PRODUCT DEMAND PREDICTION

USING MACHINE LEARNING

PRESENTED BY:S.DHANASEKAR

Demand Forecasting

Accurate demand forecasting is essential for a firm to enable it to produce the required quantities at the right time and arrange well in advance for the various factors of production, viz., raw materials, equipment, machine accessories, labour, buildings, etc.

In a developing economy like India, supple forecasting seems more important. However, the situation is changing rapidly.

The National Council of Applied Economic Research.

Factors involved in Demand Forecasting

1. How far ahead?

a. Long term – eg., petroleum, paper, shipping. Tactical decisions. Within the limits of resources already available.

b. Short-term – eg., clothes. Strategic decisions. Extending or reducing the limits of resources.

Factors involved in Demand Forecasting

2. Undertaken at three levels:
   a. Macro-level
   b. Industry level eg., trade associations
   c. Firm level
3. Should the forecast be general or specific (product-wise)?
4. Problems or methods of forecasting for "new" vis-à-vis "well established" products.
5. Classification of products – producer goods, consumer durables, consumer goods, services.
6. Special factors peculiar to the product and the market – risk and uncertainty. (eg., ladies' dresses)

Methods of demand forecasting

Though statistical techniques are essential in clarifying relationships and providing techniques of analysis, they are not substitutes for judgement. What is needed is some common sense mean between pure guessing and too much mathematics.

1. Survey of buyers' intentions: also known as Opinion surveys. Useful when customers are industrial producers. (However, a number of biases may creep up). Not very useful for household consumers.

Limitation: passive and "does not expose and measure the variables under management's control"

2. Delphi method: it consists of an effort to arrive at a consensus in an uncertain area by questioning a group of experts repeatedly until the results appear to converge along a single line of the issues causing disagreement are clearly defined.

Developed by Rand Corporation of the U.S.A in 1940s by Olaf Helmer, Dalkey and Gordon. Useful in technological forecasting (non-economic variables).

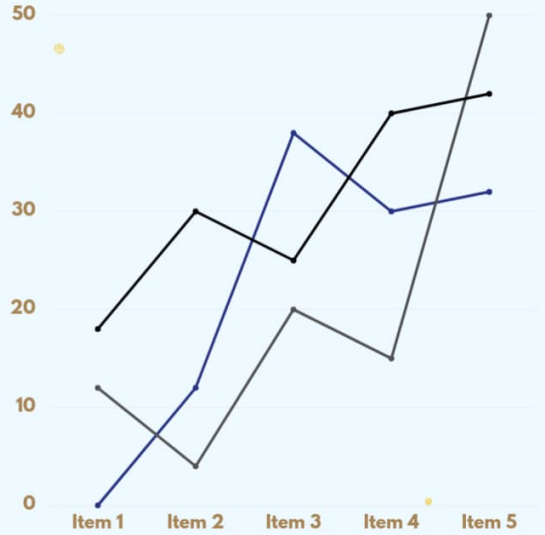
Control or management of demand

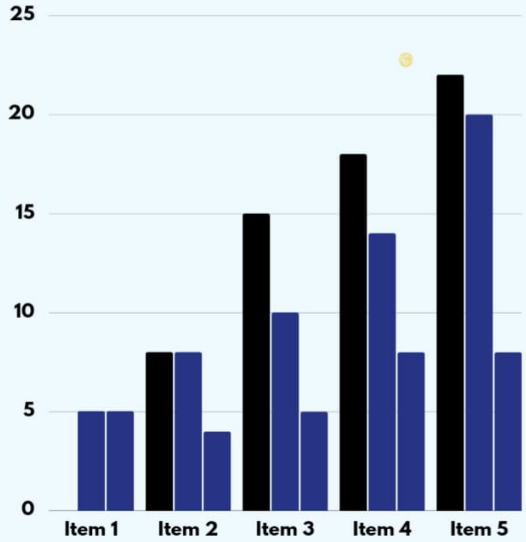
- The key to management of demand is the effective management of the purchases of final consumers.
- The management of demand consists in devising a sales strategy for a particular product. It also consists in devising a product, or features of a product, around which a sales strategy can be built. Product design, model change, packaging and even performance reflect the need to provide what are called strong selling points.


Manufacturer
Product delivery
Retailer
Future demand
Demand forecasting based on data
Consignment policy
RFID
Order

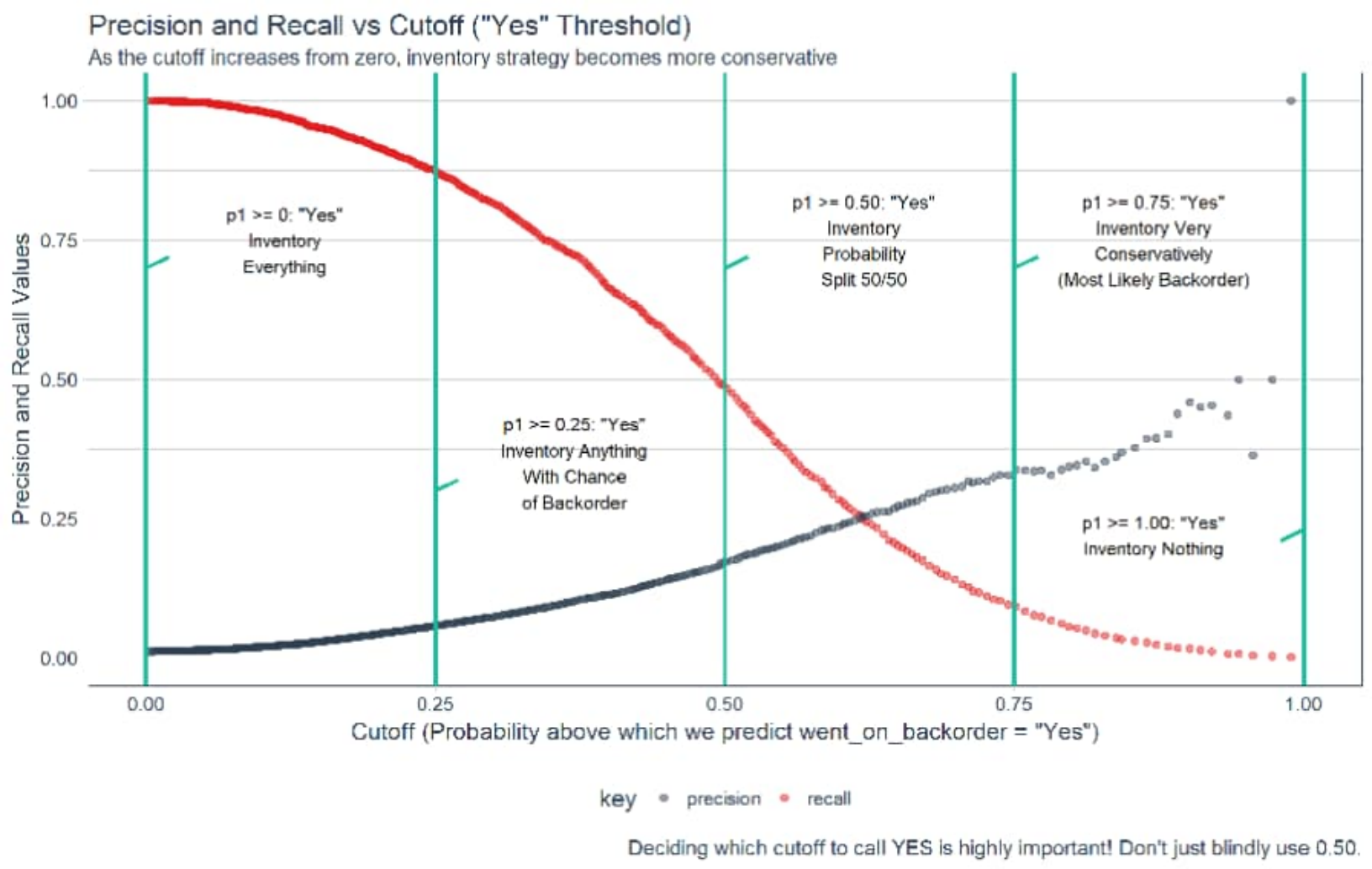
Program

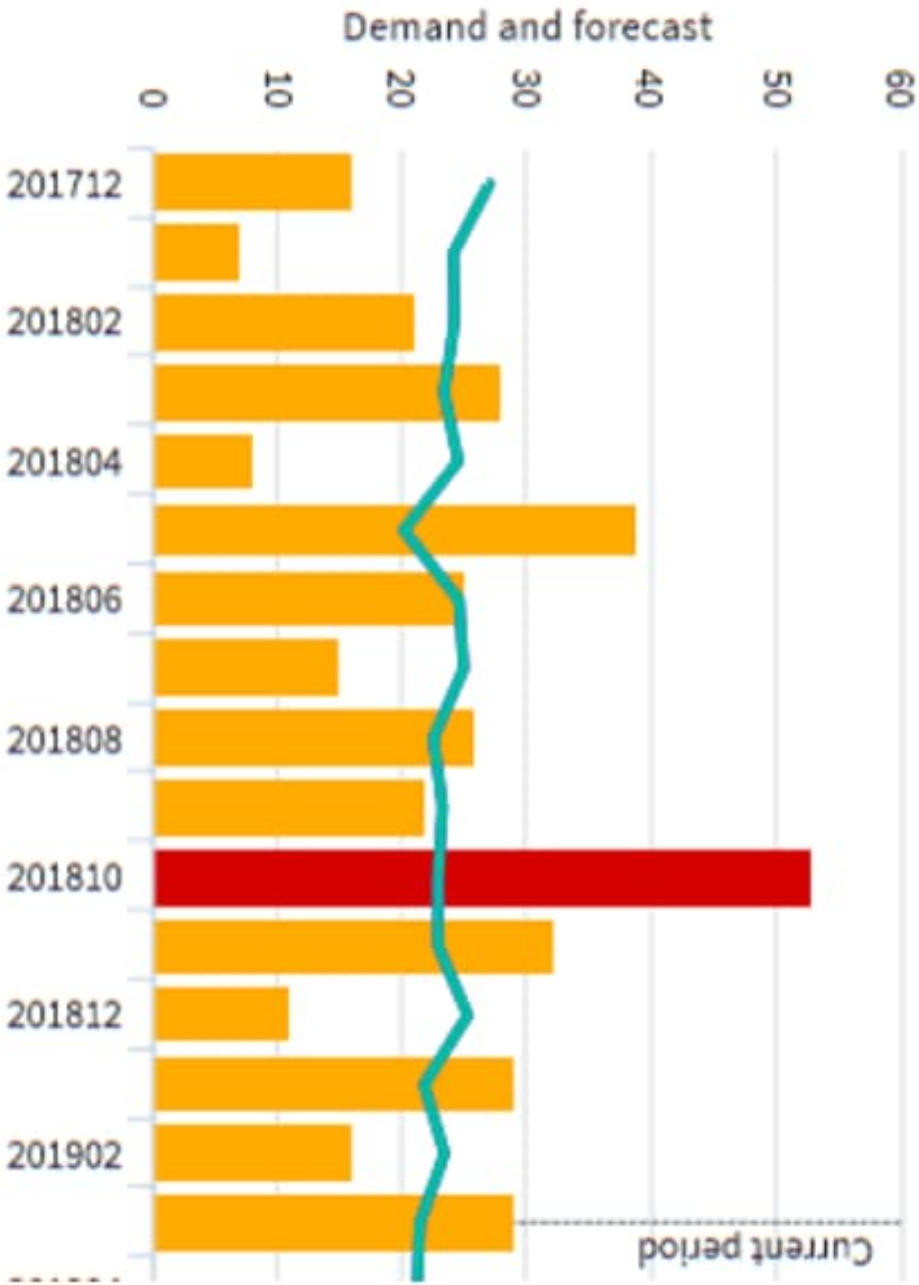
```
# Import necessary libraries
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score

# Load your dataset
data = pd.read_csv('product_demand_data.csv')  # Replace with
your dataset

# Prepare your data (e.g., feature selection and preprocessing)
X = data[['Feature1', 'Feature2', ...]]  # Select relevant features
y = data['Demand']  # Target variable

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)
```






```
# Create a linear regression model
model = LinearRegression()

# Train the model
model.fit(X_train, y_train)

# Make predictions on the test data
y_pred = model.predict(X_test)

# Evaluate the model
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print(f"Mean Squared Error: {mse}")
print(f"R-squared: {r2}")

# Use the model to make demand predictions
new_data = pd.DataFrame({'Feature1': [value1], 'Feature2':
[value2], ...})  # Provide input features
predicted_demand = model.predict(new_data)

print(f"Predicted Demand: {predicted_demand[0]}")
```


Precision and Recall vs Cutoff ("Yes" Threshold)
As the cutoff increases from zero, inventory strategy becomes more conservative
Precision and Recall Values
1.00
0.75
0.50
0.25
0.00
p1 >= 0: "Yes"
Inventory
Everything
p1 >= 0.25: "Yes"
Inventory Anything
With Chance
of Backorder
p1 >= 0.50: "Yes"
Inventory
Probability
Split 50/50
p1 >= 0.75: "Yes"
Inventory Very
Conservatively
(Most Likely Backorder)
p1 >= 1.00: "Yes"
Inventory Nothing
0.00
0.25
0.50
0.75
1.00
Cutoff (Probability above which we predict went_on_backorder = "Yes")
key
precision
recall
Deciding which cutoff to call YES is highly important! Don't just blindly use 0.50.


Demand and forecast
0
10
20
30
40
50
60
201712
201802
201804
201806
201808
201810
201812
201902
Current period