TURKISH AVIATION ACADEMY

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# Operations & Logistics Management in Air Transportation

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**Air Transportation Management**

**M.Sc. Program**

**Air Transportation Systems and Infrastructure**

**Strategic Planning**

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# THE NEWSVENDOR AND APPLICATIONS

# Additional Slides
# June 12, 2014

# Newsvendor Solution: Explanation

***Marginal Analysis***: Suppose you stock S units

| Marginal Overage Cost with S | |
|---|---|
| Probability of S being "over" | |
| Marginal cost of over-stocking | |

| Marginal Underage Cost with S | |
|---|---|
| Probability of S being "under" | |
| Marginal cost of under-stocking | |

To find the *optimal* stocking level:

$P\{D \le S\} * C_o$ = Marginal Cost of Over-Stocking = Marginal Cost of Under-Stocking = $\{1-P\{D \le S\}\} * C_u$

$$P\{D \le S\} = C_u / (C_u + C_o)$$

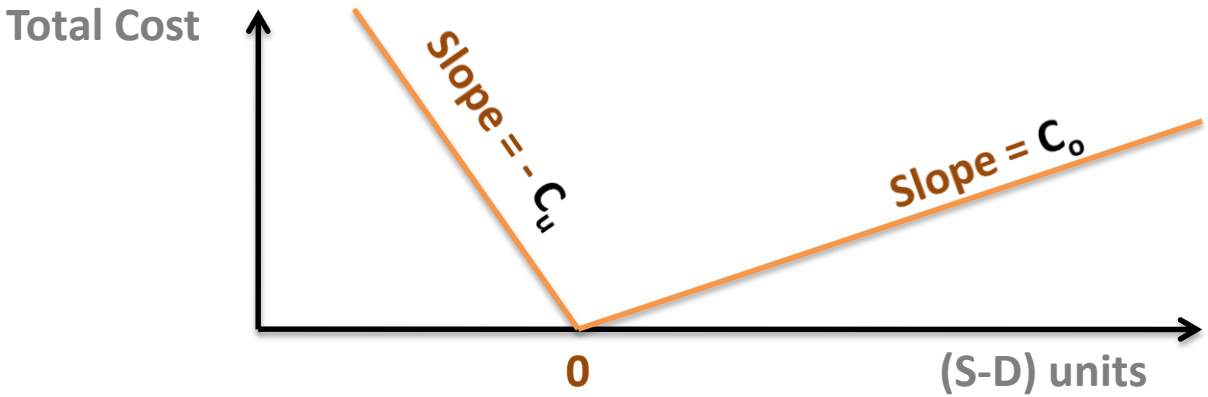
# Representing the Decision Problem *Mathematically*

- If D were known, the cost function would be

$$C(S, D) = \text{Cost}(S, D)$$
$$= C_o \cdot \max\{0, S-D\} + C_u \cdot \max\{0, D-S\}$$
$$= C_o \cdot [S-D]^+ + C_u \cdot [D-S]^+$$

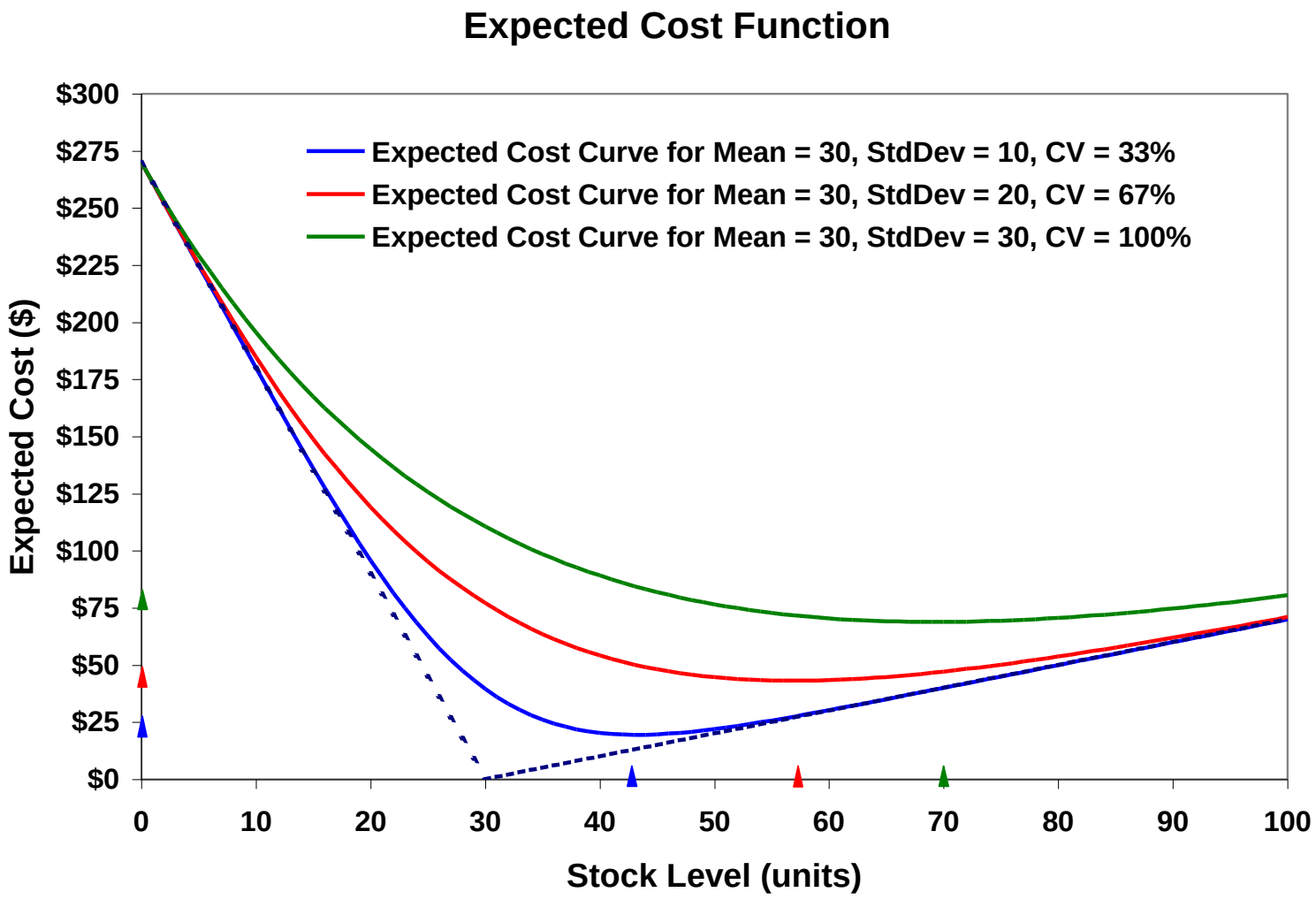
Had too much stock

Had too Little stock




There exists a fundamental economic tradeoff

# Impact of Demand Variability

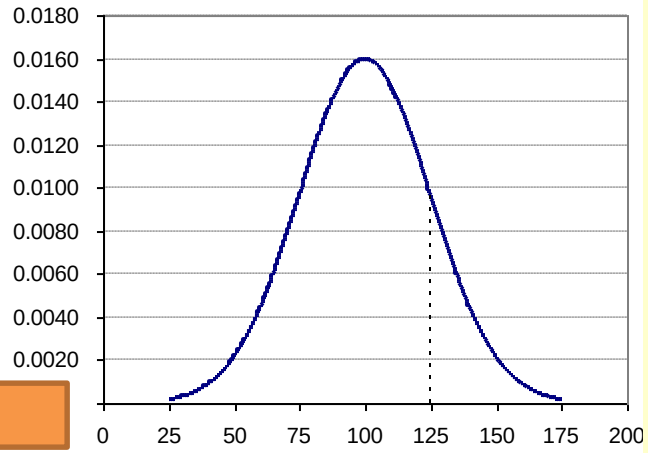


# Normal Distribution Tutorial (1)

Start with
μ= 100,
σ= 25.

$D \sim N(\mu, \sigma^2)$

Q = 125




P(D ≤ 125)

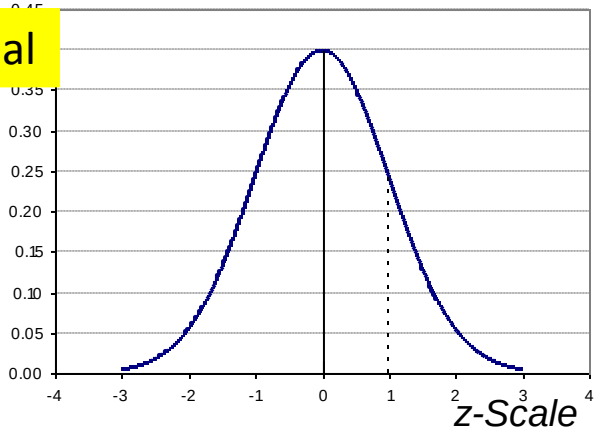
=

P(Z ≤ 1)

Standard normal

$Z \sim N(0,1)$

$$z = \frac{Q-\mu}{\sigma} = \frac{125-100}{25} = 1$$




- Let *Q* be the order quantity, and ($\mu$, $\sigma$) the parameters of the normal demand distribution
- *Prob*{demand is *Q* or lower} = *Prob*{the outcome of a standard normal is *z* or lower}, where

$$z = \frac{Q-\mu}{\sigma} \quad \text{or} \quad Q = \mu + z \times \sigma$$

- Look up *Prob*{the outcome of a standard normal is *z* or lower} in the Standard Normal Distribution Function Table, or Excel NORMSDIST function.