Introduction to Risk Management and Simulation Analysis

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“Only those who risk going too far can possibly find out how far they can go”, *T.S. Eliot*

Risk Realm

- The entire realm of risk analysis is very extensive
- We focus on applied business risk modeling and analysis
- Operational risk, Market risk, Credit risk, Liquidity risk, Country risk and so on

Risk & Uncertainty

- Risk and uncertainty are related but different
- Risk: Unknown outcomes whose odds of happening can be measured or at least learned about
- Uncertainty: Events whose outcomes cannot be measured and cannot be learned about

Level of Uncertainty

- Three levels of “uncertainties” in the world
  - The known: Contractual obligations or a guaranteed event
  - The unknown: Events that carry risk that will be reduced/eliminated over time
  - The unknowable: Events that carry risk that may not change over time (Natural disasters, wars, terrorist acts).

Level of Uncertainty

- Risk analysis: Handle unknown and unknowable factors
- *It is for the unknown factors that risk analysis will provide the most significant amount of value*
- How we handle the unknowable factors?

Dealing with Risk: The “old” and the “new” way

Dealing with Risk: A Primer

Name of Project	Cost	Expected Net Return	Risk
Project A	$50	$50	$25
Project B	$250	$200	$100
Project C	$100	$100	$10

Dealing with Risk: A Primer

Name of Project	Cost	Expected Net Return	Risk
Project C	$100	$100	$10

The best projects tend to be those with the “best bang for the buck”
A popular extension: Risk Adjusted Return on Capital

Risk Analysis: The “old” Way

- In the past, most decision makers look only to single- point estimates of a project’s profitability.
- How much do you trust single point estimates?
  - Probability of occurrence?
  - Interdependencies?

Risk Analysis: The “old” way

- Expected Unit Sales (Q): 1500
- Expected Sales Price (P): $10.0
- Expected Cost/Unit (VC): $7.0
- Expected Initial/Fixed Cost (FC): $2,500
- Expected Net Revenue: $Q \times (P - VC) - FC = \$2{,}000$

Risk Analysis: Toward the “new” way

- Scenario Analysis
  - Expected Unit Sales: 1,500 (Most likely)
    2,000 (Best Case)
    500 (Worst Case)
  - Expected Sales Price: $10.00
  - Expected Cost/Unit: $7.00
  - Fixed Cost: : $2,500
  - Expected Net Revenue: $2000 (-$1,000 ; $3,500)

Risk Analysis: Toward the “new” way

- Scenario Analysis
- Outcomes are too variable
- Interdependencies are not addressed (Similar to single point estimates)
- An interesting extension: Tornado Analysis

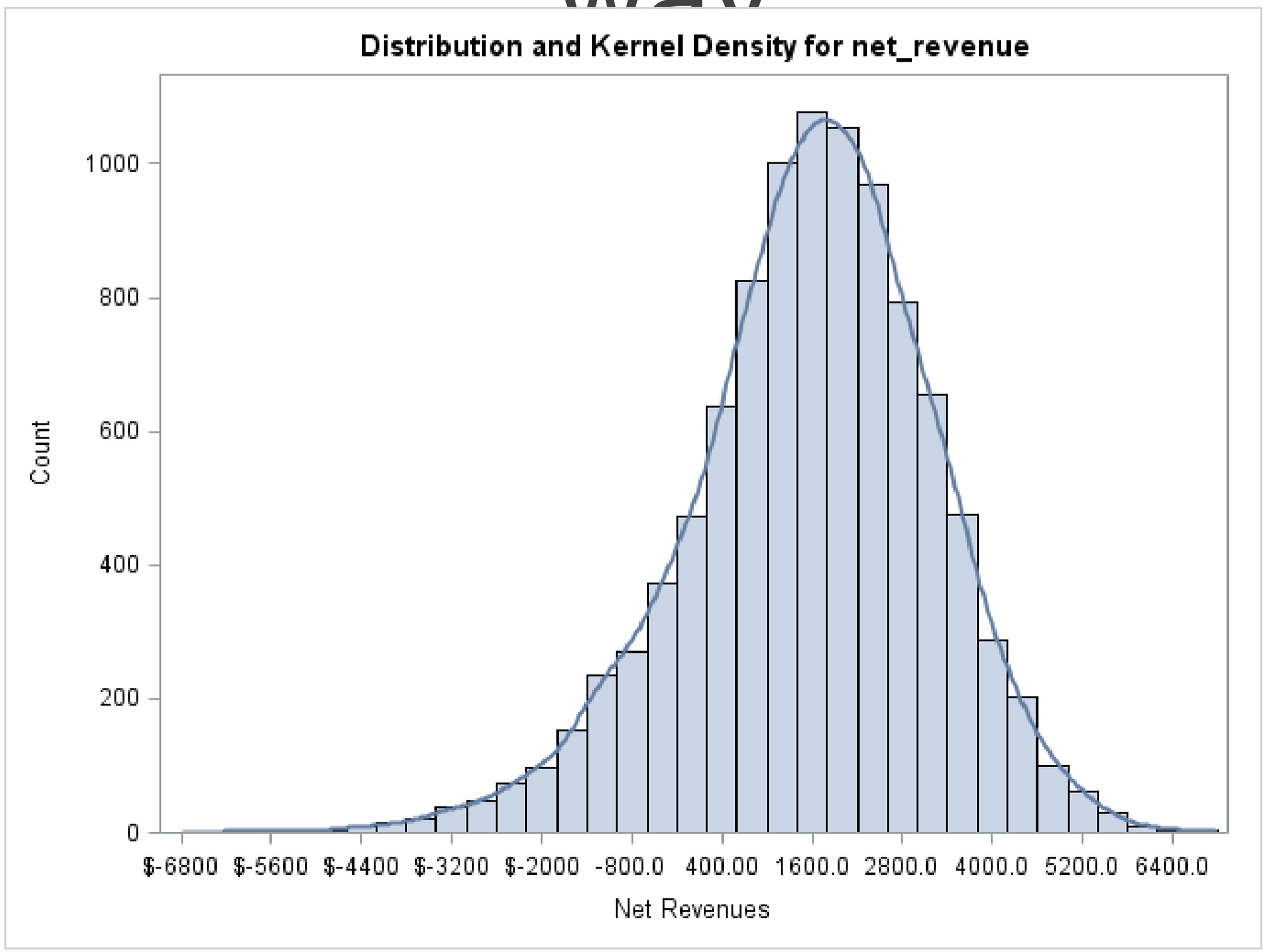
Risk Analysis: Toward the “new” way

- Sensitivity Analysis
  - What will happen if fixed costs increase by $1?
  - What if variable costs increase by $0.5?
  - What if unit sales increase by 2?
- Captures marginal costs
- Great in capturing sensitivities
- Which outcome will finally occur?

Risk Analysis: The “new” way

- Monte-Carlo Simulation
  - Simulate Unit Sales, Unit Price and Variable Cost
  - Account for correlations between the different variables
- The final output is a probability distribution of all possible outcomes

RISK ANALYSIS: The “new” way



RISK ANALYSIS: The “new” way

- SAS Example: intro_simulations_revenues.sas
- Risk Solver platform example: intro_simulations_revenues.sas
  - “Simulations” Worksheet
- Risk Solver Sensitivity Analysis
  - “Sensitivity” Worksheet

Risk Analysis: The “new” way

- Parametric Monte Carlo simulation
    - Specific distributional parameters are required before a simulation can begin.
- Nonparametric simulation
    - Raw historical data is used to tell the story and no distributional parameters are required for the simulation to run.

Questions-Comments


THANK
YOU