Visualizing Variability

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The Power of Visualization

• Ability to understand scale of key relationships quickly.
• Not just important for explanation to management.
• Important for our own understanding as well.
The Challenge with Visualizing Variability

- The type of variability we deal with is, by its nature, two dimensional (amount and probability).
- Additional dimensions (strategy alternatives, for example) become difficult to “see”
- Particular interest in tails, but the rest matters too.
- Skewness can be extreme and makes it more challenging to see both the tail
- Often interested in marginal impact - lost in scale
- Non-additivity of components (i.e. diversification)
Nice and Normal

[Graph showing a normal distribution curve with the x-axis labeled 'Millions.']
Introduce Skewness
More Skewness - Cat

Probabilty Density

Millions
Cumulative Distribution Function

![Cumulative Distribution Function Graph](image)

- X-axis: Millions
- Y-axis: Cumulative Probability

GROSS CONSULTING
Problem: Skewness

- Log scale – pro and con
- Cat convention – Return period
- Point is not just to see the numbers, but to understand the numbers
- Time is on our side
- CDF of maximum event over an N year period = $F(X)^N$, where $F(X)$ is the CDF of the maximum event for a 1 year period (assuming independence across years).
Problem 1: Skewness
Problem 1: Skewness

![Graph showing probability density versus largest event in 10 years (Millions)]
Problem 1: Skewness

• Central Limit Theorem at work
• Aggregation over time is not the only type of aggregation that works to help with skewness.
• For example, visualizing the stand-alone loss variability for a specific insurance account is typically pointless.
• Aggregated risk is much more visible and understandable.
• Highlights the importance of what really matters – marginal impact to aggregated risk...
Problem 2: Marginal Impact
Problem 2: Marginal Impact

<table>
<thead>
<tr>
<th></th>
<th>Profit Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>(75) (50) 25</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>(75) (50) 25</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>(75) (50) 25</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>(75) (50) 25</td>
</tr>
</tbody>
</table>
Problem 2: Marginal Impact

![Graph showing marginal impact comparison between Baseline, Alternative 1, Alternative 2, and Alternative 3. The graph plots millions of units against percentage increase.]
Problem 2: Marginal Impact

![Graph showing expected value of profit and standard deviation for different alternatives. The x-axis represents millions of dollars, and the y-axis represents expected value of profit in millions. Points for Baseline, Alt 1, Alt 2, and Alt 3 are plotted.]
Problem 2: Marginal Impact

![Graph showing expected value of profit and 10th percentile of profit for different alternatives.]

- Alt 1
- Alt 2
- Alt 3
- Baseline

Expected Value of Profit (Millions)

10th Percentile of Profit (Millions)
Problem 2: Marginal Impact

![Graph showing expected value of profit and 1st percentile of profit for different alternatives.]

- **Expected Value of Profit**: Millions
- **1st Percentile of Profit**: Millions

- **Baseline**
- **Alt 1**
- **Alt 2**
- **Alt 3**
Problem 2: Marginal Impact

![Graph showing profit difference versus percentile for Alternative 1. The graph indicates a declining trend in profit difference as the percentile increases.](image-url)
Problem 2: Marginal Impact

![Graph showing profit difference and percentile for two alternatives.](image-url)
Problem 2: Marginal Impact
Problem 3: Diversification

<table>
<thead>
<tr>
<th>Risk</th>
<th>Standard Deviation</th>
<th>Correlation Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk 1</td>
<td>3.16</td>
<td>Risk 1</td>
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<tr>
<td>Risk 2</td>
<td>2.24</td>
<td>1.00</td>
</tr>
<tr>
<td>Risk 3</td>
<td>1.73</td>
<td>0.00</td>
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<tr>
<td>Risk 4</td>
<td>1.41</td>
<td>0.73</td>
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<tr>
<td>Risk 5</td>
<td>1.00</td>
<td>0.22</td>
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<tr>
<td>Combined</td>
<td>5.92</td>
<td>0.32</td>
</tr>
</tbody>
</table>
Problem 3: Diversification

![Chart showing standard deviation for different risks]

- Risk 1: High standard deviation
- Risk 2: Moderate standard deviation
- Risk 3: Slightly lower standard deviation
- Risk 4: Even lower standard deviation
- Risk 5: Lowest standard deviation
Problem 3: Diversification

![Bar chart showing standard deviation and risk levels](chart.png)
Problem 3: Diversification
Problem 3: Diversification
Problem 3: Diversification

RiskCircle™

Risk 1
Risk 2
Risk 3
Risk 4
Risk 5
RiskCircle™

Area of wedge represents stand-alone risk amount
RiskCircle™

Angle represents risk attribution

- Risk 1
- Risk 2
- Risk 3
- Risk 4
- Risk 5
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Area of inner circle represents aggregated risk

Risks:
- Risk 1
- Risk 2
- Risk 3
- Risk 4
- Risk 5
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Area outside of the inner circle is risk diversified away

Risk 1
Risk 2
Risk 3
Risk 4
Risk 5
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Create your own at www.riskcircle.com
Questions?