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Sensitivity Analysis: A Comprehensive Guide**

What is Sensitivity Analysis?

Sensitivity analysis is a technique used to assess the impact of changes in input variables on the outcome of a model or decision. It helps determine the robustness of a model and identify the parameters that have the greatest influence on the results.

How to Analyze Sensitivity Analysis

1. **Identify Sensitive Parameters:** Examine the results to identify the input parameters that cause significant variations in the outcome. Parameters with high sensitivity indices indicate that small changes in their values can have a substantial impact on the output.

2. **Understand Parameter Interactions:** Analyze the interactions between parameters to determine if they have cumulative or compensating effects. Some parameters may work together to amplify or dampen the sensitivity of the model.

3. **Assess the Range of Possible Outcomes:** Explore the potential range of outcomes by varying the values of sensitive parameters within realistic bounds. This will provide insights into the model's stability and the potential risks and rewards associated with different scenarios.

Types of Sensitivity Analysis

- **One-Way:** Examines the impact of changing a single input parameter while keeping all others constant.
- **Multi-Way:** Simultaneously varies multiple input parameters to assess their combined impact.

Role of Sensitivity Analysis in Linear Programming

In linear programming, sensitivity analysis is crucial for determining the optimal solution's stability. It provides information about:

- **Allowable Changes:** The maximum or minimum amount input parameters can change without altering the optimal solution.
- **Objective Function:** The magnitude of the change in the objective function if the parameters deviate from their optimal values.

What-If Analysis and Sensitivity Analysis

What-if analysis is a type of sensitivity analysis that explores hypothetical scenarios. By manually or automatically varying input parameters, analysts can observe the resulting changes in the outcome. This helps assess the impact of potential events or decisions.

How to Do Sensitivity Analysis in SPSS

SPSS offers several methods for sensitivity analysis, including:

- **One-Sample Sensitivity Test:** Compares the results of a model with and without a specific input variable to determine its significance.
- **Tornado Diagram:** Visually depicts the sensitivity of the model to key input parameters.

How to Solve Sensitivity Analysis Problems

Solving sensitivity analysis problems involves:

1. **Defining the Model:** Specify the input parameters, objective function, and constraints of the model.

2. **Performing Sensitivity Analysis:** Apply sensitivity analysis techniques to identify sensitive parameters and assess their impact.
3. **Drawing Conclusions:** Interpret the results and make informed decisions based on the sensitivity analysis findings.

Formula for Sensitivity Analysis

The sensitivity index (SI) for one-way sensitivity analysis is calculated as:

SI = (Change in Output) / (Change in Input)

Example of a Sensitivity Analysis Question

"What is the impact on project profitability if the revenue forecast decreases by 10%?"

Example of Sensitivity Analysis Usage

A sensitivity analysis may be used to assess the potential impact of government regulations on the financial performance of a company.

Validating Sensitivity Analysis

- **Use Realistic Parameters:** Ensure that the input parameters are plausible and within the model's applicable range.
- **Test Extreme Values:** Explore both extreme and moderate variations in input parameters to verify the model's stability.
- **Compare to Empirical Data:** If possible, compare the model's predictions with actual historical or experimental data.

Assessing and Determining Analytical Sensitivity

- **Correlation Analysis:** Examine the correlation between input and output variables to identify potential relationships.
- **Confidence Intervals:** Calculate confidence intervals around the model's predictions to account for uncertainty in the input parameters.
- **Statistical Significance Tests:** Conduct hypothesis tests to determine if the observed sensitivity is statistically significant.

Sensitivity Analysis in DCF

In discounted cash flow (DCF) analysis, sensitivity analysis can assess the impact of changes in key assumptions, such as discount rate, terminal growth rate, and operating expenses. This helps evaluate the robustness of the DCF valuation and mitigate investment risks.

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