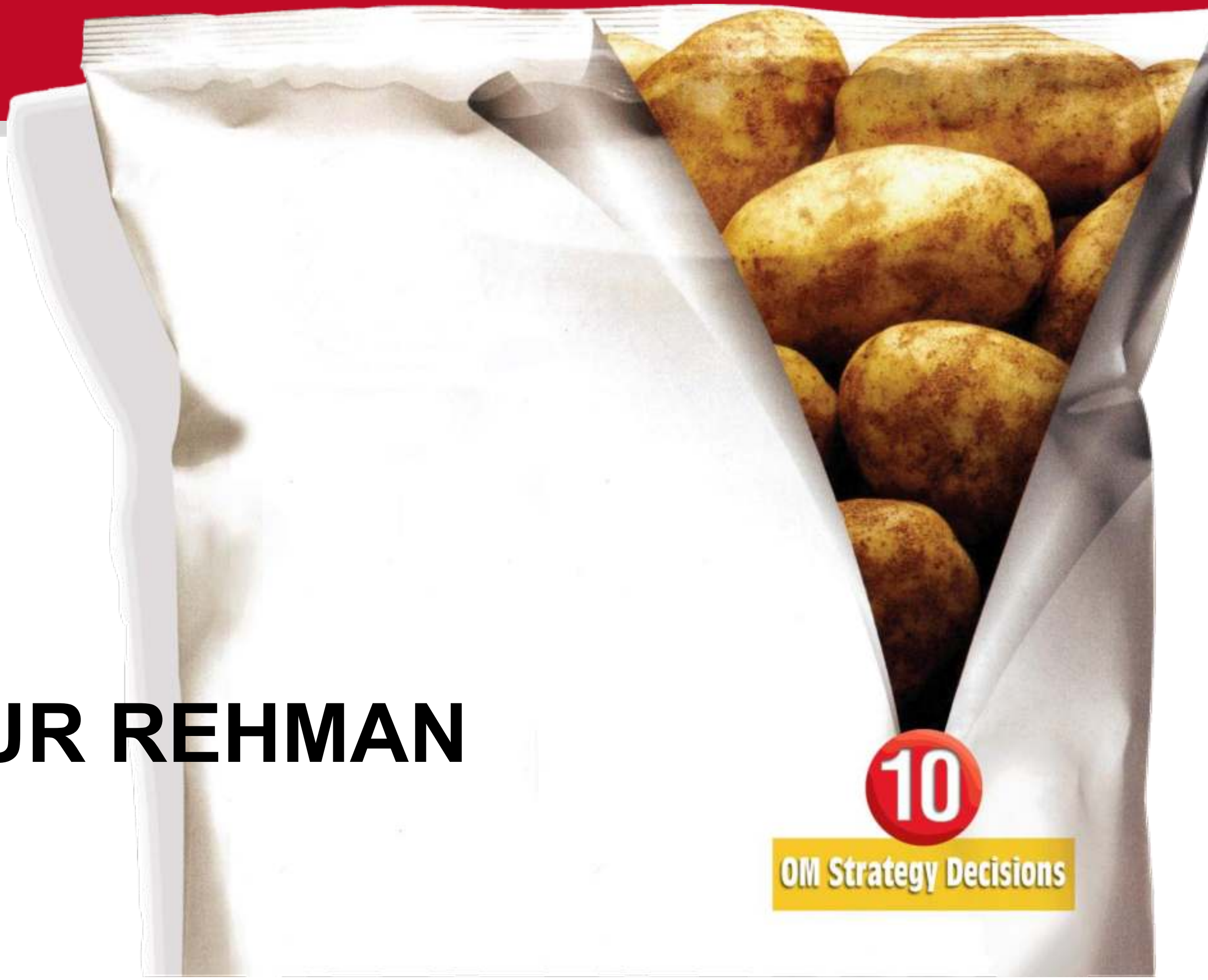
4 Forecasting



Part 3

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Overview of Quantitative Approaches

1. Naive approach
2. Moving averages
3. Exponential smoothing
4. Trend projection
5. Linear regression

Items 1–4: time-series models

Item 5: associative model

Naive Approach

- Assumes demand in next period is the same as demand in most recent period
  - e.g., If January sales were 68, then February sales will be 68
- Sometimes cost effective and efficient
- Can be good starting point

Moving Average Method

- MA is a series of arithmetic means
- Used if little or no trend
- Used often for smoothing
  - Provides overall impression of data over time

$$\text{Moving average} = \frac{\sum \text{demand in previous } n \text{ periods}}{n}$$

Moving Average Example

Month	Actual Shed Sales	3-Month Moving Average
January	10	
February	12	
March	13	
April	16	$(10 + 12 + 13)/3 = 11\ ^2/_3$
May	19	$(12 + 13 + 16)/3 = 13\ ^2/_3$
June	23	$(13 + 16 + 19)/3 = 16$
July	26	$(16 + 19 + 23)/3 = 19\ ^1/_3$

Weighted Moving Average

- **Used when some trend might be present**
  - **Older data usually less important**
- **Weights based on experience and intuition**

$$\text{Weighted moving average} = \frac{\sum (\text{weight for period } n) \times (\text{demand in period } n)}{\sum \text{weights}}$$

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Weights Applied	Period
3	Last month
2	Two months ago
1	Three months ago
6	Sum of weights

Month	Actual Shed Sales	3-Month Weighted Moving Average
January	10	
February	12	
March	13	
April	16	$[(3 \times 13) + (2 \times 12) + (10)]/6 = 12^1/_6$
May	19	$[(3 \times 16) + (2 \times 13) + (12)]/6 = 14^1/_3$
June	23	$[(3 \times 19) + (2 \times 16) + (13)]/6 = 17$
July	26	$[(3 \times 23) + (2 \times 19) + (16)]/6 = 20^1/_2$

Exponential Smoothing

- Form of weighted moving average
  - Weights decline exponentially
  - Most recent data weighted most
- Requires smoothing constant (α)
  - Ranges from 0 to 1
  - Subjectively chosen
- Involves little record keeping of past data

Exponential Smoothing

New forecast = Last period's forecast
+ α (Last period's actual demand
– Last period's forecast)

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

where F_t = new forecast

F_{t-1} = previous forecast

A_{t-1} = Actual Demand for period 't-1'

α = smoothing (or weighting) constant ($0 \le \alpha \le 1$)

Exponential Smoothing Example

In January a car dealer predicted for February demand of 142 Ford Mustangs . Actual February demand was 153 autos. Using smoothing constant chosen by management of $\alpha = 0.20$, the dealer wants to forecast March demand using the exponential smoothing model.

Predicted demand = 142 Ford Mustangs
Actual demand = 153
Smoothing constant α = .20

New forecast = 142 + .2(153 – 142)

= 142 + 2.2

= 144.2 ≈ 144 cars