# Profit Models

## Outline

- Basic Profit Model
- Influence Diagram
- Simon’s Pie Case
- Spreadsheet Modeling

## Basic Profit Model

- Selling Price (SP)
- Quantity (Q)
- Sales volume
- Production volume
- Demand (D)
- Revenue
- Profit

- Cost
  - Overhead cost
  - Sunk cost
  - Fixed cost (FC)
  - Variable cost (VC)
  - Total cost (TC)
  - Breakeven point
  - Crossover point
Basic Profit Model

- **Profit Model**
  - Profit = Revenue - Total Cost
  - Profit = \( SP \times Q - (FC + VC \times Q) \)

- **Break-even point**
  - Revenue = Total Cost
  - \( Q = FC/(SP - VC) \)

- **Crossover Point**
  - Total Cost of process A = Total Cost of Process B
  - \( Q = (FC_A - FC_B)/(VC_B - VC_A) \)

Influence Diagram

- **Simon's Pie Case**

  **Step 1: Study Environment**
  - Two ingredients combined to make apple pies: fruit and frozen dough
  - The pies are then processed and sold to a local grocery in order to generate profit
  - Diagnose problem and organize facts:
    - Need for immediate profit on apple pies
    - Apple pie characteristics: size, ingredients, quality, and the wholesale price
  - Frame management situation
    - **Critical decision**: setting the “right” wholesale pie price in order to generate maximum profit
    - Setting the “best” pie price together with the cost structure will determine profit
Simon’s Pie Case

Step 2: Model Formulation

- Create a selective representation of reality
  - Revenue based on
    - Apple pie wholesale price
    - Demand by local grocery stores
  - Costs based on
    - Ingredients (material) costs
    - Processing (labor) costs
    - Rent, utilities, loan payments, etc.
- Simplifying assumptions
  - Demand independent of wholesale pie price

**Simon’s Pie Case**

Step 2: Model Formulation

- Identify decisions and objectives
  - Decision variable: price of the apple pies
  - Objective: maximize profit
  - Parameters: unit processing cost, unit ingredient costs, and fixed costs
- Conceptually formulate the model

### Influence Diagram

- **Profit**
  - Revenue
  - Total Cost
  - Processing Cost
  - Ingredient Cost
  - Pie Demanded
- **Pie Price**
  - Pie Processing Cost
  - Unit Cost Filling
  - Unit Cost Dough
  - Fixed Cost
Simon’s Pie Case

Step 3: Model Construction

- Construct a symbolic model
  - Profit = Revenue - Total Cost
  - Revenue = Pie Price * Pies Demanded
  - Total Cost = Processing Cost + Ingredients Cost + Fixed Cost
  - Processing Cost = Pies Demanded * Unit Pie Processing Cost
  - Ingredients Cost = Pies Demanded * (Unit Filling Cost + Unit Dough Cost)

Spreadsheet Modeling

- Simon’s Pie case base model
  - Independent demand
  - Dependent demand
    - How much can Simon realistically increase the pie price?
    - For each additional dollar Simon charges per pie, he estimates losing some demand
    - At some pie price, grocery stores would not buy from Simon at all (no demand)
  - Sensitivity (“what-if”) analysis
    - How do “small” changes in apple pie price affect demand and profit?
    - Excel’s Data Table function

Spreadsheet Modeling

- Simon’s Pie base model validation
  - Model validation on processing cost
- Simon’s Pie expanded model
  - Four different types of pies
    - Set the apple pie price
    - All the other pie prices directly related to apple
  - Product contribution margin and combined overhead cost
  - Model validation on processing capacity and overtime
  - Sensitivity (“what-if”) analysis
    - How do “small” changes in apple pie price and capacity affect the profit?