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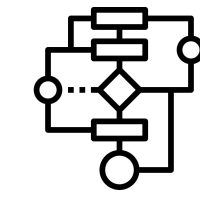
### Problem Statement

CMA CGM is in need of a tool that can flag rates that are out of the market or that can predict the impact of contract rate changes on future bookings.

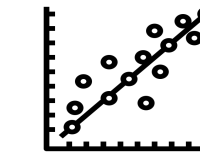


- Which customers' rates need adjustment each week?
- What price should we adjust the rates to?
- What will happen to the potential shipping quantities if we adjust the rates?

### Objective



Automate **outlier detection algorithm** to identify and flag rate outliers in CMA contracts



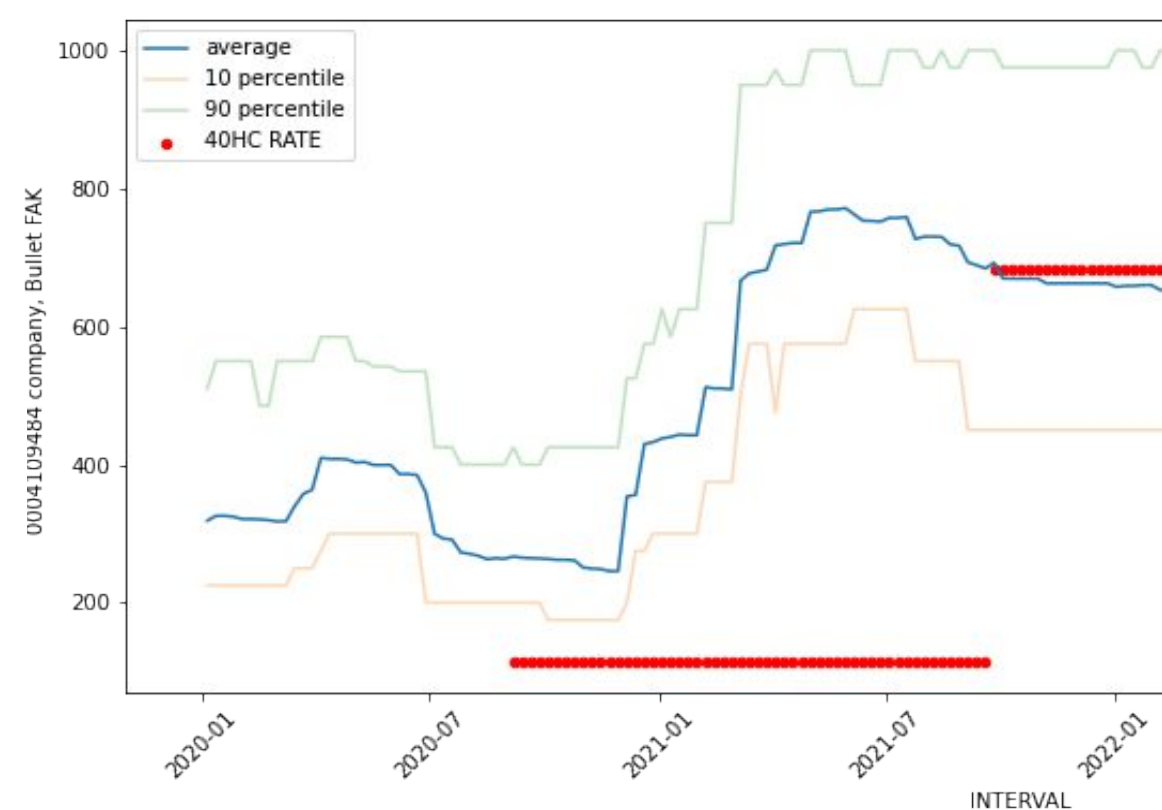
**Price elasticity** analytics to assess price and quantity relationship

### Dataset

#### Historical Shipping Contract Amendments (2020-2023)

17M rows X 24 features

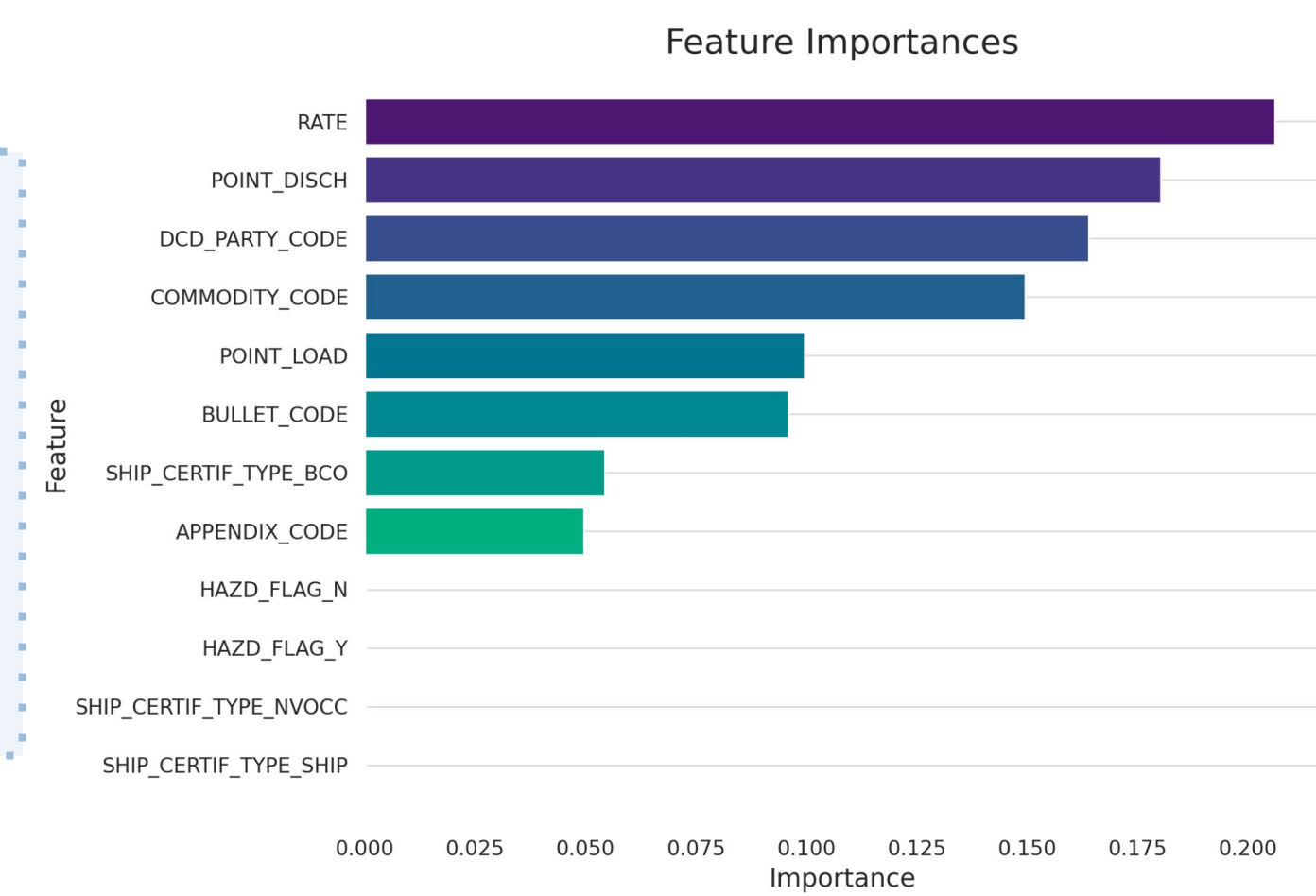
Route specifics and rate adjustment, customers, price, contract duration, port pairs



#### Historical Customer Bookings & Cancellations (2020-2023)

1.4M rows X 25 features

Booking activity: booking status, customers, shipping volume, port pairs



### Methodology

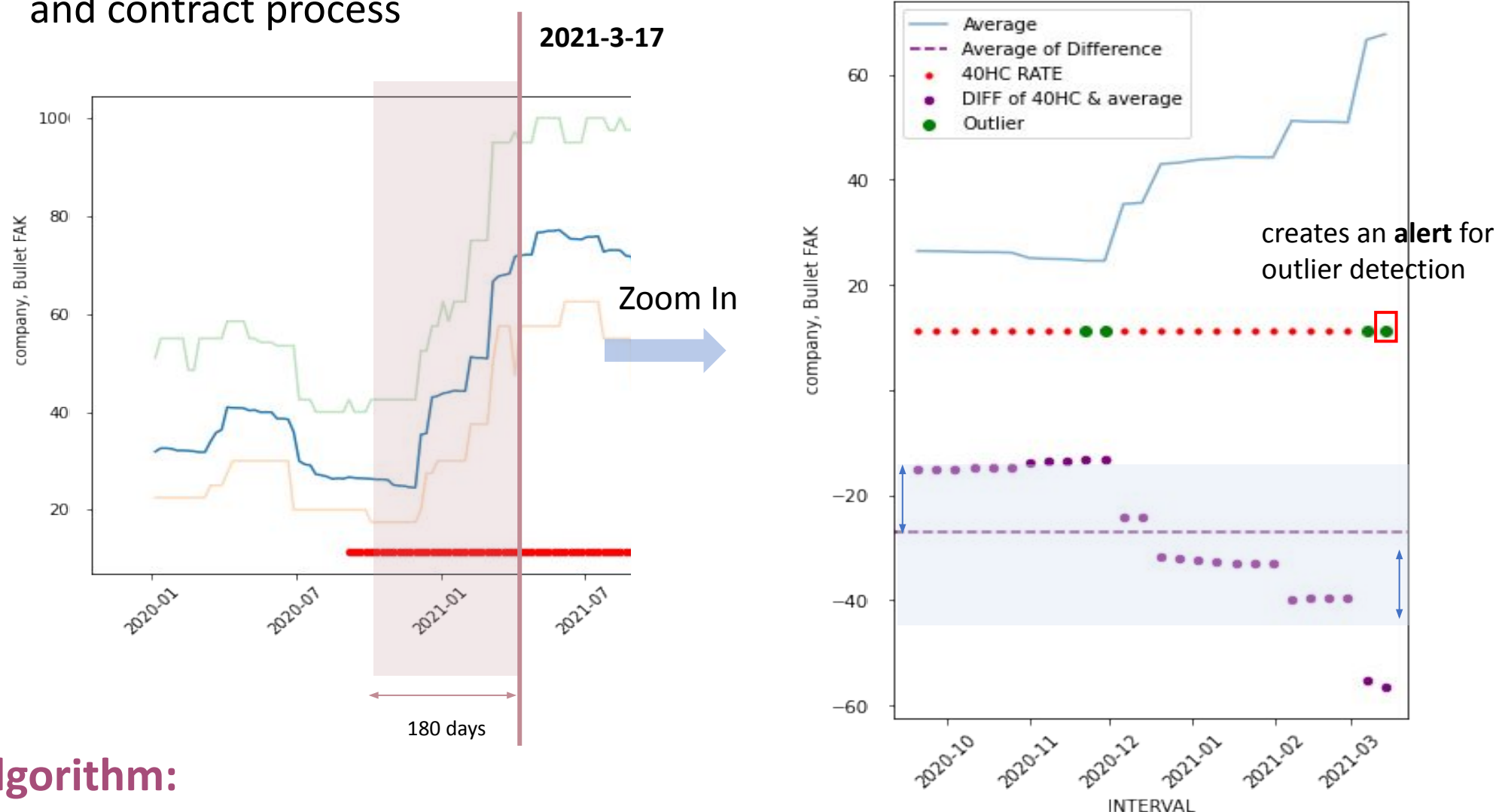
#### Phase I - Outlier Detection

**Goal:** design an outlier detection algorithm to identify and flag pricing outliers in 70M CMA contracts to replace the manual identification

**Outlier** appears when:

- Rates are not reviewed frequently enough to capture market changes
- There are errors in the rate adjustments and contract process

Defined when: **gap to average changed significantly**

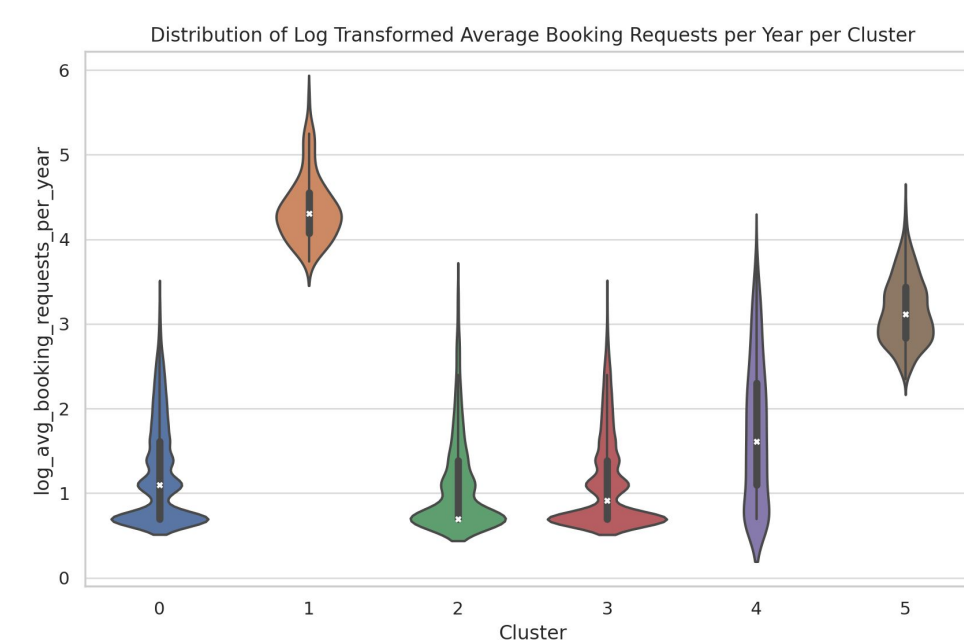


#### Algorithm:

- Calculate the **difference** between rate and averages
- Apply **clustering** techniques and use **5%** threshold to select outliers

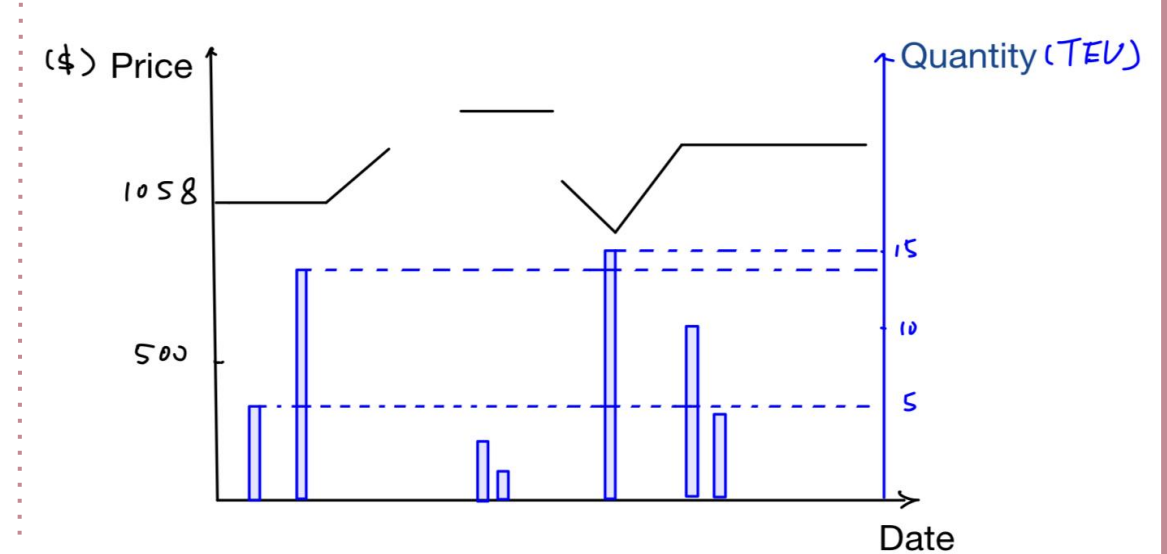
#### Phase II - Price Elasticity

**Goal:** For each customer and route combination, we quantified the effect of price adjustments on potential shipping quantities.



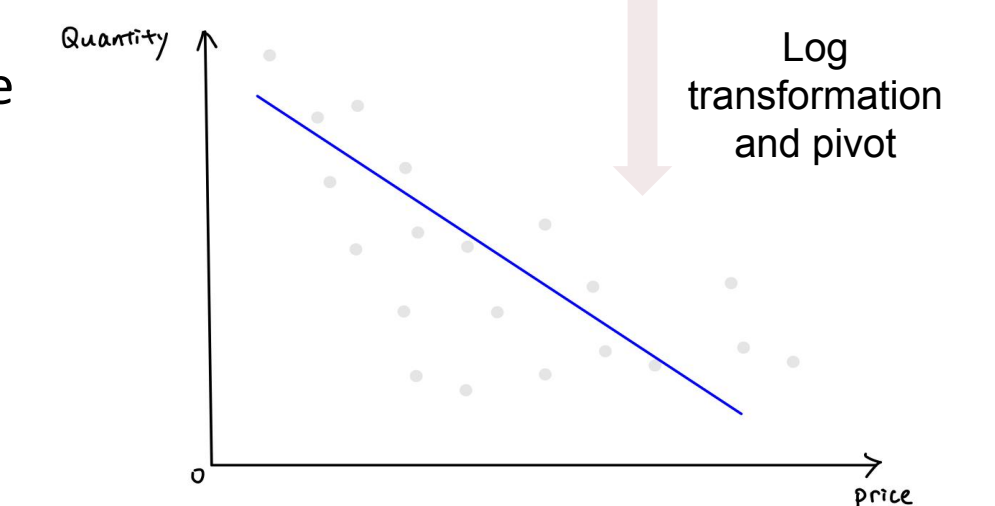
Consolidate price and quantity historical data, apply log transformation for price and quantity

- Utilize K-means clustering to pick out customers with consistent booking behaviors.



- Run linear regression to get the slope (x) - represents the price elasticity:

1% change in price -> x% change in quantity



### Results

#### Phase I - Outlier Detection

Run algorithm on 4M company rates and identify 2.5k outliers weekly

Week	Outlier Driver	Name	...	Price	Volume Shipped	Weekly Potential Impact with Price Adjustment
7/9/23	Customer Rate Decreased more than market rate decrease	A	...	\$1,364	270	\$ 752
7/16/23	Market Rate Increased more than customer rate increase	B	...	\$2,100	34	\$ 369

Figure 1. Sample outlier result deliverable

#### Phase II - Price Elasticity

Run algorithm for 1400+ customer-route pairs and output elasticity.

Company	Route	Price Elasticity	Std.err	...
A	NYC-RTM	-3.25	0.025	...

Example. 1% change in price will result in 3.25% **decrease** in quantity booked.

Figure 2. Sample algorithm output

### Business Impact



Successfully completed testing and **identified 2555** critical **outliers** out of **4M total** active contracts for week of July 16th



Estimate a **saving of \$500k/year** if CMA adjusts rate to the our suggested levels



Algorithm **already in weekly use** for the trade team, ready for production and adaptation for more specific use cases

### Future Work



**Statistical Significance of Elasticity Estimates:** Possible reasons for high p-value are: insufficient data or the presence of confounding variables.



**Positive Price Elasticity & No Bookings:** Optimize the results considering the unusual positive elasticity and lack of information regarding customers with no bookings



**Price Adjustment Strategy:** Balances the potential benefits of price increases with the potential risks considering customer loyalty, competitive landscape