

## SCENARIO, SENSITIVITY ANALYSIS

### Scenario and Sensitivity Analysis in Excel

#### Step 1: Prepare the Base Financial Model

1. Build a financial model (DCF, NPV, or project cash flows) with clearly defined **inputs** and **outputs**.
2. Identify **key inputs** (variables) such as:
  - Revenue growth
  - EBITDA margin
  - Discount rate
  - Capital expenditures
3. Identify the **output metrics** to analyze (valuation, NPV, IRR).
4. Separate **assumptions from calculations** in distinct cells for clarity.

#### Step 2: Identify Key Variables

1. List all variables that significantly affect the output.
2. Decide the **range of variation** for each variable for sensitivity analysis (e.g.,  $\pm 2\%$ ,  $\pm 5\%$ ).
3. Decide **scenario values** for each variable:
  - Base Case → Most likely assumptions
  - Best Case → Optimistic assumptions
  - Worst Case → Pessimistic assumptions

Example Table:

Variable	Base Case	Best Case	Worst Case
Revenue Growth	10%	15%	5%
EBITDA Margin	30%	35%	25%
Discount Rate	10%	9%	12%

### Step 3: Scenario Analysis in Excel

#### Option 1: Manual Calculation

1. Create separate calculation tables for Base, Best, and Worst cases using the scenario assumptions.
2. Record output metrics for each scenario:

Scenario	Valuation (\$M)
Base Case	100
Best Case	130
Worst Case	75

#### Option 2: Using Scenario Manager

1. Go to **Data** → **What-If Analysis** → **Scenario Manager**.
2. Click **Add** to define a scenario:
  - Name: Base Case
  - Changing cells: input variables (Revenue, Margin, Discount Rate)
  - Enter Base Case values
3. Repeat for Best Case and Worst Case.
4. Click **Summary** → Excel generates a table comparing all scenarios.

### Step 4: Sensitivity Analysis in Excel

1. Choose one key variable at a time (e.g., Revenue Growth).
2. Create a **data table** showing how output changes across a range of that variable.

Example Table:

Revenue Growth	Valuation (\$M)
8%	=OUTPUT_CELL
10%	=OUTPUT_CELL
12%	=OUTPUT_CELL

### Automation with Excel Data Table:

1. Select the table range.
2. Go to **Data → What-If Analysis → Data Table**.
3. Set **row or column input cell** as the variable you are analyzing.
4. Excel calculates the output for all values automatically.
5. Repeat for other key variables.
6. Summarize results in a table for comparison:

Variable	Low Case	Base Case	High Case
Revenue Growth	90	100	110
EBITDA Margin	85	100	115
Discount Rate	110	100	90

### Step 5: Visualize the Results

1. **Scenario Analysis:**
  - Use a **bar chart** to compare Base, Best, and Worst case outcomes.
2. **Sensitivity Analysis:**
  - Create a **Tornado Chart**:
    - Rank variables by the size of their impact (High Case – Low Case).
    - Plot horizontal bars.

### Step 6: Interpret Results

1. **Scenario Analysis:**
  - Identify the **range of outcomes** and assess risks vs. opportunities.
2. **Sensitivity Analysis:**
  - Determine **which assumptions are most critical**.
  - Focus management attention on variables with the largest impact.

## Step 7: Combine Scenario and Sensitivity Analysis

1. Use sensitivity analysis results to determine which variables should **vary across scenarios**.
2. Apply high-impact variables to Best, Base, and Worst cases for a **more robust scenario analysis**.
3. This provides a **full spectrum of potential outcomes** while highlighting the key drivers of uncertainty.

## Scenario Analysis in Financial Modeling and Valuation

### 1. Introduction

In finance and business planning, predicting the future is inherently uncertain. Decisions regarding investments, projects, or corporate strategies rely on assumptions about key variables such as revenue growth, costs, interest rates, or market conditions. Scenario analysis is a structured approach used to evaluate **how different possible future scenarios can impact a company's performance or valuation**. Unlike a single-point forecast, scenario analysis considers multiple possible outcomes, helping decision-makers understand both risks and opportunities.

### 2. Definition and Concept

Scenario analysis is a technique that evaluates a financial model under **different sets of assumptions**, usually grouped as:

- **Base Case:** The most likely or expected scenario.
- **Best Case:** Optimistic assumptions that assume favorable conditions.
- **Worst Case:** Pessimistic assumptions reflecting potential challenges or risks.

The fundamental idea is that future events are uncertain, and by examining multiple scenarios, organizations can **prepare for a range of outcomes rather than a single forecast**. Scenario analysis is widely used in corporate finance, investment valuation, project appraisal, and risk management.

### 3. Objectives of Scenario Analysis

The primary objectives of scenario analysis include:

1. **Risk Assessment:**

By modeling worst-case scenarios, companies can identify potential vulnerabilities and develop strategies to mitigate risks.

2. **Opportunity Evaluation:**

Best-case scenarios help decision-makers understand the upside potential of investments or strategies.

3. **Decision Support:**

Scenario analysis provides a structured framework for planning under uncertainty, enabling management to make informed choices.

4. **Strategic Planning:**

Companies can test the impact of different strategic options on financial performance and long-term value creation.

### 4. Key Steps in Scenario Analysis

#### Step 1: Identify Key Variables

Financial outcomes depend on a few critical drivers, such as:

- Revenue growth rates
- Profit margins
- Capital expenditures
- Discount rates
- Market demand or prices

Identifying these drivers allows analysts to focus on the assumptions that have the greatest impact on valuation or cash flows.

## Step 2: Define Scenarios

Develop different scenarios by combining alternative assumptions:

Scenario	Revenue Growth	EBITDA Margin	Discount Rate
Base Case	10%	30%	10%
Best Case	15%	35%	9%
Worst Case	5%	25%	12%

## Step 3: Recalculate Financial Outcomes

For each scenario, recalculate metrics such as:

- Net Present Value (NPV)
- Discounted Cash Flow (DCF) valuation
- Earnings Before Interest and Taxes (EBIT)
- Free Cash Flow (FCF)

This allows comparison of outcomes across scenarios.

## Step 4: Analyze Results

Compare the outputs to identify:

- The **range of potential outcomes**
- Which variables have the largest effect on performance
- Strategic implications for risk management or investment decisions

## Advantages of Scenario Analysis

1. Provides a **range of outcomes**, not just a single estimate.
2. Helps in **risk management** by highlighting potential vulnerabilities.
3. Supports **strategic planning** and scenario-based decision-making.
4. Enhances **stakeholder confidence** by showing thorough analysis.

## 7. Limitations

1. Relies on **assumptions**, which may not capture all real-world complexities.
2. Does not assign probabilities to scenarios (unless combined with probability modeling).
3. Can become **complex and time-consuming** if many variables and scenarios are analyzed.

## 8. Applications

Scenario analysis is widely used in:

- **Corporate Finance:** Evaluating investment projects and capital budgeting decisions.
- **Valuation:** Assessing how different market conditions affect company value.
- **Risk Management:** Stress testing for financial institutions.
- **Strategic Planning:** Analyzing the impact of market changes, new regulations, or technological disruptions.

# Sensitivity Analysis in Financial Modeling and Valuation

## 1. Introduction

In financial modeling and corporate valuation, future outcomes are uncertain because they depend on multiple assumptions. Small changes in key variables—such as revenue growth, profit margins, or discount rates—can have significant effects on valuation. **Sensitivity analysis** is a structured technique used to evaluate how changes in individual assumptions impact financial outcomes.

Unlike scenario analysis, which changes multiple variables at once to examine specific scenarios, sensitivity analysis focuses on **one variable at a time** to quantify its effect on an output, such as net present value (NPV), discounted cash flow (DCF) valuation, or internal rate of return (IRR).

## 2. Definition and Concept

### Definition:

Sensitivity analysis is a financial modeling method used to determine **how sensitive a particular outcome is to changes in one or more input variables**. It answers questions like: *“If revenue growth increases by 1%, how much will valuation change?”*

### Conceptual Idea:

- Identify key assumptions driving financial outcomes.
- Vary one assumption while holding others constant.
- Measure the impact on results.

This method allows analysts to **identify which assumptions are most critical** to a company's financial performance or valuation.

## 3. Objectives of Sensitivity Analysis

The main objectives include:

### 1. Risk Identification:

- Detect which assumptions could significantly impact financial outcomes if they deviate from expectations.

### 2. Decision Support:

- Provide management with insight into which variables require close monitoring.

### 3. Investment Evaluation:

- Help investors understand the potential variability in returns based on key assumptions.



#### 4. Strategic Planning:

- Allow businesses to stress-test their financial models under realistic variations.

### 4. Key Steps in Sensitivity Analysis

#### Step 1: Identify Key Variables

Variables with significant influence on valuation or performance must be identified. Common examples:

- Revenue growth rate
- EBITDA margin
- Capital expenditures (CapEx)
- Working capital requirements
- Discount rate
- Terminal growth rate

#### Step 2: Determine Base Case

Develop a financial model using your most likely assumptions. For example, in a DCF valuation:

Variable	Base Case Value
Revenue Growth	10%
EBITDA Margin	30%
Discount Rate	10%
Terminal Growth	3%

#### Step 3: Vary Each Variable

Change one variable at a time while keeping others constant. For example:

Revenue Growth	Valuation (\$M)
8%	90
10%	100
12%	110

This shows how valuation responds to changes in revenue growth.

## Step 4: Analyze Results

- Identify the **most sensitive variables**—those that cause the largest change in the output.
- Use this insight for **risk management and decision-making**.

## Visualization in Sensitivity Analysis

### Tornado Diagram:

A tornado chart is often used to visualize sensitivity. The variables are ranked by their impact on the output, with the **most sensitive variables at the top**.

- Horizontal bars represent the range of outcomes.
- The longer the bar, the more impact the variable has.

Example:



## Advantages of Sensitivity Analysis

1. **Identifies Critical Variables:**
  - Shows which assumptions have the largest effect on outcomes.
2. **Risk Management:**
  - Helps prioritize monitoring and mitigation of critical risks.
3. **Decision-Making Tool:**
  - Supports management in evaluating investment and strategic decisions.
4. **Improves Transparency:**
  - Demonstrates how robust a valuation or model is to changes in assumptions.

## **Limitations of Sensitivity Analysis**

- 1. Single Variable Focus:**
  - Varies one variable at a time; interactions between variables are not captured.
- 2. No Probability Assignment:**
  - Does not indicate the likelihood of outcomes; it only shows the range of impact.
- 3. Simplistic in Complex Models:**
  - For complex systems with many interdependent variables, sensitivity analysis alone may not provide full insight.
- 4. Data Accuracy Dependency:**
  - Results are only as reliable as the input assumptions.

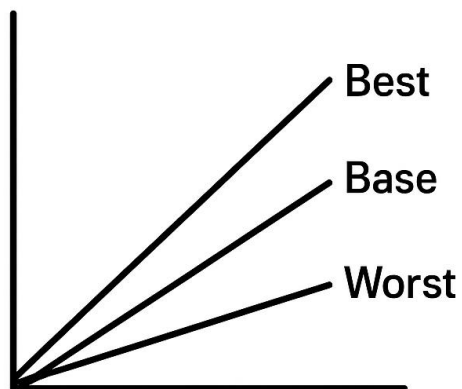
## **Applications of Sensitivity Analysis**

- 1. Corporate Finance:**
  - Evaluate project viability and capital budgeting decisions.
- 2. Valuation:**
  - Determine which assumptions most influence company value in DCF, NPV, or IRR analysis.
- 3. Investment Analysis:**
  - Stress-test expected returns on investments under different conditions.
- 4. Risk Management:**
  - Assess financial exposure and identify key risk factors.
- 5. Strategic Planning:**
  - Model the impact of operational or market changes on performance.

### Comparison with Scenario Analysis

Feature	Sensitivity Analysis	Scenario Analysis
Approach	Change <b>one variable at a time</b>	Change <b>multiple variables simultaneously</b>
Purpose	Identify critical assumptions	Evaluate overall risk/reward in different scenarios
Output	Sensitivity of output to each variable	Range of outcomes under defined scenarios
Usefulness	Risk prioritization, model robustness	Strategic planning, planning for uncertainty

### SCENARIO ANALYSIS



### SENSITIVITY ANALYSIS

