INTRODUCTION TO RISK MANAGEMENT

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INTRODUCTION TO RISK

Risk Realm

- “Only those who risk going too far can possibly find out how far they can go.”

  - T.S. Eliot

- The entirety of risk analysis is a very extensive space.
- Focus is on applied business risk modeling and analysis.
- Examples:
  - Market Risk
  - Operational Risk
  - Credit Risk
  - Liquidity Risk

Risk vs. Uncertainty

- Risk and uncertainty are related, but different than each other.
- Risk is something that someone bears.
- **Risk** is the outcome of **uncertainty**.

- **Once you have an uncertain event and you can put some distribution to it, you can measure the risk associated with that event.**
- Just because there is uncertainty, there could very well be no risk.
  - Example – Flipping a coin with no care of the outcome.

Levels of Uncertainty

- There are 3 levels of uncertainty in the world:
  1. The **known** – guaranteed event
  2. The **unknown** – events that carry risk that will be reduced/eliminated over time as the event gets closer.
  3. The **unknowable** – events that carry risk that may not change over time as the event gets closer.

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Risk analysis provides the most value for the unknown factors, but also can handle unknowable factors.

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

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- Best projects tend to be those with the return for the amount invested.
- Popular extension – Risk Adjusted Return on Capital

Dealing with Risk: A Primer

Name of Project	Cost	Net RETURN	Risk	RAROC
Project A	$50	$50	$25	2.0
Project B	$250	$200	$100	2.0
Project C	$100	$100	$10	10.0

- Best projects tend to be those with the return for the amount invested.
- Popular extension – Risk Adjusted Return on Capital

DEALING WITH RISK

THE “OLD” WAY

The "Old" Way

- In the past, most decision makers looked only to single point estimates of a project's profitability.

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- How much do you trust single point estimates?
- What is the probability on a continuous distribution that these exact values will occur?

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- How much do you trust single point estimates?
- What is the probability on a continuous distribution that these exact values will occur? **ZERO**

Example of The "Old" Way

- Expected Unit Sales (Q): 1500
- Expected Sales Price (P): $10.00
- Expected Cost/Unit (VC): $7.00
- Expected Initial/Fixed Cost (FC): $2,500

- Expected Net Revenue:

$$NR = Q \times (P - VC) - FC$$

$$NR = 1500 \times (\$10 - \$7) - \$2500$$

$$NR = \$2{,}000$$

DEALING WITH RISK

TOWARD THE “NEW” WAY

Scenario Analysis

- People then started accounting for possible extreme values in their estimation of some of the inputs.
- This introduced the initial idea of risk into these calculations.

Example of Toward The "New" Way

- Expected Unit Sales (Q): 1500 (Most Likely)
  2000 (Best Case)
  500 (Worst Case)
- Expected Sales Price (P): $10.00
- Expected Cost/Unit (VC): $7.00
- Expected Initial/Fixed Cost (FC): $2,500

- Expected Net Revenue:

$$NR = \$2{,}000$$

$$NR\ Range = (-\$1{,}000, \$3{,}500)$$

Scenario Analysis

- People then started accounting for possible extreme values in their estimation of some of the inputs.
- This introduced the initial idea of risk into these calculations.
- **Outcomes are too variable in this type of analysis.**
- **Doesn’t account for interdependencies.**

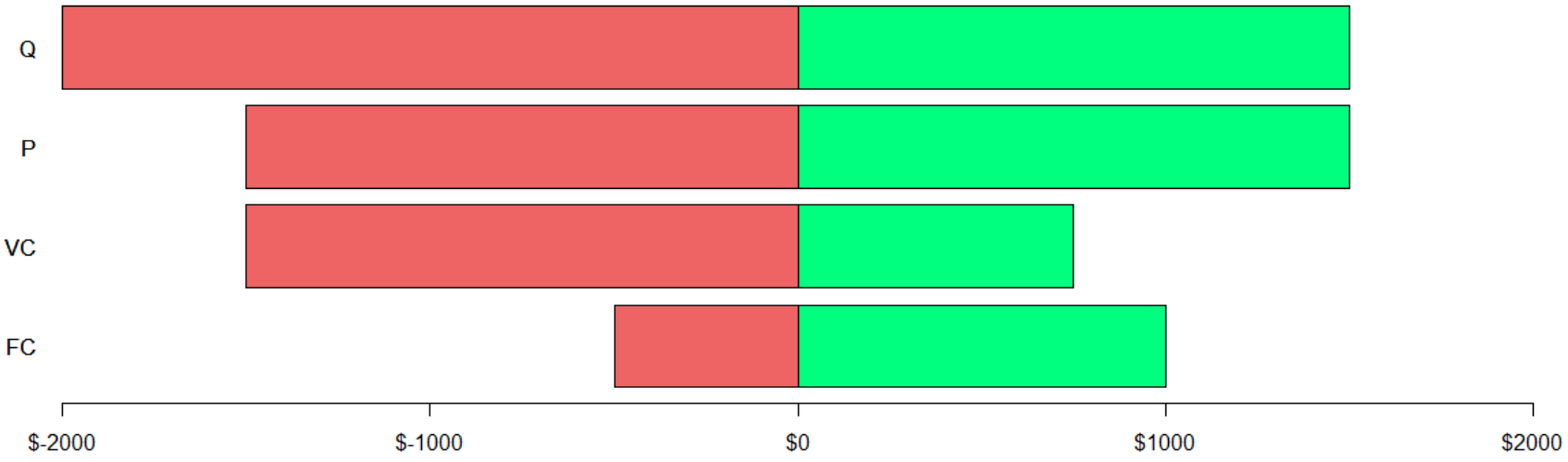
Scenario Analysis

- Popular Extension – **Tornado analysis** where you look at the best and worst case scenarios for each of the inputs and look at the highest impact.

- Expected Unit Sales (Q): 500, 1500, 2000
- Expected Sales Price (P): $9.00, $10.00, $11.00
- Expected Cost/Unit (VC): $6.50, $7.00, $8.00
- Expected Initial/Fixed Cost (FC): $1,500, $2,500, $3,000

Scenario Analysis

- Popular Extension – **Tornado analysis** where you look at the best and worst case scenarios for each of the inputs and look at the highest impact.



Sensitivity Analysis

- Sensitivity analysis was the next extension.
  - What will happen if fixed costs increase by $1?
  - What if the variable costs increase by $0.50?
  - What if unit sales increase by 2?
- Captures marginal costs.
- Great at capturing sensitivities.
- What is the probability of different possible outcomes?

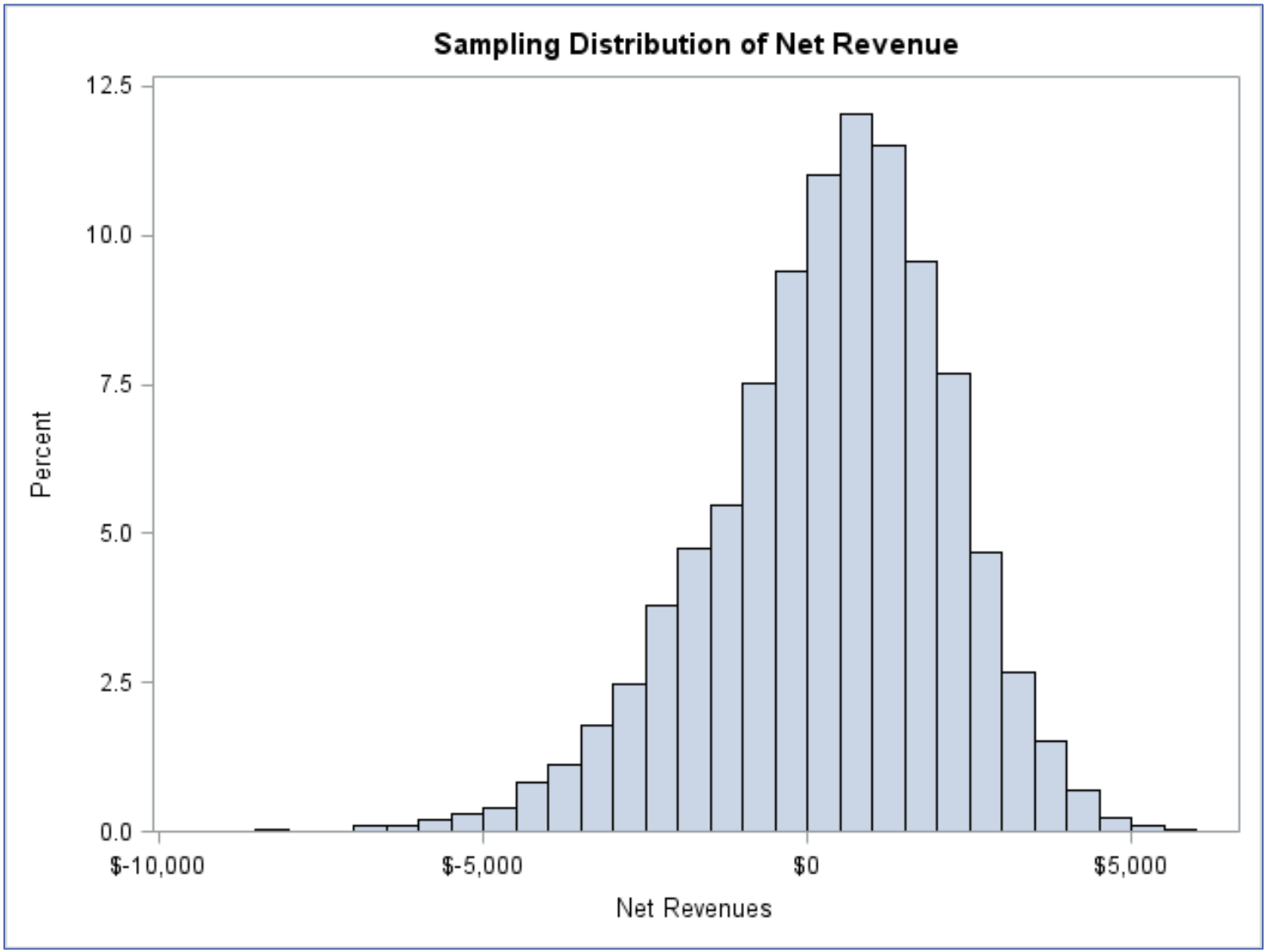
DEALING WITH RISK

THE “NEW” WAY

Monte Carlo Simulation

- Simulation analysis allows us to account for all of the possible changes in all these variables and the possible correlations between them.
- The final output is a **probability distribution of all possible outcomes**.

Monte Carlo Simulation



Monte Carlo Simulation

- Parametric Monte Carlo Simulation
  - Specific distributional parameters are required before a simulation can begin.

- Nonparametric Monte Carlo Simulation
  - Raw historical data is used to estimate the distribution and no distributional parameters are required for the simulation to run.