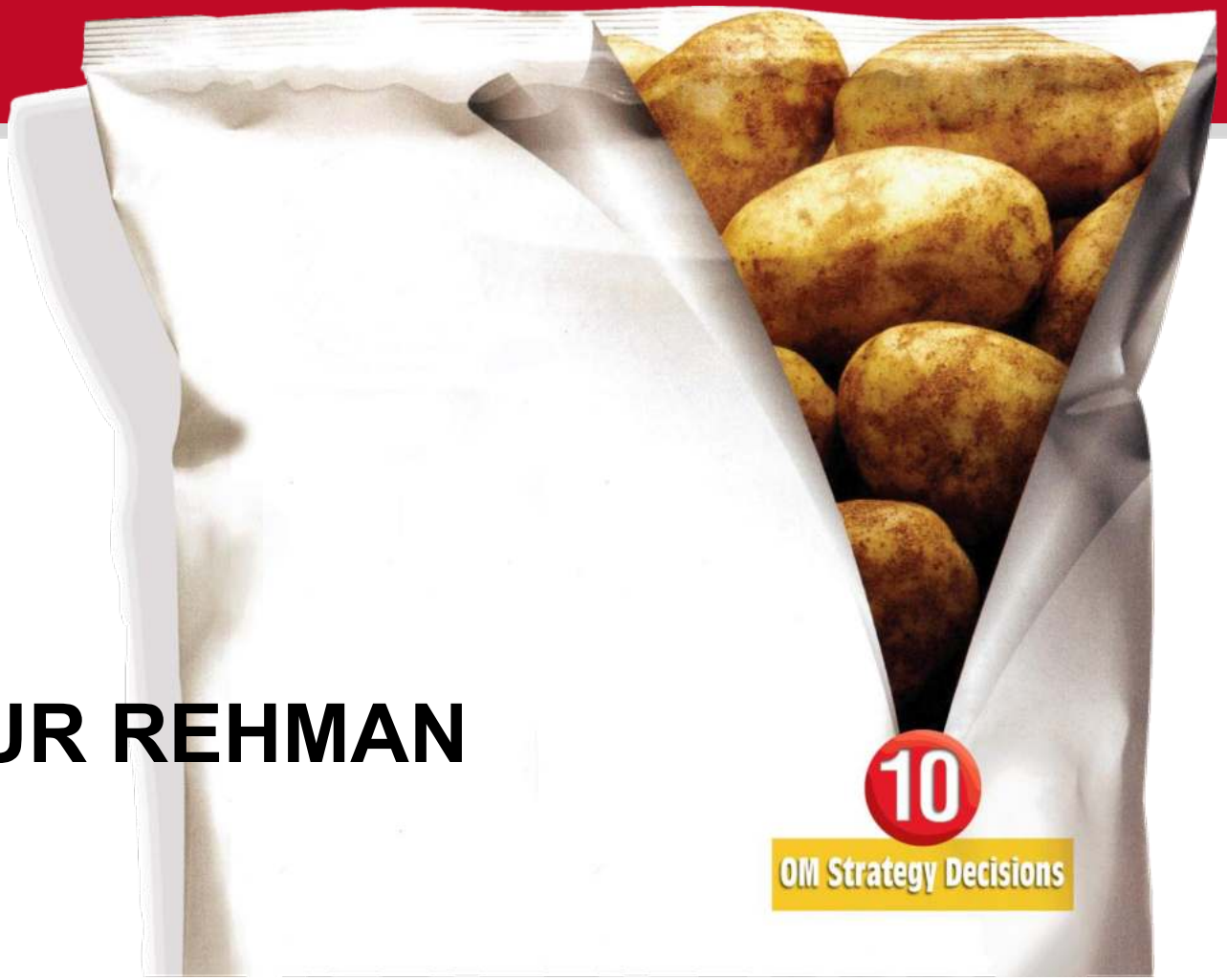
4 Forecasting



Part 4

By

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Overview of Quantitative Approaches

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

} time-series models

5. Linear regression

} associative model

Exponential Smoothing with Trend Adjustment

When a trend is present, exponential smoothing must be modified

Forecast including trend (FIT_t) = Exponentially smoothed forecast (F_t) + Exponentially smoothed trend (T_t)

Exponential Smoothing with Trend Adjustment

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

$$T_t = \beta(F_t - F_{t-1}) + (1 - \beta)T_{t-1}$$

Step 1: Compute F_t

Step 2: Compute T_t

Step 3: Calculate the forecast $FIT_t = F_t + T_t$

Example **A large manufacturer wants to forecast demand for an item. A review of past sales shows increasing trend as below. Smoothing constants selected are α=0.2. and β= 0.4. The firm assumes the initial forecast for month 1 (F1) was 11 units and trend over that period (T1) was 2 units.**

Month(t)	Actual Demand (A_t)	Smoothed Forecast, F_t	Smoothed Trend, T_t	Forecast Including Trend, FIT_t
1	12	11	2	13.00
2	17			
3	20			
4	19			
5	24			
6	21			
7	31			
8	28			
9	36			
10				????

Exponential Smoothing with Trend Adjustment Example

Month(t)	Actual Demand (A_t)	Smoothed Forecast, F_t	Smoothed Trend, T_t	Forecast Including Trend, FIT_t
1	12	11	2	13.00
2	17			
3	20			
4	19			
5	24			
6	21			
7	31			
8	28			
9	36			
10				

Table 4.1

Step 1: Forecast for Month 2

$$F_2 = \alpha A_1 + (1 - \alpha)(F_1 + T_1)$$

$$F_2 = (.2)(12) + (1 - .2)(11 + 2)$$

$$= 2.4 + 10.4 = 12.8 \text{ units}$$

Exponential Smoothing with Trend Adjustment Example

Month(t)	Actual Demand (A_t)	Smoothed Forecast, F_t	Smoothed Trend, T_t	Forecast Including Trend, FIT_t
1	12	11	2	13.00
2	17	12.80		
3	20			
4	19			
5	24			
6	21			
7	31			
8	28			
9	36			
10				

Table 4.1

Step 2: Trend for Month 2

$$T_2 = \beta(F_2 - F_1) + (1 - \beta)T_1$$

$$T_2 = (.4)(12.8 - 11) + (1 - .4)(2)$$

$$= .72 + 1.2 = 1.92 \text{ units}$$

Exponential Smoothing with Trend Adjustment Example

Month(t)	Actual Demand (A_t)	Smoothed Forecast, F_t	Smoothed Trend, T_t	Forecast Including Trend, FIT_t
1	12	11	2	13.00
2	17	12.80	1.92	
3	20			
4	19			
5	24			
6	21			
7	31			
8	28			
9	36			
10				

Table 4.1

Step 3: Calculate *FIT* for Month 2

$$FIT_2 = F_2 + T_2$$
$$FIT_2 = 12.8 + 1.92$$
$$= 14.72 \text{ units}$$

Exponential Smoothing with Trend Adjustment Example

Month(t)	Actual Demand (A_t)	Smoothed Forecast, F_t	Smoothed Trend, T_t	Forecast Including Trend, FIT_t
1	12	11	2	13.00
2	17	12.80	1.92	14.72
3	20	15.18	2.10	17.28
4	19	17.82	2.32	20.14
5	24	19.91	2.23	22.14
6	21	22.51	2.38	24.89
7	31	24.11	2.07	26.18
8	28	27.14	2.45	29.59
9	36	29.28	2.32	31.60
10		32.48	2.68	35.16

Table 4.1