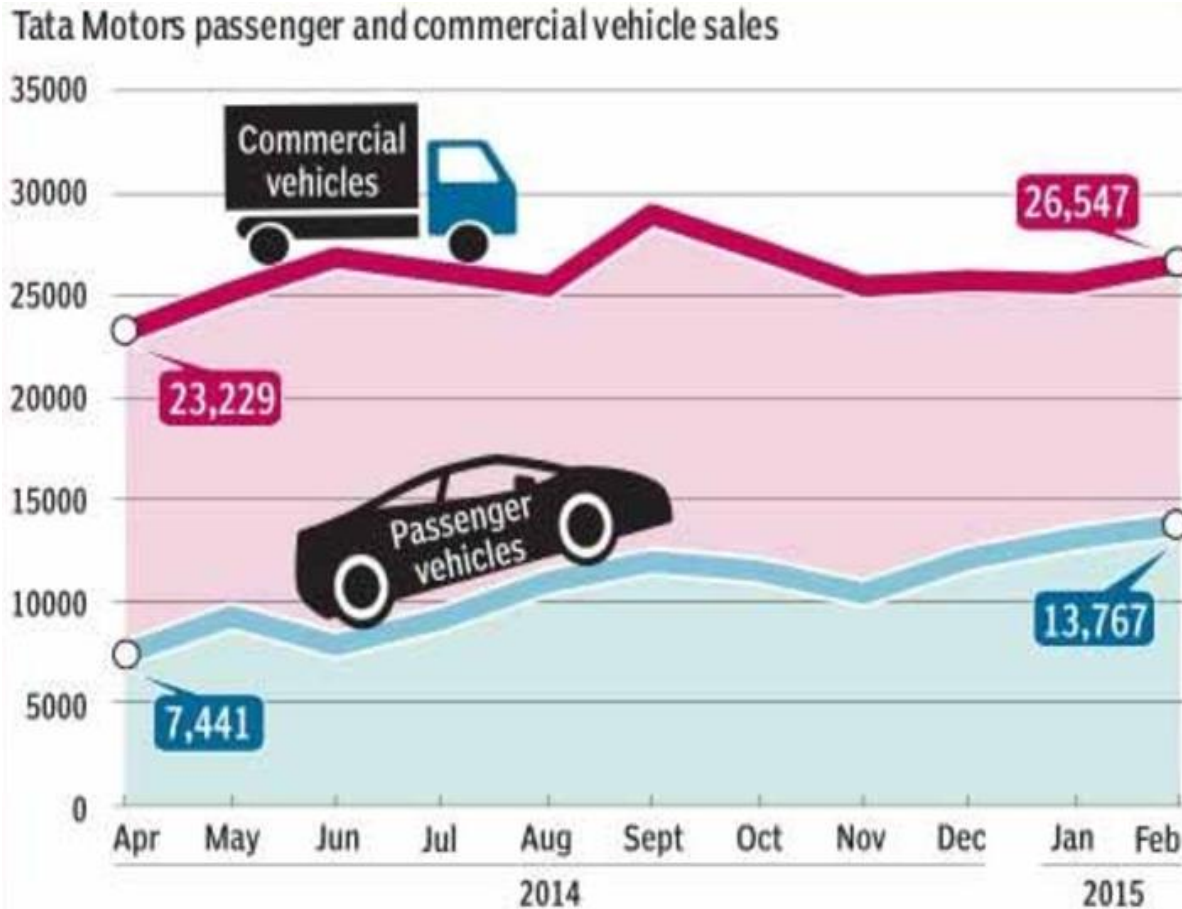


# Time Series and Forecasting

# Time Series data



- ✓ Collection of data recorded over a period of time
- ✓ Forecast for next period
- ✓ Inputs for business processes at the firm.
- ✓ Underproduction/Overproduction

# Daily/Weekly/Monthly/Quarterly/Yearly



- ✓ Quantities/amount of ingredients required for food preparation etc.
- ✓ Beverages.

Restaurant at Taj Hotel

Number of guests visiting the restaurant

# Daily/Weekly/Monthly/Quarterly/Yearly



- ✓ Allocations to army, navy, air force
- ✓ Numbers of defense equipments and configurations

Defense budget of a country

# Components of time series – Secular Trend

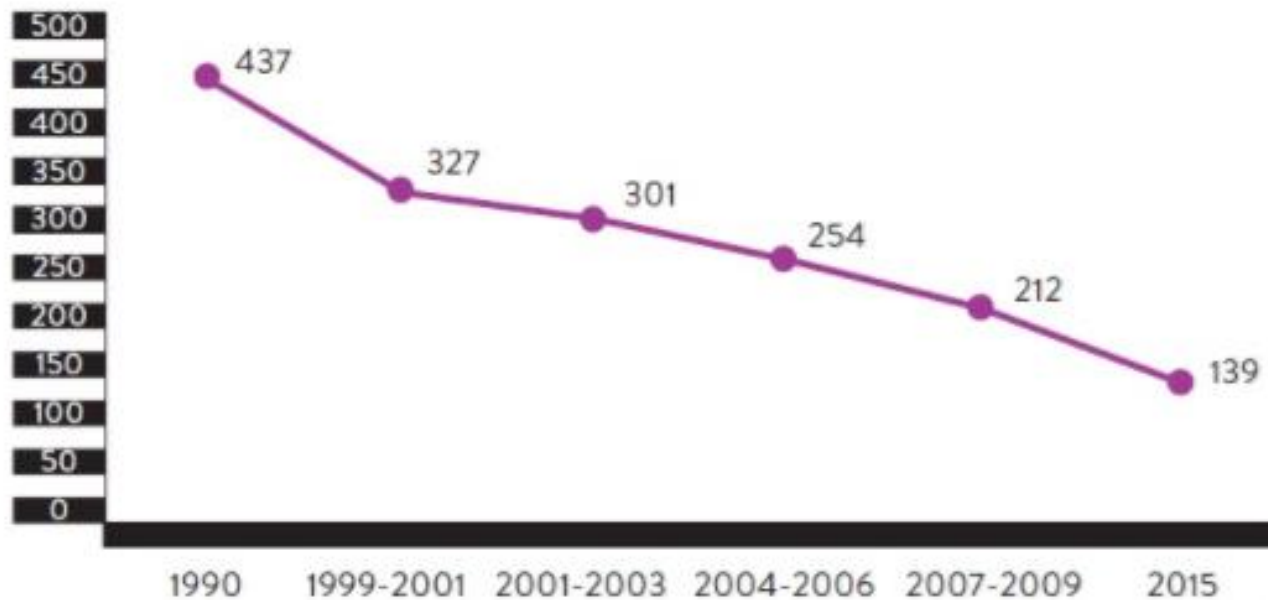


Secular Trend: The smoothed long-term direction of a time series

# Source: World Bank

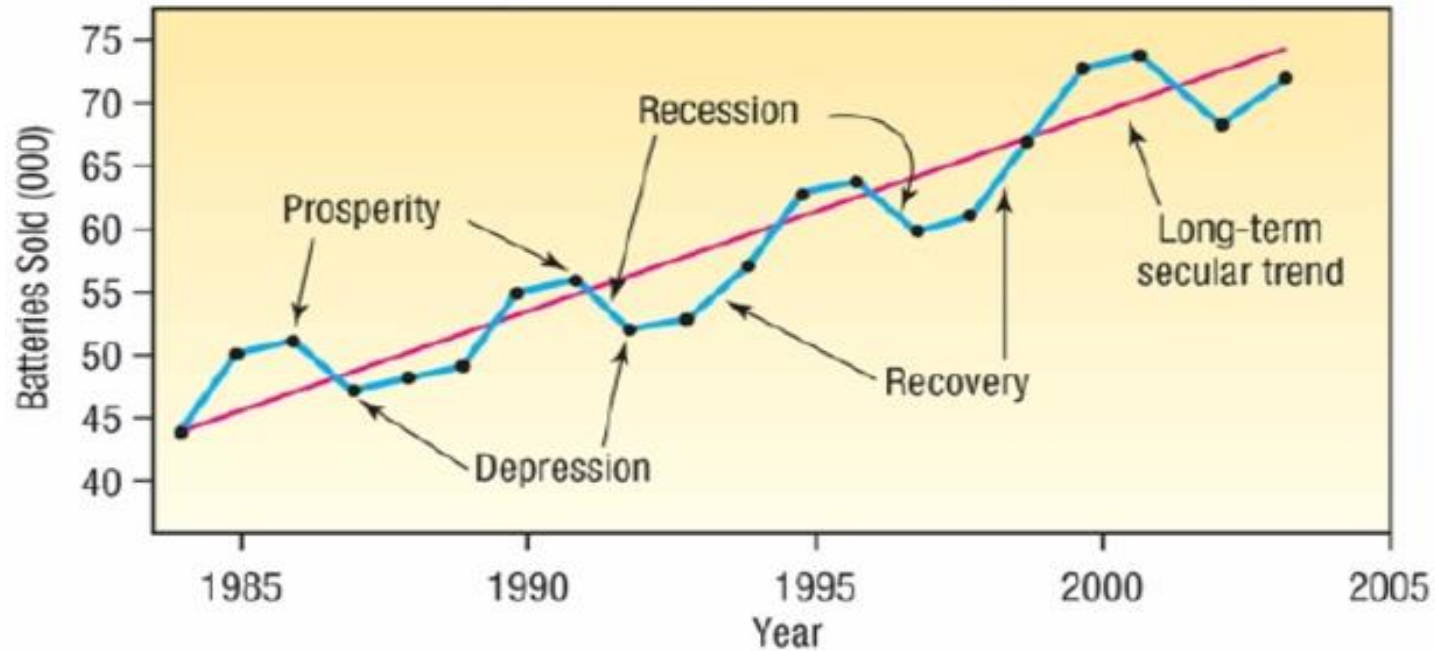
# Components of time series – Secular Trend

## MATERNAL MORTALITY RATE (PER 100,000 LIVE BIRTHS)



# Source: Registrar general of India

## Components of time series – Cyclical Variation



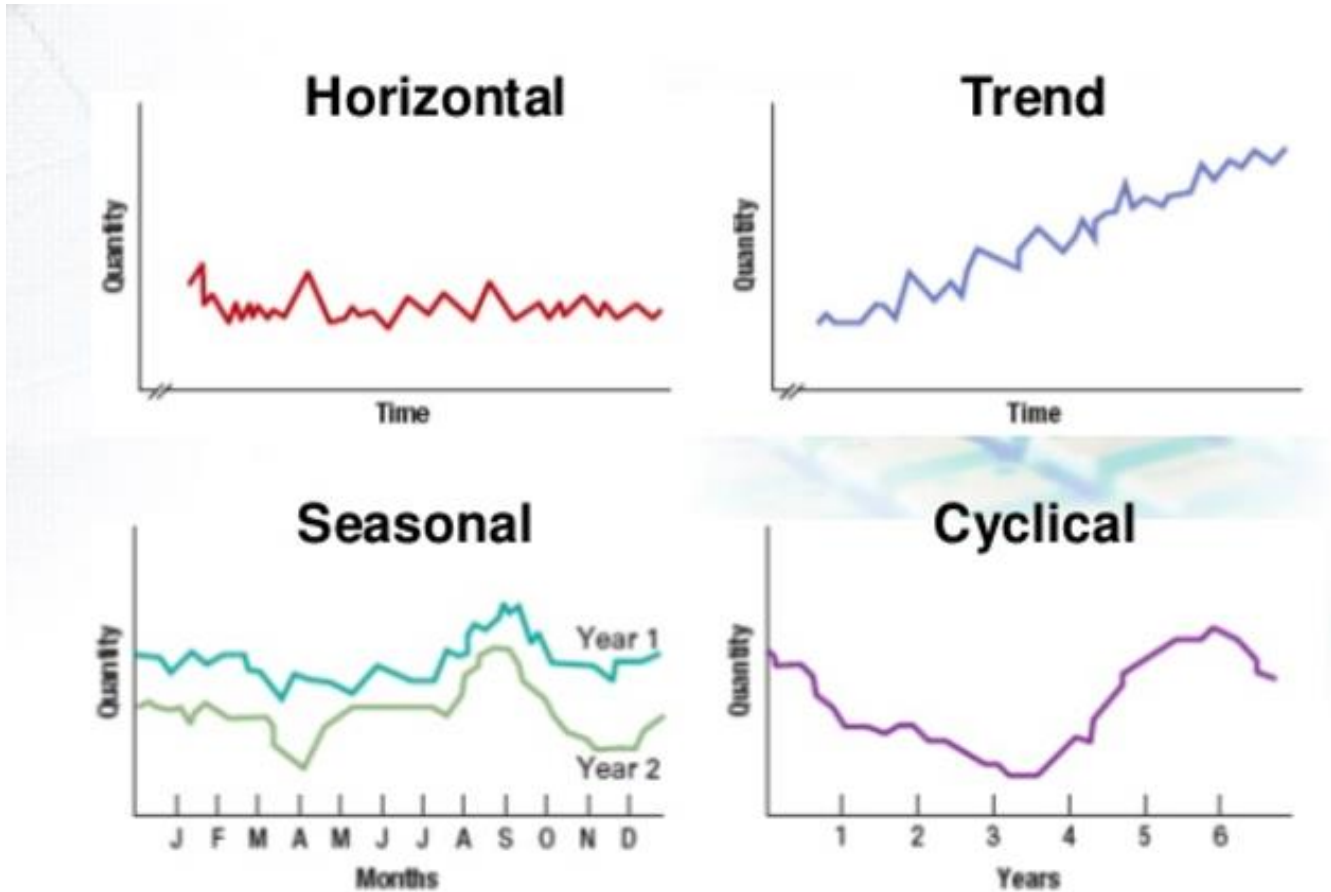
The rise and fall of a time series over longer periods, typically more than a year in case of business/economic cycles.

# Source: Sales data from National Battery Retailer Inc.

## **Components of time series – Seasonal Variation**

- ✓ Patterns of change in a time series typically within a year.  
These patterns tend to repeat themselves each year
- ✓ Air conditioners / Gold purchase / Leather jackets

# Level + Trend + Seasonality + Cyclicity



# Forecasting methods

## Deposits in a Cooperative bank

	As at the end of each quarter (in Rs. 1000s)			
	March	June	September	December
2014	391	439	452	480
2015	509	562	572	622
2016	625	685	687	745
2017	??	??	??	??

Actual 2018

<b>743</b>	<b>808</b>	<b>805</b>	<b>867</b>
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MAPE?

	Year 1	Year 2	Year 3	Year 4
Q1	53	58	62	??
Q2	22	25	27	??
Q3	37	40	44	??
Q4	45	50	56	??

## Trend (year-on-year) + Seasonality

Considering that seasonality observed in each year is equally important to the forecasting manager, what is going to the forecast for each quarter of year 4.