

FINANCIAL RISK ANALYSIS AND MANAGEMENT

Presented By:

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General Process Flow

- **IDENTIFY** the uncertainties that matter, the true risks.
- **ASSESS** the costs associated with each risk, and how they relate.
- **CHOOSE** the risk control technique(s) most appropriate.
- **IMPLEMENT** the chosen techniques.
- **EVALUATE** and adjust as necessary.



Identification

- Effective risk identification requires taking the perspective of the firm as a whole.
- Examining each risk in isolation is never better than considering it in the context of the whole, and can be deceptive.
- Look for subtle risks that may not be directly observable, but can amplify the observable risks (liquidity, for instance).



Assessment

- Quantify the cost each risk.
- Quantify the relationship among the risks (few risks exist in a vacuum).
- “Closed form” descriptions aren’t needed (an historical histogram may be better than the “generally accepted” probability density).
- First describe the reality, and then build the necessary abstraction.



Management Techniques

- Risk Avoidance – You don't have to retain every risk. Do you have a relative advantage?
- Risk Transfer – Three ways: hedging, insuring, and diversifying.
- Risk Retention – Where you have a relative advantage, and the consequences are not lethal, you may want to accept the risk.

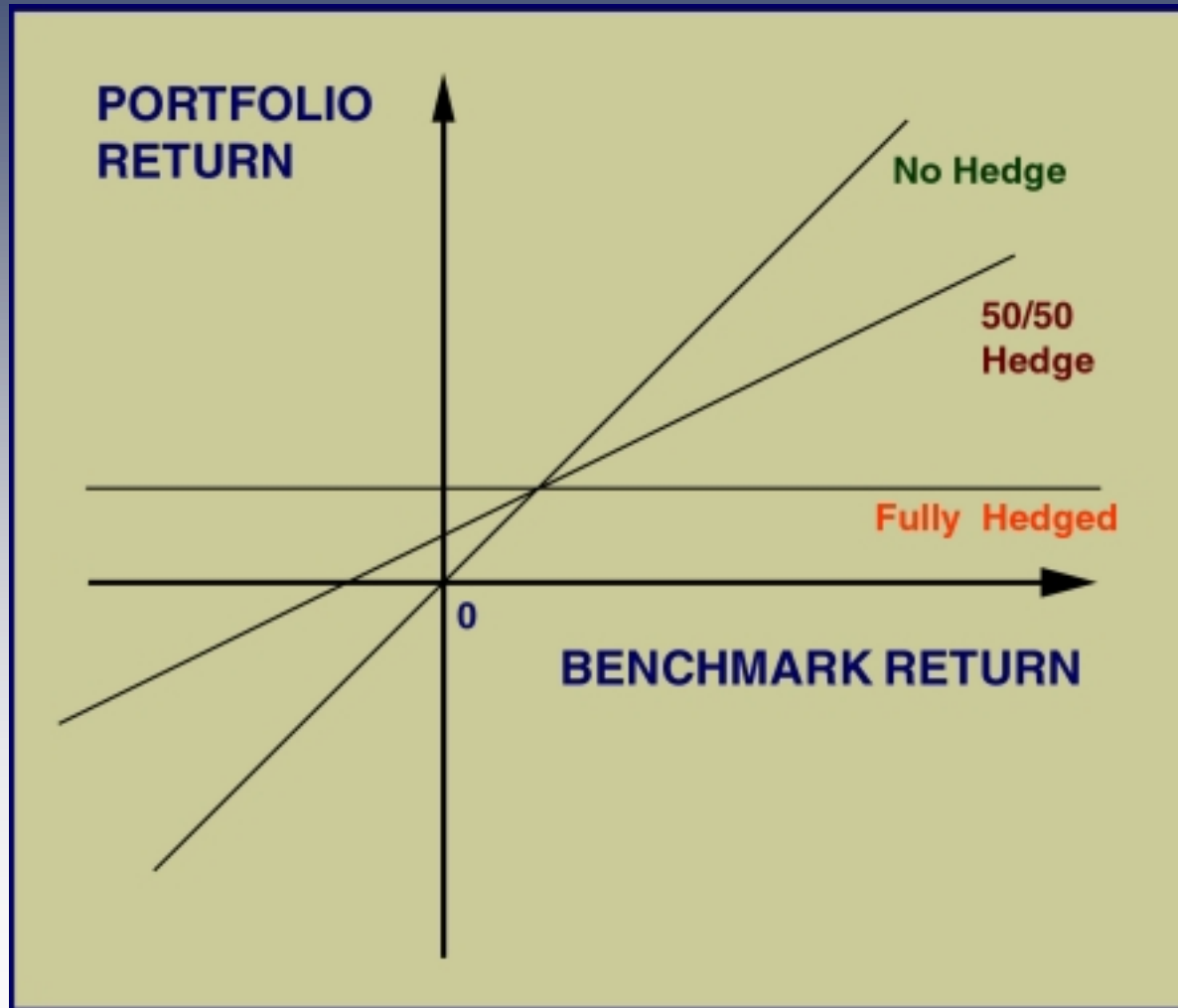


Risk Transfer

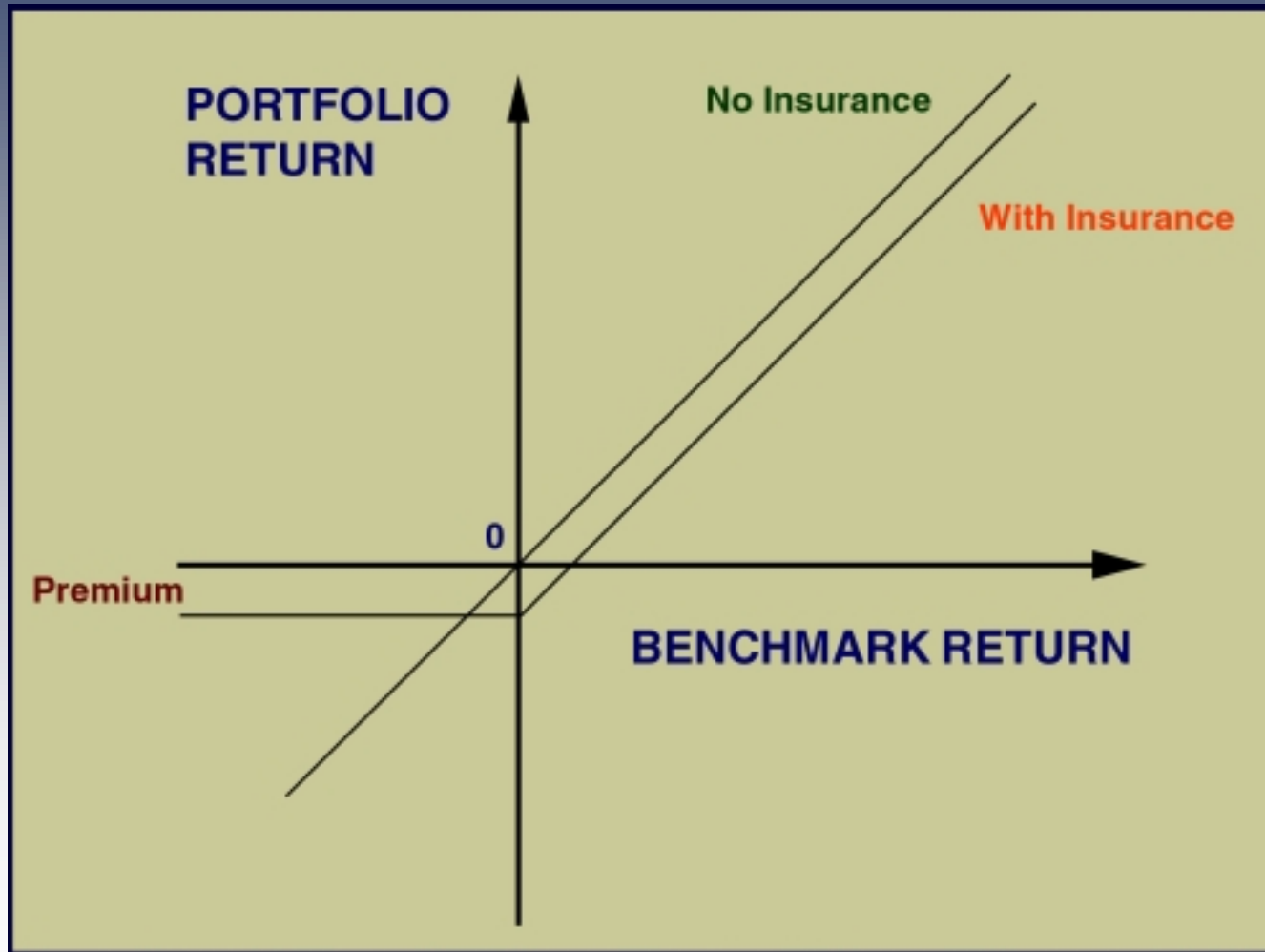
- Hedging – limiting gain and loss proportionately.
- Insuring – paying a premium to avoid the downside while retaining the upside.
- Diversifying – reducing the span of outcomes at some sacrifice of upside potential.



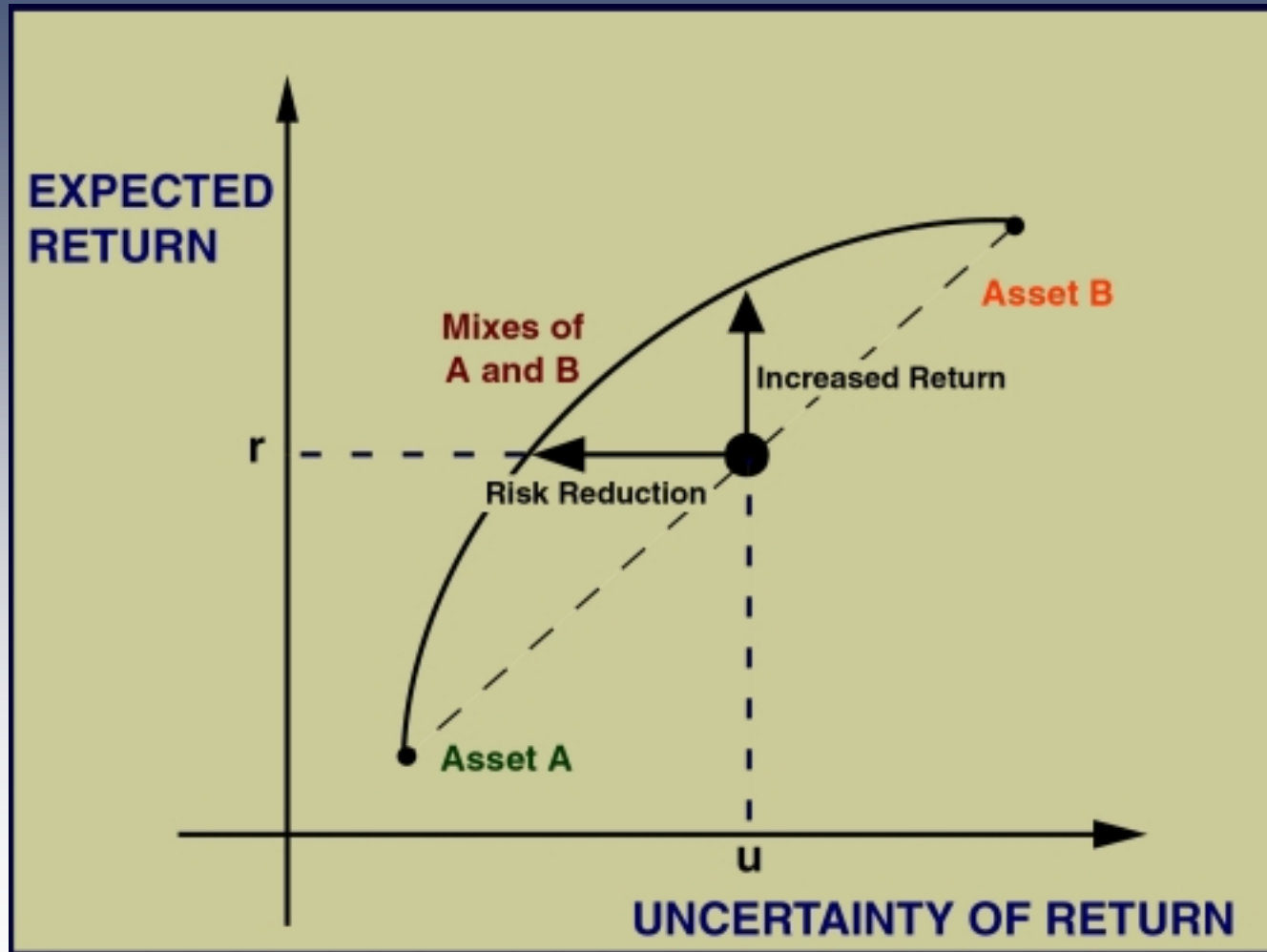
Hedging Payoff Diagram



Insurance Payoff Diagram



Diversification Payoff Diagram



Diversification Analysis – Scenario or “State” Approach

	S1	S2	S3	S4	E(v)	PR Loss
Asset 1 (A1)	4	0	0	4	2	50%
Asset 2 (A2)	0	4	0	4	2	50%
$\frac{1}{2} A1 + \frac{1}{2} A2$	2	2	0	4	2	25%

Assumptions:

1. Payoff in each “State” assumes one unit of investment in either Asset 1 or Asset 2.
2. States 1 – 4 equally likely, and exhaustive.



Dimensions of Financial Risk

- **Financial risk** measures the likelihood and magnitude of loss, and is represented either by a probability density function, or by outcomes in various “states of the world.”
- **Financial risk analysis** estimates individual, and joint loss density functions.
- **Financial risk management** uses hedging, insurance, and diversification to optimally manage the risk of loss.



Value at Risk (VaR)

- VaR is the currently accepted paradigm for representing the loss probability function.
- Philippe Jorion defines VaR-type risk as quantifying potential loss under “normal” market conditions.
- “Normal” market conditions are those conditions for which the currently accepted risk models adequately represent reality (somewhat circular reasoning).



Stress Testing

- Stress testing extends the parameters of the VaR model (typically the volatility and correlation parameters) beyond their normal ranges.
- Monte Carlo simulation methods may be used to free VaR from its typical “closed form” probability density assumptions.



Scenario or “States of the World” Analysis

- Scenario analysis evaluates the portfolio of risks in various “States of the World”.
- Systematically analyzes the risks inherent in scenarios, but is not as formulaic as VaR.
- Scenario analysis is more intuitive than VaR, and frequently can be performed by a management team rather than by quantitative analysts.
- Monte Carlo simulation can be useful in combining various states of the world into broad planning scenarios.



Correlation of Risks

- The most interesting estimation, and the one most fraught with danger, is that of the correlation matrix of risks.
- Doctor's warn, "The chart is not the patient". Financial engineers should warn, "The estimate is not the reality".
- The firm named Long Term Capital Management (LTCM) is the "poster child" for the risks of correlation estimation.



Correlation of Risks (2)

- The sophisticated math of probability and statistics is often sabotaged by historical data.
- Inferences drawn from historical statistical relationships are often most wrong when they are most critical.



What Should We Infer?

- 1,000 serial observations of the return of two assets, A and B, show 950 instances where A and B's return's are opposite in sign and roughly equal in magnitude, while 50 show both A and B to be negative.
- The statistical correlation of A and B's returns is strongly negative.
- We naturally infer that A and B are diversifying in a portfolio, and serve to lower its risk.



The Rest of the Story

- Deeper analysis reveals that all 950 observations showing negative correlation between A and B occur when an underlying state variable is in state S1, while the 50 positive correlations occur when the underlying state is S2.
- Now we would infer that A and B diversify a portfolio in the frequently occurring state S1, but they are reinforcing in state S2. Sadly, state S2 may be a crucial state.
- The lesson from this example is obvious, but generally ignored.



Correlation Lessons

- It is vital to understand the causes for correlation and to be alert to changing underlying factors.
- It doesn't matter how frequently success occurs, if failure is catastrophic.
- The really important factors in risk management and control are often not easily observed or measured.



Good Risk Management

- Separate risk management into two activities; one for the frequent condition of “normal” markets, the other for “non-normal” markets.
- For normal market conditions, apply the largely statistical and routine procedures of VaR.
- For non-normal markets, create a management-lead “scenario analysis” process.



Preparing for Non-normal Markets

- This is a strategic, line management function and should be lead by a senior line manager.
- Develop scenarios that could lead to non-normal markets.
- Identify “signals” that would foreshadow each scenario.



Preparing for Non-normal Markets (2)

- Create a “playbook” of responses for each scenario, including identifying a crises team.
- Look across the playbook for quasi-universal responses across scenarios. Be prepared to quickly implement these common responses.
- Occasionally, have a “fire drill” to test your playbook and crises team.



Financial Engineering and Risk Management

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