowing for more accurate forecasting of future trends.
- **Flexibility:** can be customized to different types of time series data, including daily, weekly, monthly, or quarterly sales data.

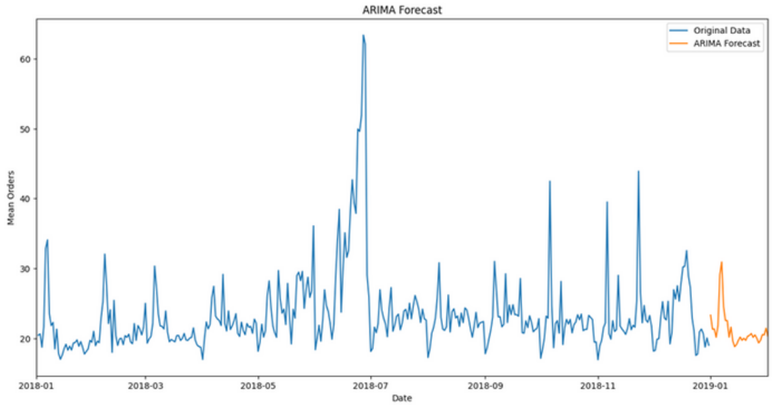
- **SMA (Simple Moving Average)**
- **Smoothness**: SMA produces a smooth trend line that represents the overall pattern of the time series data. A rolling average from the past 7 days was used.
- **Interpretability**: The calculated SMA values provide insights into the underlying trend and direction of the sales data.
- **complimentary to ARIMA**: SMA provided insights by reducing short-term fluctuations.

Modelling Approach

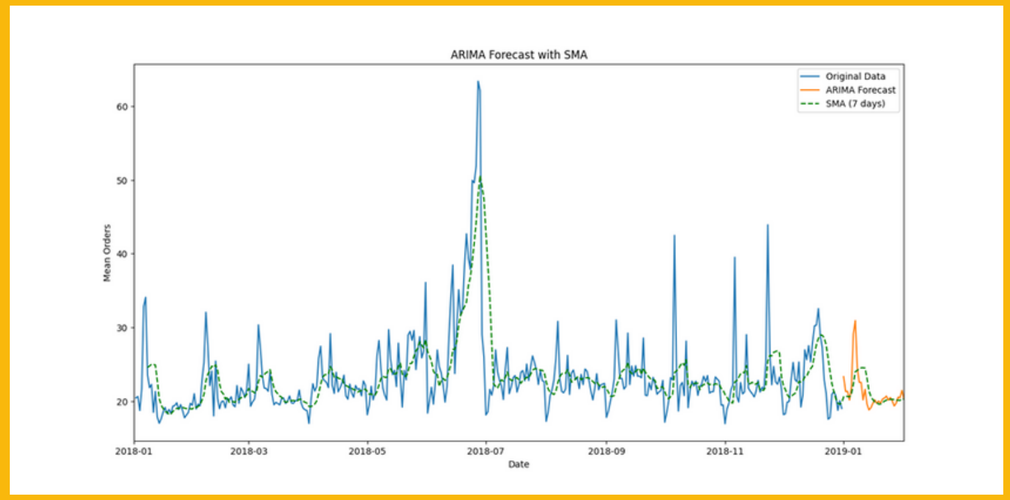
- **Prophet Model**
- **Additive Model**: Prophet utilizes an additive model to decompose time series data into trend, seasonality, and holidays.
- **Non-linear Trend**: Prophet can capture non-linear trends in the data, unlike ARIMA, which assumes linear trends.
- **Flexible Seasonality**: Prophet can handle multiple seasonal patterns, including daily, weekly, and yearly seasonality.
- **Holiday Effects**: Prophet can incorporate holiday events into the model to account for their influence on sales

Results

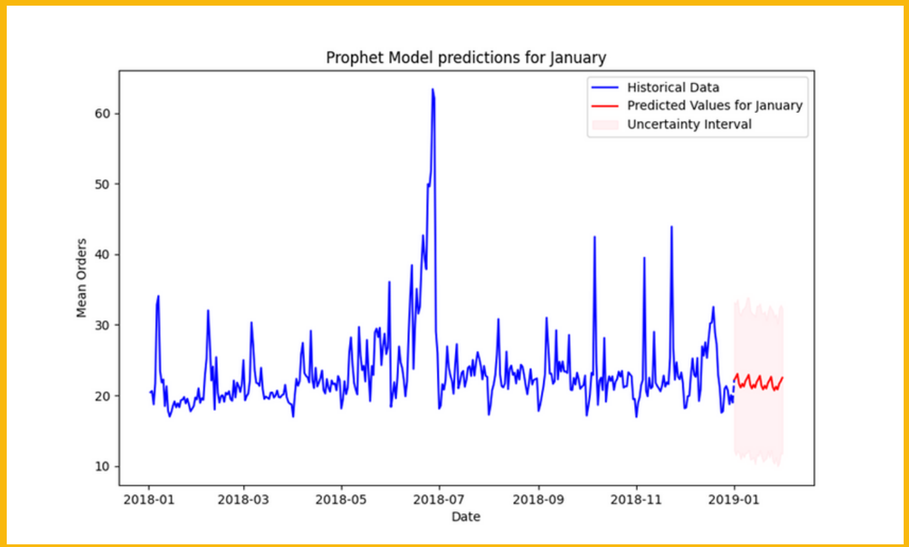
The results of using the 3 models:



ARIMA



ARIMA + SMA

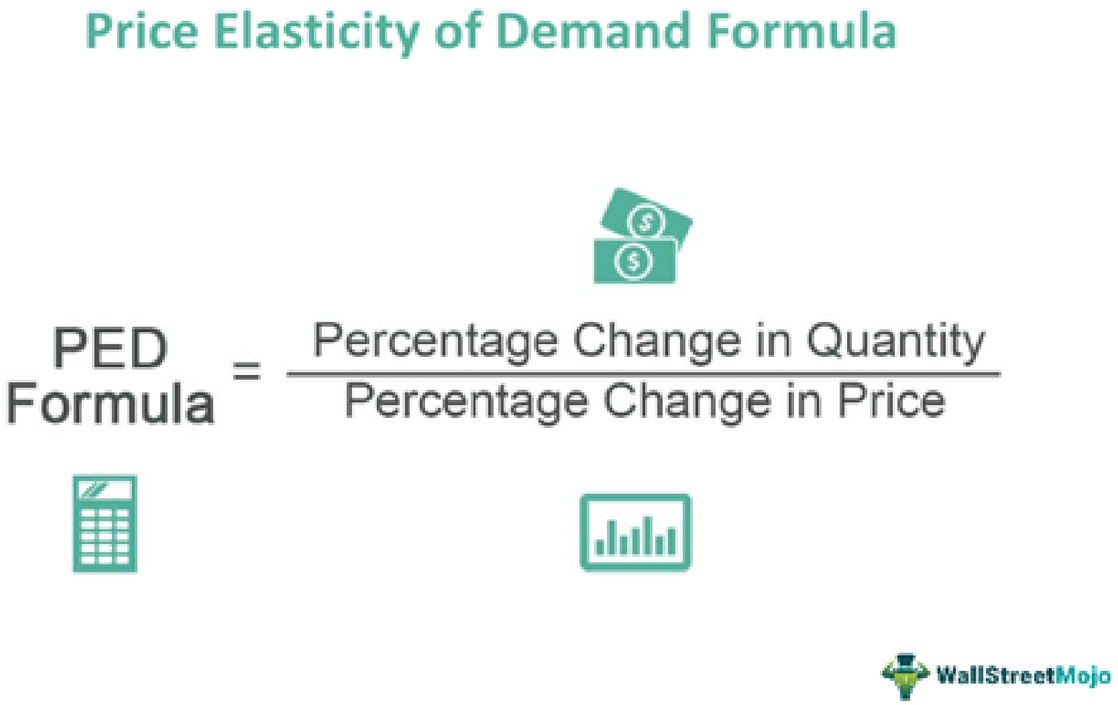


Prophet Model

Future research

- Parameters
- Seasonality
- cross- validation
- Data-set analysis
- Sum of orders

Price Elasticity



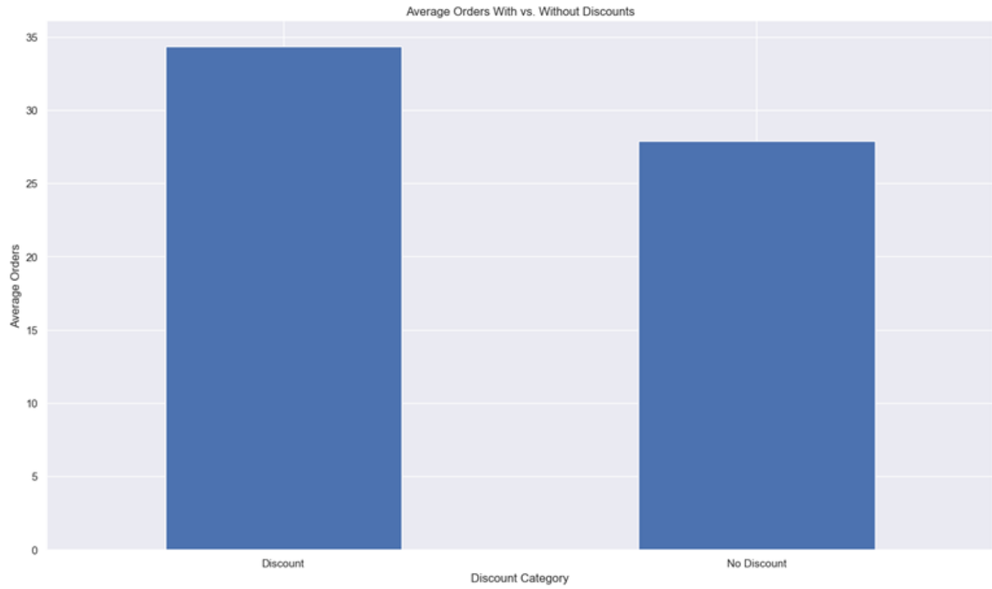
Price elasticity can fall into one of two buckets:

Price is elastic — PED > 1, changes in price significantly influence consumer demand

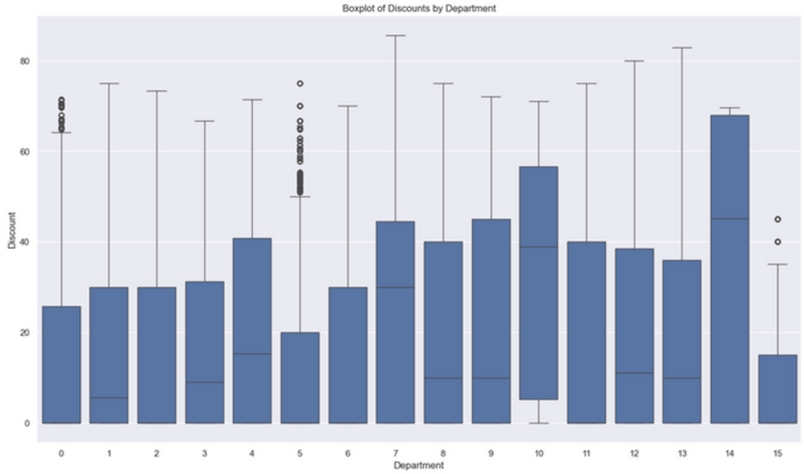
Price is inelastic — PED < 1, changes in price do not significantly influence consumer demand

Approach and Exploration

- £100 assumed base price for each product
- It was important to analyse the relationship between volume of orders and discounts as this is important in price setting for the future.



The relationship between orders with and without discounts



Department 14 had the highest median discount

Results

- Mean - 3.74
- Standard Deviation - 5.97
- Range - 53.30
- Correlation coefficient between price and order quantity - -0.20

product_number	department_desc	Product_PED	D
0	0	16.005482596475556	
2	2	0.8854509989111051	
5	3	12.73632473582227	
8	4	14.434782608695652	
9	4	0.6703360942077982	
10	4	2.830933093142308	
11	4	2.7150989028347365	
12	4	3.056674198298517	
15	3	18.47462195453126	
18	3	4.76604712121257	
19	4	6.09256633067417	
20	4	6.373864529310074	
21	4	3.4566078960181397	
23	4	3.961682447891559	
24	4	1.6065072299328258	
25	4	708.5898547335465	
26	4	6.777839153270016	

Price elasticity by department

Future research

- Check for elasticity across departments
- Elasticity with seasonality

Conclusions

- Our model would have been more accurate if we were able to factor in seasonality more effectively.
- On average, products across departments were only somewhat elastic.
- our model would have been more accurate if the 2018 and 2019 data were similar.

THANK YOU