Financial Risk Management

Spring 2016

Dr. Ehud Peleg

Class 1 - Introduction

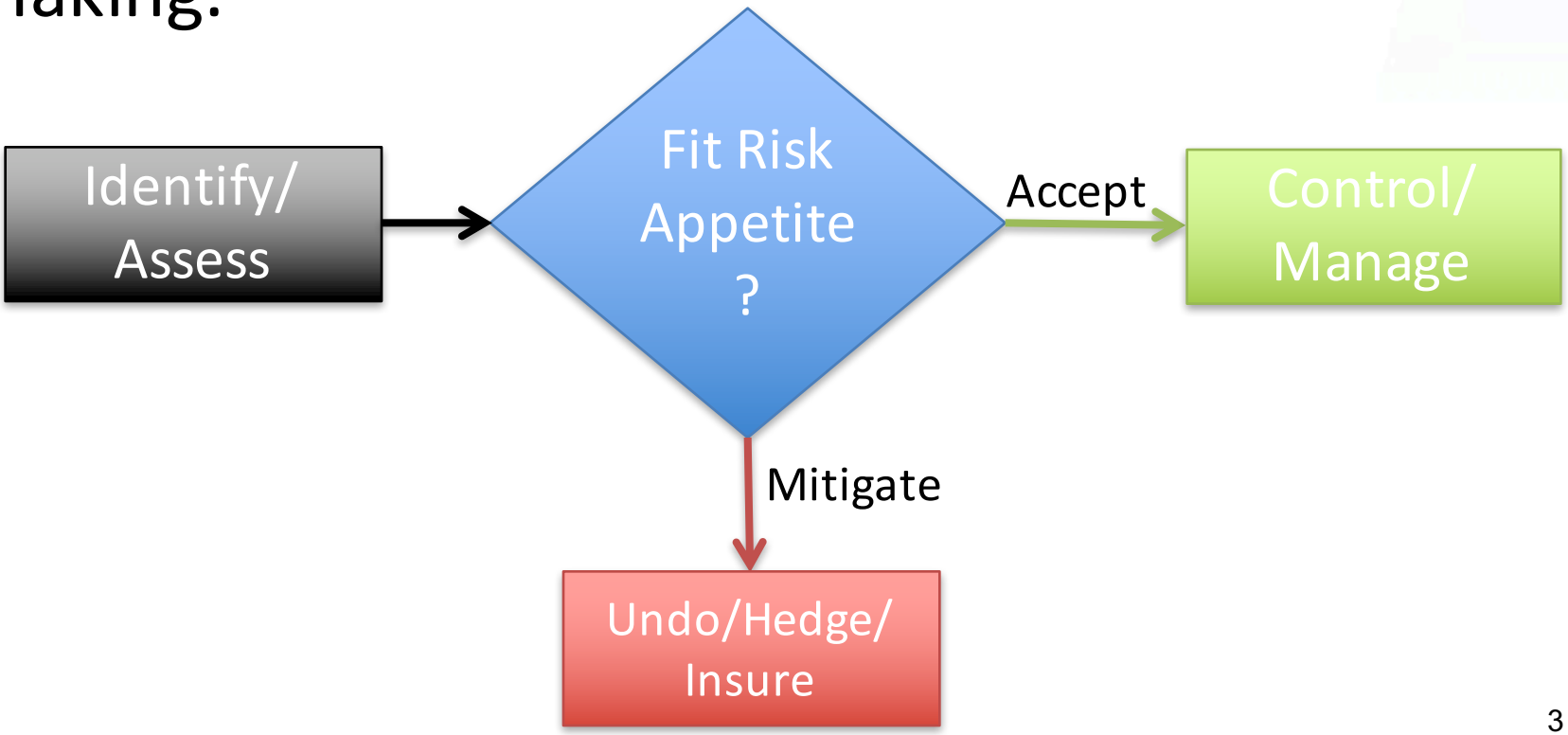
UCLA Anderson
THINK IN THE NEXT

Agenda

- What is risk management?
- Risk Appetite Framework
- Syllabus
- Course Topics

Risk Management

A process for identification, assessment, control, or mitigation of risks in business decision making.



Risk Appetite Framework

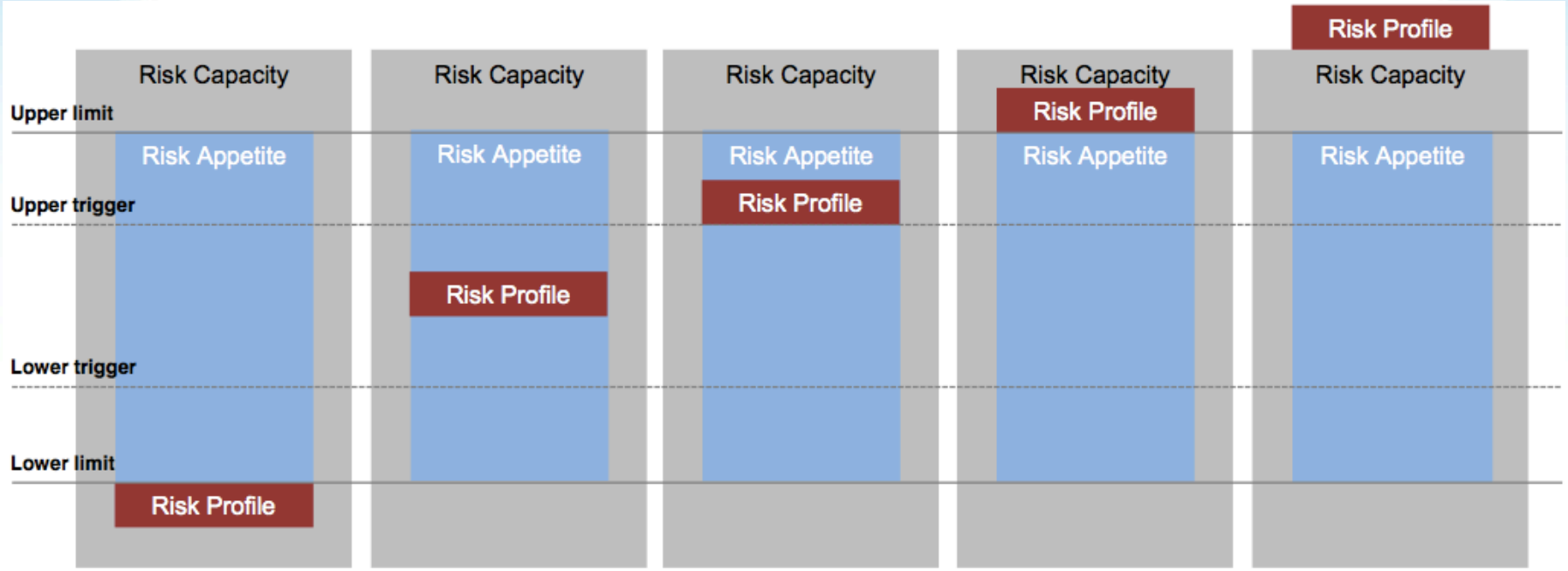
- Derived from the firm's business strategy, culture and governance.
- Allows to decide whether to accept a specific risk and control it, or to mitigate it.
- Defines a language, which allows to communicate among all stakeholders, internal and external.
- Includes targets, preferences, escalation thresholds, limits and capacities.
- For most part, quantitative, but also qualitative.

Example of a Risk Appetite Statement

Parameter	Types of Risk Appetite Statements	Risk Dimension
Earnings at Risk	"We will tolerate a maximum reduction of X% in projected earnings every Y years"	Profitability
Concentration Risk	"We will maintain a balanced portfolio considering both geography, products and customer types"	Profitability
Rating Ambition	"We will target an Aa level rating for senior unsecured long-term debt "	Capital
CET1 vs ECap	"We will have a common equity Tier 1 capital of minimum x% of economic capital"	Capital
LCR	"We will target a liquidity coverage ration of x% "	Liquidity
Reputational Risks	"We will not be associated with operations which may harm its reputation"	Other

Adapted from "Risk as a Growth Enabler" – Adem Yilmaz – CRO, Hyundai Capital America

Monitoring Risk Profile vs Risk Appetite



Objective under threat	Desired range	Escalation	Objective under threat	Firm is unviable
Risk profile is less than the lower limit. Corrective action must be taken.	Risk profile is between the upper and lower thresholds.	Risk profile is between the upper threshold and limit. Escalation to consider corrective action.	Risk profile exceeds the upper limit. Corrective action must be taken.	Risk profile exceeds risk capacity. The firm must enact its recovery and resolution plan.

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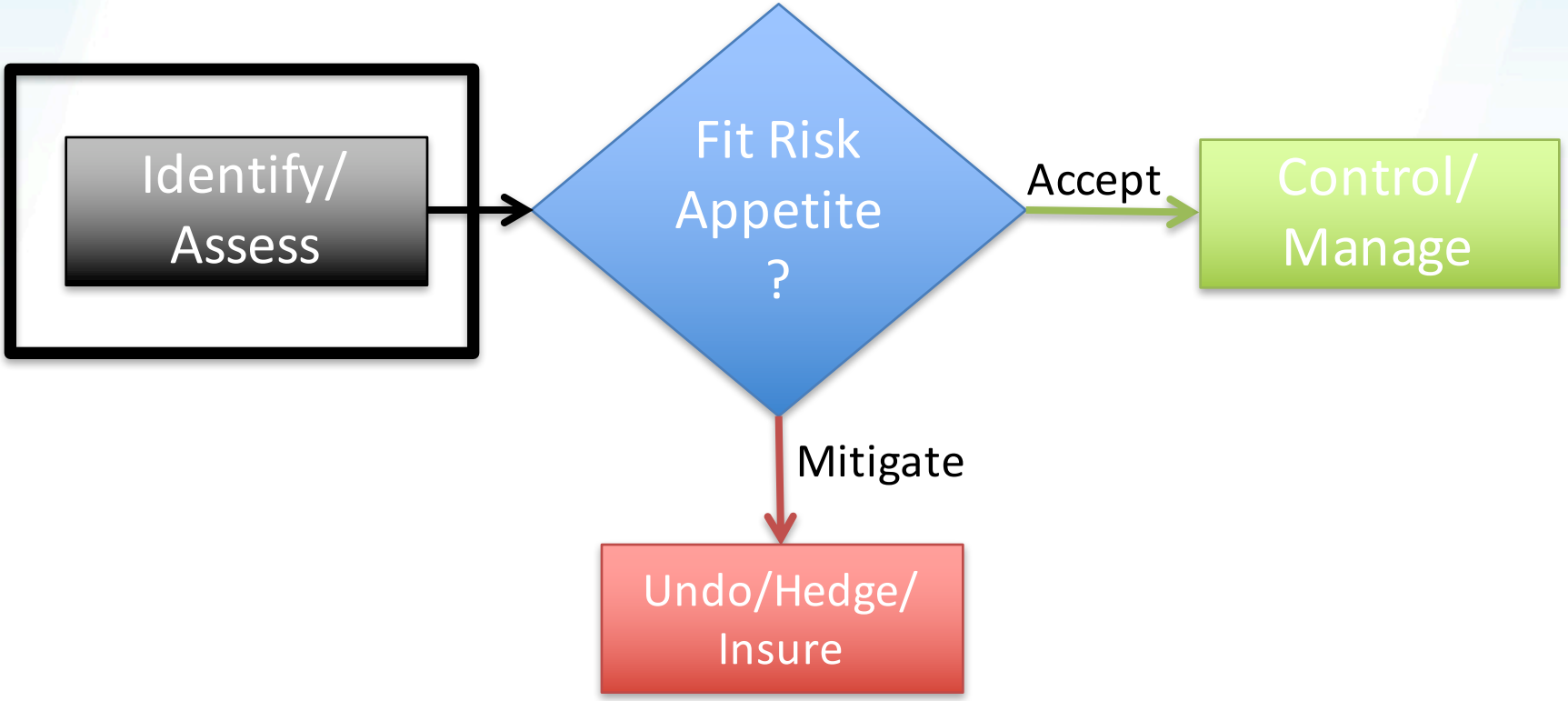
Risk Management Process



Risk Assessment

Common ways to assess the nature and severity of risks:

1. Risk statistics
   - Moments of return distribution: standard deviation, skewness, kurtosis
   - Sensitivity to underlying: Greeks, Duration
2. "What if?" analysis:
   - Scenario analysis: shock a single underlying factor and compute potential losses
   - Stress testing: portfolio behavior given a stressful economic scenario
3. Compute the "worst-case" scenario at a certain confidence level (i.e. probability)
   - Value at Risk (VaR)
   - Expected Shortfall (ES), Conditional VaR (CVaR)

Risk Assessment (Cont.)

- Risk Assessment and Control are performed on multiple levels:
- Single Exposure
  - Credit Scoring/Rating
  - Interest Rate Sensitivity
  - Risk-Return Metrics
- Portfolio Risk
  - Economic Capital / VaR
  - Stress Testing
  - Diversification

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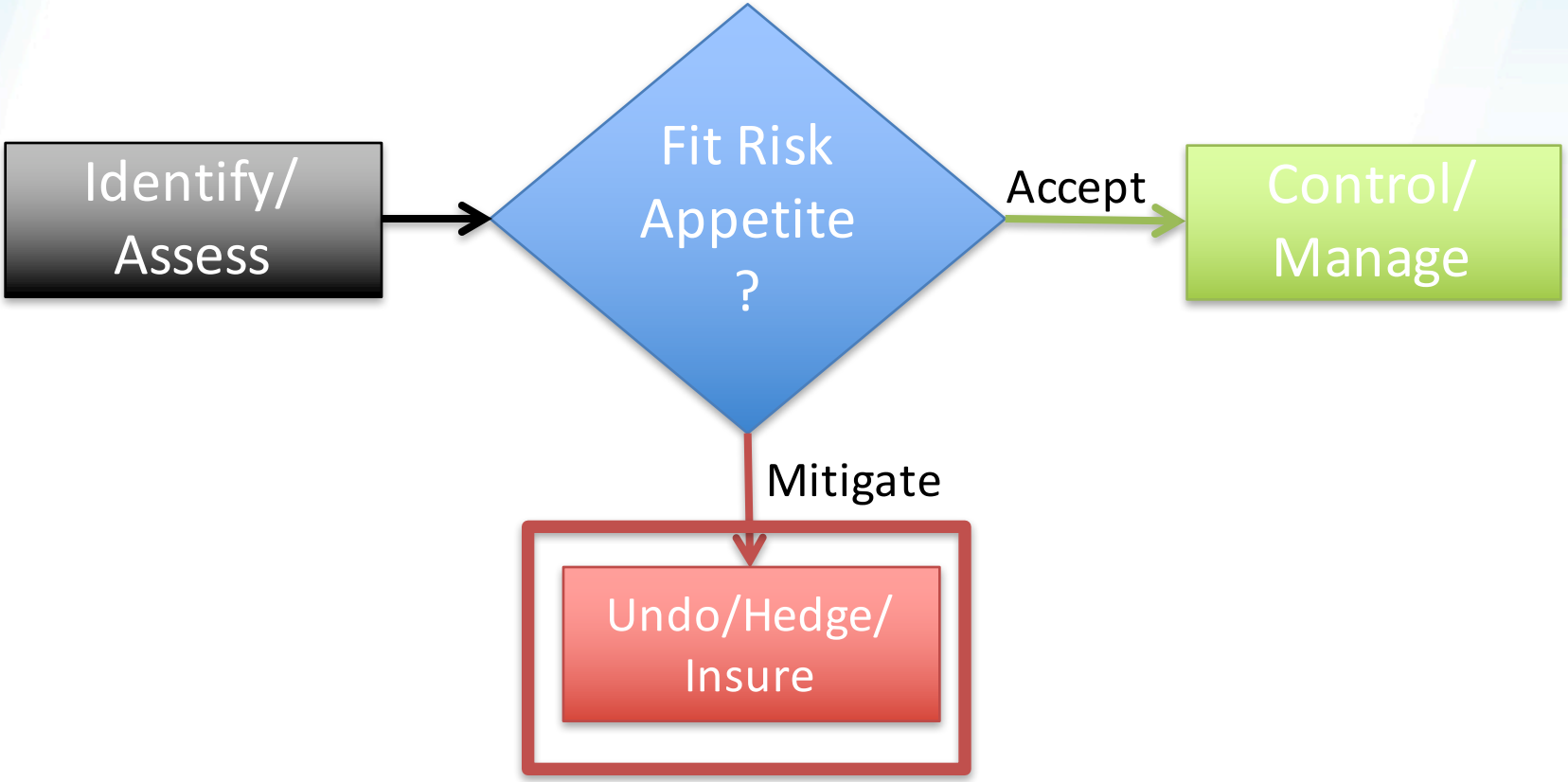
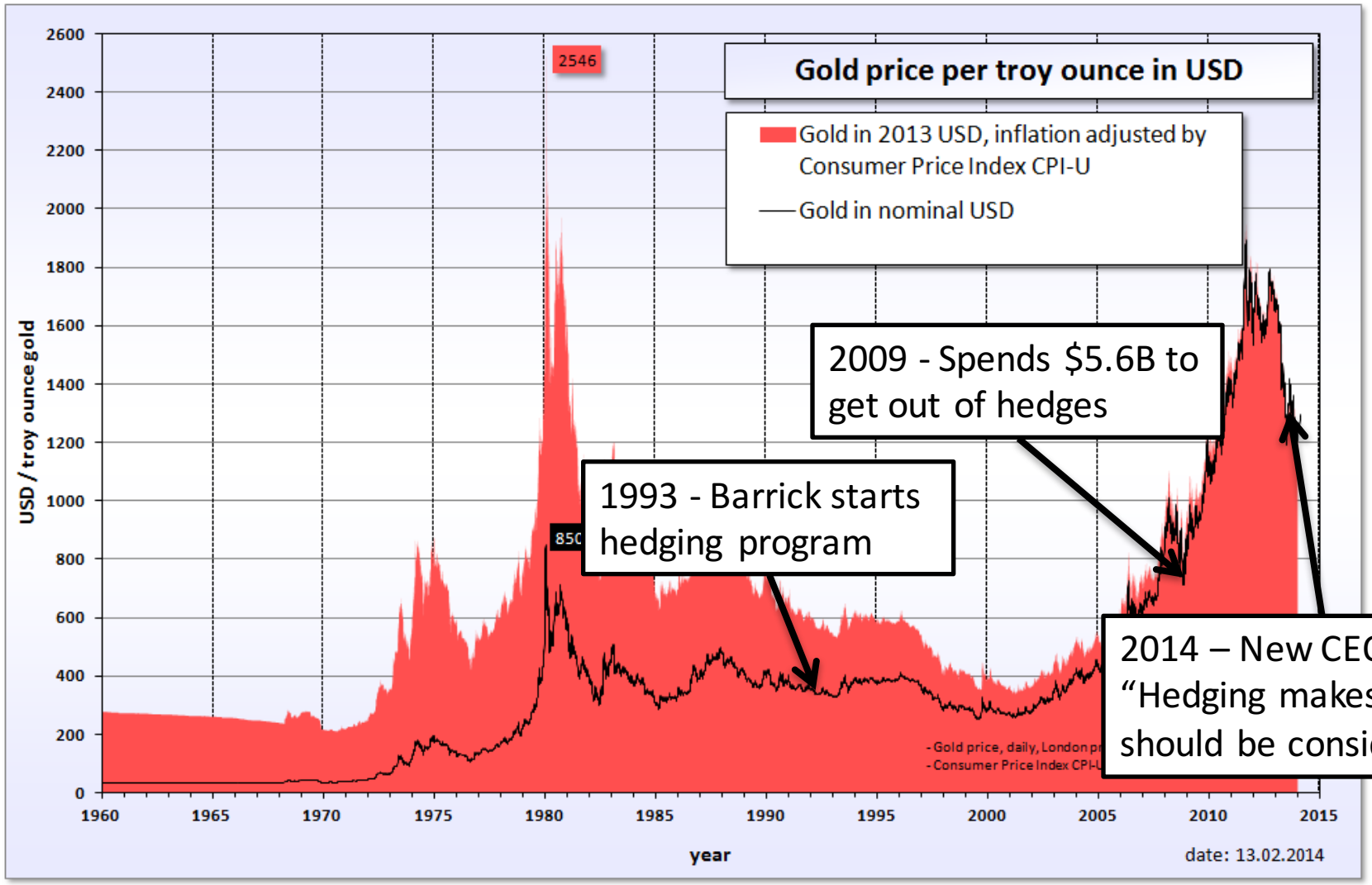


Risk Mitigation

- Hedging – eliminating both upside and downside
- Insurance – protecting against unfavorable events and keeping potential upside; typically involves paying a premium
- Diversification – holding a large collection of imperfectly-correlated assets to minimize idiosyncratic risks

Risk Mitigation or Speculation?



Why Hedge?

- If the firm has “unfair” advantage over investors:
  - Expertise and cost advantages in industry-specific markets
  - Firm has more accurate information about current exposures and future prospects
- If cash flow variability can affect firm’s liquidity or interrupt its long-term investment activity.
- Reduce earnings volatility and dividend volatility, as signals of management quality to shareholders

Why Not Hedge?

- It may increase risk to hedge when competitors do not.
- Explaining a situation where there is a loss on the hedge and a gain on the underlying can be difficult.
- Bid-Ask spread is larger for futures and options than spot.
- Employee costs and the cost of aligning their incentives to prevent speculation.

Risk Aware Business Management

- Modern Risk Management supports the organization above and beyond assessment/control/mitigation:
- Risk adjusted profitability and measurement
- Risk-based pricing
- Risk-minded culture and incentives

Syllabus

Required Material

Hull, John C. ***Risk Management and Financial Institutions,*** 4th Edition, John Wiley & Sons, 2015 (Hull)

Additional Texts

1) McNeil, Frey and Embrechts, ***Qunatitative Risk Management, Revised Edition,*** Princeton University Press, 2015 (MFE)

2) Jorion, Philippe ***Financial Risk Manager Handbook FRM Part I/Part II,*** 6th Edition, John Wiley & Sons, 2011 (Jorion)

- Grading: Problem Sets 30% , Midterm 30%, Final 40%
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- TA: Yuji Sakurai

Foundations

Market Risk

Credit Risk

Enterprise RM

Week	Lecture Topics	Hull	MFE	Jorion
1	Introduction to Class and Risk Management	1.6	1.1, 1.4	1.1,1.5, 27
	Volatility Models	10	4	5.4
2	MLE Estimation		A3	
	VaR I	12.1-12.6	2.2, 2.3	
3	VaR II	12.7-12.10	8, 9.3	
	Interest Rate Risk: Duration and Convexity.	9		13, 14.1-14.2, 6.2-6.5
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Volatility Models

- The most common risk measure
  - Especially in trading market risk management
  - Serves as building block for VaR calculations
- Estimation:
  - Historical, i.i.d. assumption
  - Model-based, serial correlation: EWMA and GARCH
  - Implied, from option prices
- Sensitivity and Scenario Analysis for changes in volatility

Maximum Likelihood Estimation

- Statistical Framework for fitting models and testing hypotheses
- We use it throughout the course:
  - Estimate volatility models
  - Fit credit risk models
  - Framework for backtesting VaR
  - Fit copula models

Value at Risk

- Answers "How bad can things get?" in one parameter:
  - "We are *X* percent certain that we will not lose more than *Y* dollars in time *T*."
- We cover:
  - Basic models (discrete and continuous)
  - Desirable and undesirable properties of tail measures
  - Alternative tail measures (Expected Shortfall)
  - Aggregation, Attribution and Allocation
  - Confidence Intervals
  - Back-testing

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Market Risk

- Uncertainty concerning changes in market prices and rates (including interest rates, equity prices, fx rates and commodity prices), the correlations among them and their levels of volatility.
- Examples:
  - Investment portfolio facing equity price risk
  - Company expecting a payment in Foreign Currency
  - Effect of exchange rate on competitiveness in foreign markets
  - Farmer intending to sell wheat
  - Homebuyer taking Adjustable Rate Mortgage (ARM)

Interest Rate Risk

- The basic interest rate risk:
  - Bond value is equal to the discounted value of all future payments.
  - If rates increase, the value of the bond decreases.
- Risk Tools:
  - Sensitivity is measured by Duration and Convexity
  - Scenario analysis: what is the effect of change in one interest rate, or shifts in term structure?
  - Set up the tools to find the “worst-case” scenario of a bond portfolio.
- Consider additional interest rate risks: basis risk, term-structure shape, behavioral options (prepayment risk), etc.

Market Risk VaR

- We analyze the distribution of future returns, with focus on the tails.
- Two main issues:
  - Should we make distributional / parametric assumptions, or make a non-parametric evaluation?
  - How can we analyze the return distribution of a portfolio that has many positions, some that are time consuming to re-price?
- Modeling heavy tails – Extreme Value Theory

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Credit Risk

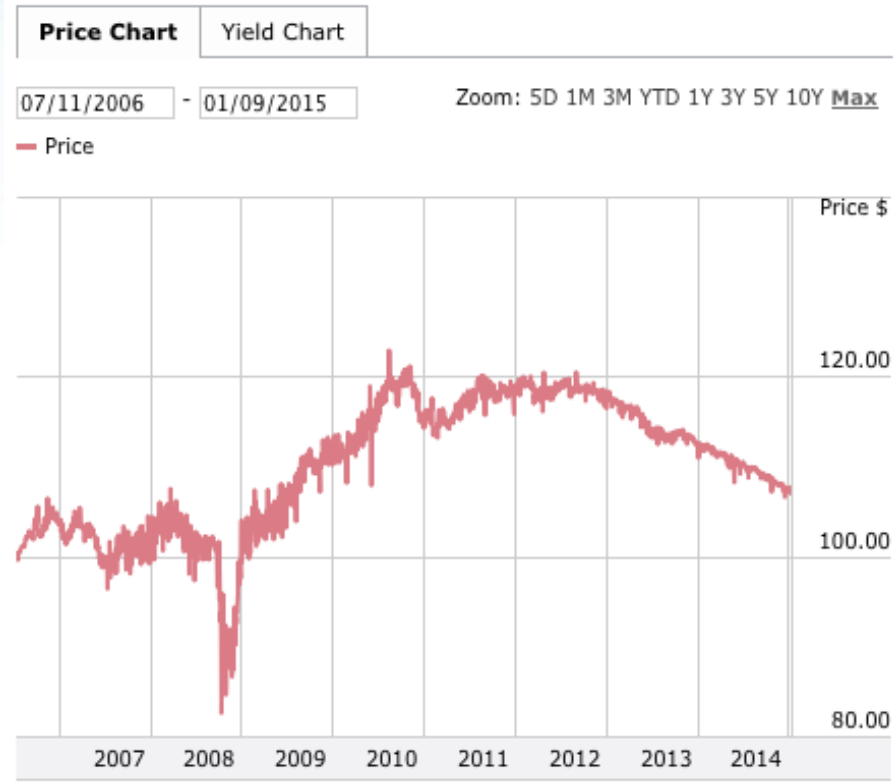
- Risk of default by
  - Obligor/counterparty/borrower/debt issuer
  - which leads to failure to meet contractually obligated payments
  - in relation to actual, contingent or potential claims.
- Examples
  - Loans: Mortgages, Commercial & Industrial, Commercial Real Estate
  - Lines of Credit, Guarantees
  - Trade Credit
  - Counterparty Credit Risk
  - Credit Default Swap

Topics in Credit Risk (1)

- Probability of Default – PD
- What is the chance that a borrower will not pay back the loan, or make payment on a bond?
- We will look at how we deduce this probability from:
  - Historical information about defaults (How to build a model and how to validate it).
  - Market prices.

What does price tell us about PD?

TARGET CORP.
Coupon 5.875%
Maturity 07/15/2016



Topics in Credit Risk (2)

- Loss Given Default – LGD
- Suppose the borrower defaults, what portion of the debt will we lose?
- LGD = 1 – Recovery Rate
- How is this correlated with the probability of default?

Topics in Credit Risk (3)

- Exposure At Default – EAD
- What will be our exposure to the obligor if it defaults?
- In what cases might this be unknown at time zero?

Counterparty Credit Risk

- Suppose we agree to buy 1000bbl of crude forward at $80 from JP Morgan, what is our exposure if JP Morgan defaults tomorrow?
  - If the price of oil is $80? $90? $60?
- What will be our exposure if JP Morgan defaults in a week? What if both sides post collateral every day?
- What is our credit exposure to JP Morgan if we sold (wrote) it a put option on oil?

Dependency of Credit Defaults

- How do we model a degree of dependency between credit exposures or bonds?
- Example:
  - An insurer is selling protection on two bonds that will pay out if **both** bonds default
  - Is the insurance worth more if the bonds are independent or if their perfectly dependent?
  - What if the insurance pays out if **either** of the bonds defaults?

Credit VaR

- It is harder to limit downside of credit portfolios by diversification than equity portfolios:
  - Discrete nature of each credit
  - Bulkiness of credits
  - Contagion and dependence effects
- Credit portfolios usually have many more loans/bonds than stock portfolios
- How do we model the dependency structure among thousands of loans?

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Stress Testing

- Assessing tail risk through scenarios (stories) rather than statistical VaR.
- How do we translate stories into portfolio losses?
- How do we know the probability of the scenario? Is it severe enough?
- Big advantage: Can point us to the cause of the problem, and help us think about a mitigation plan.

Financial Regulation

- Focused on guaranteeing bank survival:
  - Solvency – Using Capital as a cushion for losses
  - Liquidity – Examine funding under stress scenarios
- Basel frameworks historically focused on capital adequacy (leverage).
  - Following the crisis, attention to liquidity has increased.
- Dodd-Frank Act – Regulating bank activities to limit systemic risks.

Operational Risk

- Operational Risk – Potential of failure in relation to employees, contractual specifications and documentation, technology, infrastructure failure and disasters, external influences and customer relationships.
- Examples:
  - Fire, Earthquake, Mudslide
  - Internal/external fraud
  - Teller/dealer mistakes
  - Cyber-attack

Liquidity Risk

- Liquidity Trading Risk, Liquidity Market Risk – Inability to sell an asset in a short time in the required quantity without affecting price.
  - A type of Market Risk
- Liquidity Funding Risk – Inability to meet all payment obligations when they come due, or only being able to meet these obligations at excessive costs
  - Typically a result of other risks
  - A major cause of many financial failures

Other Risks

- Business or Strategic Risk – Risk due to potential changes in general business conditions, such as market environment, client behavior and technological progress
- Compliance or Legal Risk – Risks that the firm will be exposed to regulatory actions, be fined, or incur increased legal expenses (sometimes included in Operational Risk)
- Reputational Risk – Risk that bad publicity will impact the public's trust in the organization
- Insurance Risks – Risks affecting size and timing of insurance and pension obligations, such as longevity and mortality risks

Interaction of Risks

- Market Risk causing Credit Risk
  - Russian default in August 1998
  - Savings & Loan Debacle of 1980s
- Operational Risk causing Market Risk
  - Barings collapse due to unauthorized trading and high volatility in Japanese stock index
- Operational Risk causing Credit Risk
  - Mortgage Loan Buybacks
- Credit Risk causing Market Risk
  - AIG Credit downgrade
  - Credit availability on October 1987
- Wrong-way risk - occurs when there is a correlation between the counterparty's credit risk and the exposure to that counterparty.

Thanks