

Risk - A Real World Perspective

February 2013

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Agenda

What is financial 'Risk'?

What is the 'Hedging' of risk?

What is the 'correct' approach to management of financial risks?

How do we implement this 'correct approach' in practice?

Intuitive Examples on 'Risk' & 'Hedging'

Is the price of aviation fuel a 'risk' to an Airline?

Does British Petroleum have FX exposures that need management?

Case of the Sony – does this company have FX risks?

If Microsoft sells in the FX forward market, is it fully 'hedged'?

Financial Risks

Defining 'Risk'

- Not so easy to define risk!
- Broadly, change in (absolute or relative) financials, due to unit change in market factor (FX/ Rate/ Commodity price etc)
- Absolute risks: change to company's financials on account of movement in market factors
- Relative risks: change in competitive advantage on account of movement in market factors, even if the absolutes remain as is
- Competition is rarely one static entity!

Postulate on Risk 'Hedging'

- The 'hedged' state is a risk less state of indifference, where both absolute and relative risks have been neutralized
- It's a great idea, **but can't be done: this state does not exist**
- The financial practitioner cannot escape having to take a view on markets: this is like taking a penalty in professional soccer
- **The brutal truth** : if the 'hedge' trade loses money, it's speculation. If it makes money, it's a hedge.
- At best: if your business runs into problems on account of a market move, a good 'hedge' should generate offsetting cash flows. Likewise, if a good 'hedge' was to erode in value, there should be something in business that compensates for this loss.

The only thing that matters – Have the right view !

Getting it Directionally Right

Technical Analysis? The old man's wisdom

Positioning and pain – the corporate advantage

“Out of syllabus” issues (Subprime, Monoline insurers, Greece, Dubai)

“Hen oida hoti ouden oida” – does anyone know at all?

Oil



Courtesy Bloomberg

GBPUSD



Courtesy Bloomberg

Getting it Smart ... with Caveats!

What is the pain threshold for our trades/ risks?

Can we buy insurance using options?

Value at Risk : Caveats

Using history to predict the potential future losses- would it have predicted the credit crisis?

Conjunction with Human Judgement?

Stress tests for scenarios based on Human Judgement to pre-empt tail events

Type I errors

Rejecting a True Hypothesis

Classifying a firm as not likely to default when it actually does default

The error is a type I error

OR

You see a tiger and you do not Run!

Type II errors :Avoiding False Negatives

Classifying a firm as likely to default when it does not default

Classifying all derivatives as ‘ WEAPONS OF MASS DESTRUCTION’ , when they can be used as risk management tools

Should the idea that Derivatives may get abused mean that a firm should not use Derivatives at all ?

OR

“ You are running away – but there is no tiger in sight”

Risk Management – The Theory

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What is Risk?

What is Risk?

- A risk is a potential problem – it might happen and it might not
- Risk is the potential that a chosen action or activity will lead to a loss. The notion implies that a choice having an influence on the outcome, exists. Potential losses themselves may also be called "risks"
- Two characteristics of risk
 - Uncertainty** – the risk may or may not happen, that is, there are no 100% risks
 - Loss** – the risk becomes a reality and unwanted consequences or losses occur.
- In financial markets, risk is the chance that the return achieved on a portfolio will be different from that expected, and also takes into account the size of this difference. This includes the possibility of losing some or all of the original investment

Risk

Types

- Business Risk
- Financial Risk
 - market risk
 - credit risk
 - liquidity risk
- Operational Risk
- Legal Risk

Bond Portfolio Risks

The major risks affecting a bond portfolio are

- **Interest Rate Risk**
- **Credit Risk**
- **Exchange-Rate Risk**

The other risks relevant to a bond portfolio are

- Call And Pre-payment Risk
- Re-investment Risk
- Yield Curve Risk
- Liquidity Risk
- Volatility Risk
- Inflation Risk
- Event Risk

Types of Risks

Interest Rate Risk

- Interest rate risk is concerned with a decline in the price of a bond or a portfolio of bonds due to an increase in market rates. As rates increase, bond prices decline and vice versa.

Call and Prepayment Risk

- Call and prepayment risk is concerned with the holders having their bonds paid off earlier than the maturity date. This is due to decreasing market rates, which cause the issuer to call the bonds.

Types of Risks

Re-investment Risk

- Reinvestment risk is the risk that the proceeds from the payment of principal and interest, which have to be reinvested at a lower rate than the original investment.

Yield Curve Risk

- The yield curve risk is how a portfolio will react with different exposures based on how the yield curve shifts.
- When all maturities on the yield curve move by an equal amount, it is known as a parallel shift in the yield curve.
- Most often, the yield curve does not move this way.
 - **Steepening of the curve:** The yield increases at a faster rate at the long end of the curve compared to the short end.
 - **Flattening of the curve:** The yield on the long end decreases at a faster rate than at the short end of the curve.

Types of Risks

Credit Risk

- **Default Risk** - Default risk is the risk that the issuer will not be able to pay its obligations of interest and principle.
- **Credit Spread Risk** – This type of credit risk deals with how the spread of an issue over the treasury curve will react. For example, a five-year bond may trade at 50 basis points above the current five-year treasury. If this spread of 50 bps widens out compared to other bond issues, it would mean that this bonds is not performing as well as the other bonds in the marketplace.
- **Downgrade Risk** –This type of credit risk deals with the rating agencies. These agencies, give an issuer a rating or grade that indicates the possibility of default. If one of these rating agencies downgrades a company's rating, it may be harder for the corporation to pay. This will typically cause its market value to decrease.

Liquidity Risk

- Liquidity refers to how deep or liquid the market is for a particular security. If the market is deep, an investor can purchase or sell a security at current prices. If the market is not liquid, it is harder to sell or buy a security at the last market price.
- Liquidity is typically measured by the bid/ask spread. If the spread is wide, the market is illiquid. If the spread is narrow, the market is more liquid. Liquidity risk is important because it tells how easily one can get rid of a position near the last market price.
- This is even more important if you plan to hold a security to maturity because the marking to market of your positions. In an illiquid market, it may be hard to obtain quotes, and when you revalue the security it could be well below market prices.
- This risk also changes over time, and hence requires active risk management.

Types of Risks

Exchange Rate Risk

- Exchange-rate risk is the risk of receiving less in domestic currency when investing in a bond that is in a different currency denomination than in the investor's home country.
- When investors purchase a bond that is designated in another currency other than their home countries, investors are opened up to exchange risk. This is because the payment of interest and principal will be in a foreign currency. When investors receive that currency, they have to go into the foreign currency markets and sell it to purchase their home currency. The risk is that their foreign currency will be devalued compared to the currency of their home countries and that they will receive less money than they expected to receive.

Volatility Risk

- Volatility risk refers to the amount of uncertainty or risk about the size of changes in a security's value. A higher volatility means that a security's value can potentially be spread out over a larger range of values. This means that the price of the security can change dramatically over a short time period in either direction. A lower volatility means that a security's value does not fluctuate dramatically, but changes in value at a steady pace over a period of time.

Types of Risks

Inflation Risk

- Also known as Purchasing Power Risk, this risk arises from the decline in value of securities cash flow due to inflation, which is measured in terms of purchasing power
- Only Inflation Protection Bonds such as TIPS offer protection against this risk. Floaters help reduce this risk because of the resetting of the interest rates. All other bonds expose the investor to this risk because the interest rate is fixed for the life of the bond

Event Risk

- Event risk is the risk that an issuer will not be able to make a payment because of dramatic and unexpected events. Such risks can affect a single issuer or an entire sector depending on the type of risk.
- Event risk falls into three categories:
 - **Natural Disasters or Industrial Accidents** that hamper their ability to make payments causing a downgrade in their credit rating.
 - **Corporate Takeovers/Restructurings**
 1. Happens when a company is taken over or restructured, causing the firm to take on new or additional debt that may be too heavy for them to make their payments of interest and principal.
 2. The company may also have to issue new or additional debt at higher yields, which will also increase the debt burden.
 3. This could also cause the rating agencies to get spooked and downgrade the issue
 - **Regulatory Risk**
 1. Comes in various forms and extends across several industries such as investment companies, insurance companies and depository institutions.

Risk Measurement Tools

Duration

Effective Duration

- Effective duration is the approximate percentage change in price for a 100 basis point change in rates

$$\text{Effective duration} = \frac{V_{-\Delta y} - V_{+\Delta y}}{2(V_0)\Delta y}$$

$V_{-\Delta y}$ and $V_{+\Delta y}$ are the values that the bond will take if the yield falls by y or rises by y

Modified Duration

- Modified duration is a price sensitivity measure, defined as the percentage derivative of price with respect to yield.
- Modified duration applies when a bond or other asset is considered as a function of yield.

$$\text{ModD}(y) \equiv -\frac{1}{V} \cdot \frac{\partial V}{\partial y} = -\frac{\partial \ln(V)}{\partial y}$$

V is the present value of all cash flows from the bond

Macaulay Duration

- The weighted average term to maturity of the cash flows from a bond. The weight of each cash flow is determined by dividing the present value of the cash flow by the price, and is a measure of bond price volatility with respect to interest rates.

$$\text{MacD} = \frac{\sum_{i=1}^n t_i PV_i}{V} = \sum_{i=1}^n t_i \frac{PV_i}{V}$$

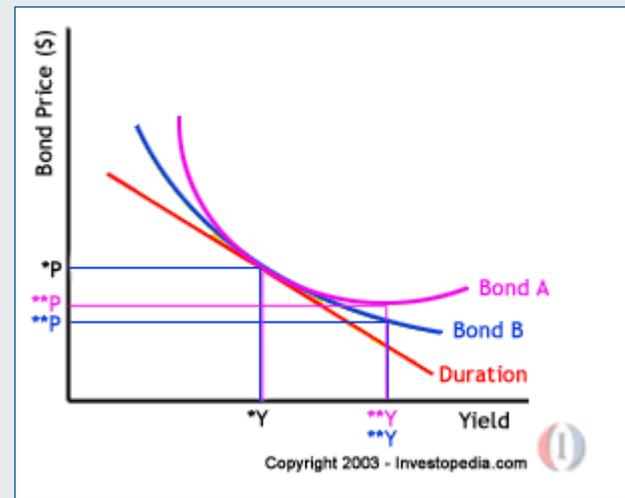
i indexes the cash flows,
 PV_i is the present value of the i^{th} cash flows from an asset,
 t_i is the time in years until the i^{th} payment will be received,
 V is the present value of all cash payments from the asset.

Risk Measurement Tools

Convexity

A measure of the curvature in the relationship between bond prices and bond yields that demonstrates how fast the duration of a bond changes as the interest rate changes.

- Convexity helps to measure and manage the amount of market risk to which a portfolio of bonds is exposed.
- As convexity increases, the systemic risk to which the portfolio is exposed increases.
- As convexity decreases, the exposure to market interest rates decreases and the bond portfolio can be considered hedged.
- In general, the higher the coupon rate, the lower the convexity (or market risk) of a bond. This is because market rates would have to increase greatly to surpass the coupon on the bond, meaning there is less risk to the investor



Risk Measurement Tools

Standard Deviation

- A measure of the dispersion of a set of data from its mean. The more spread apart the data, the higher the deviation.
- Standard deviation is applied to the annual rate of return of an investment to measure the investment's volatility. Standard deviation is also known as historical volatility and is used by investors as a gauge for the amount of expected volatility.

$$s_N = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2}$$

Tracking Error

- A divergence between the price behavior of a position or a portfolio and the price behavior of a benchmark.
- Tracking error (also called active risk) is a measure of the deviation from the benchmark; Intuitively an actively managed portfolio would normally have a higher tracking error.

Value at Risk – Compressing Risk into a Single number

VaR is a measure of that summarises the total risk in a portfolio of financial assets

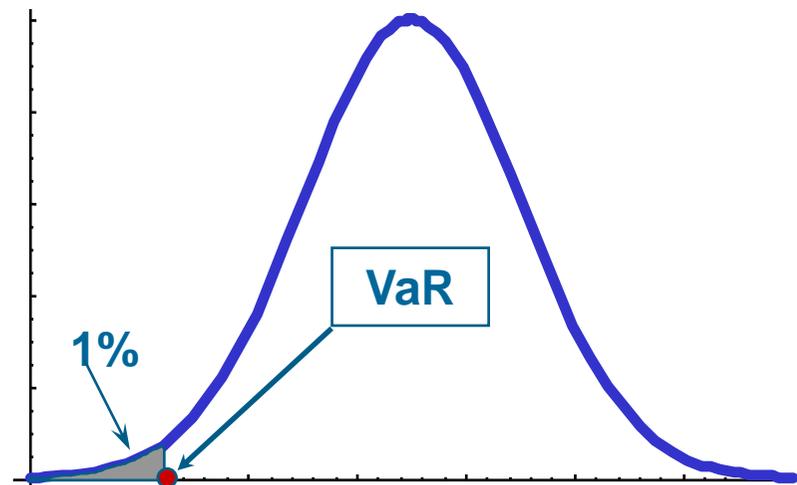
- It is the loss level that will not be exceeded with a specified probability in a particular time period
- VaR asks the simple question: “How bad can things get?”
 - The answer is - I am **X%** certain that there will not be a loss of more than **V** dollars in the Next **N** days
 - V is the VaR of the portfolio
 - X% is the confidence level
 - N is the time horizon
- This is a widely used measure of market risk over the word used by risk managers and regulators

Meaning of VaR

A portfolio manager has a daily VaR equal \$1M at 99% confidence level.

This means that there is only one chance in 100 that a daily loss bigger than \$1M occurs,

under normal market conditions.



Managing Risk

Risk management, as a process involves

- the identification of exposures to risk,
- the establishment of appropriate ranges for exposures
- the continuous measurement of these exposures
- And the execution of appropriate adjustments whenever exposure levels fall outside of target ranges.

The process is continuous and may require alterations in any of these activities to reflect new policies, preferences and information.

Managing risk is broadly based on 3 important pillars.

A Risk governance model

- An effective risk governance model places overall responsibility at the senior management level to allocate resources effectively. It also features appropriate separation of tasks between revenue generators and those on the control side of business.

Systems and Technology

- Appropriate systems and technology combine information and analysis in such a way as to provide timely and accurate risk information to decision makers.

Personnel

- Sufficient and suitably trained personnel evaluate risk information and articulate it to those who need this information for the purposes of decision making.

Risk Budgeting as a means to Managing Risk

What is Risk Budgeting?

- Risk budgeting involves establishment of objectives for individuals/groups of an organization that take into account the allocation of acceptable level of risk.
- Risk budgeting focuses on questions such as
 - Where do we want to take risk?
 - What is the efficient allocation of risk across various investment opportunities?
- It is also important to carefully manage allocated limits and monitor their utilization on a constant basis.

Risk Budgeting Metrics

To ensure that a portfolio operates within a well conceived risk budget framework, it is important to consider the following parameters

Performance Stopouts	<ul style="list-style-type: none">• A performance stopout is the maximum amount that a given portfolio is allowed to lose in a period.
Capital Allocation	<ul style="list-style-type: none">• Allocation of working capital among portfolio managers as a means to enforcing risk disciplines.
Risk Factor Limits	<ul style="list-style-type: none">• Limits on individual risk factors, as generated by a VAR analysis(e.g. VAR exposure to a certain risk cannot exceed, say \$X or X%) or driven by linear(e.g. Duration, beta) or non-linear (e.g. Convexity, gamma) risk estimation methodologies
Position Concentration Limits	<ul style="list-style-type: none">• Enforcement of diversification by mandating a specific maximum amount for individual positions.
Leverage Limits	<ul style="list-style-type: none">• A maximum amount of leverage in the portfolio may be specified to avoid highly leveraged positions.
Liquidity Limits	<ul style="list-style-type: none">• To manage liquidity exposure, large funds will often also set position limits as a specified maximum percentage of daily volume, float, or open interest.

Managing Credit Risk

Credit Risk is not easily analyzed and controlled using measures such as standard deviation and VAR. The following risk management techniques allow regular monitoring of credit exposure.

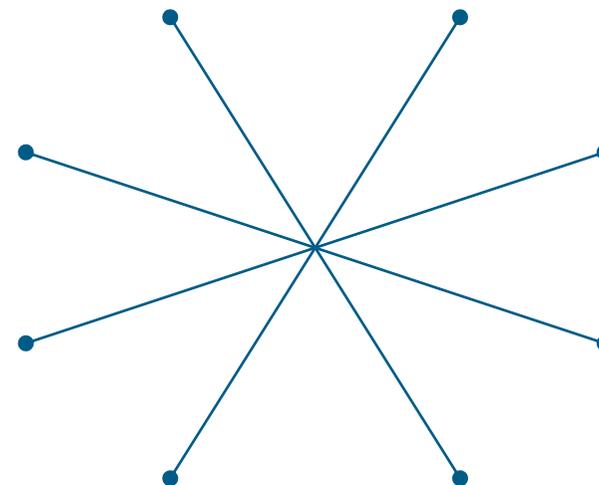
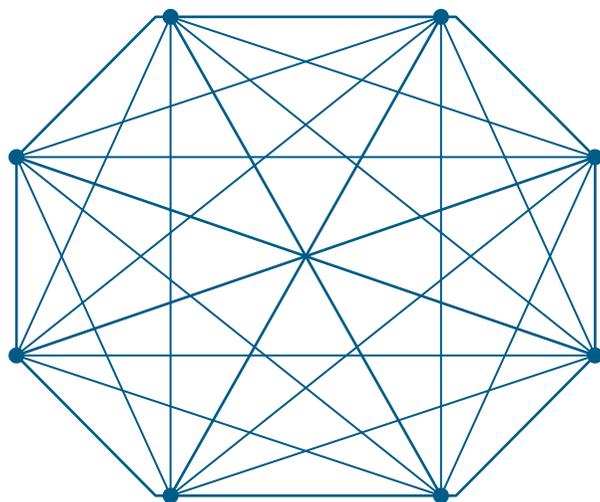
Limiting Exposure	<ul style="list-style-type: none">• Limiting the amount of exposure to a given party is the primary means of managing credit risk.• These limits can be measured in terms of notional limits, risk(e.g. VAR) limits or maximum loss limits
Marking to Market	<ul style="list-style-type: none">• Marking to market allows for excellent risk management. It is usually done for contracts with two-way credit risk.
Collateral	<ul style="list-style-type: none">• Posting of collateral is a widely accepted credit exposure mitigation technique.• The amount of collateral is usually decided by the credit rating of the counterparty and the marked to market position of trade.
Netting	<ul style="list-style-type: none">• Netting involves reduction of all obligations owed between counterparties into a single cash transaction that eliminates these liabilities
Credit Quality	<ul style="list-style-type: none">• Apart from limiting the amount of business one party engages with another it is also important to identify the credit quality of counterparties and setting a minimum acceptable credit standard
Credit Derivatives	<ul style="list-style-type: none">• Credit Derivatives allow managing credit risk by transferring it to another party.• Credit Default Swaps allows protection buyer the right to receive a payment from the seller in the event of a specified credit event.
Capital Requirements (Internal/External)	<ul style="list-style-type: none">• Internal capital requirements specify the level of capital that management believes to be appropriate for the firm. But when regulations demand it, the inclusion of regulatory capital as part of the overall capital allocation process is, of course, unavoidable

Collateralization in OTC Markets

Market participants continue to expand their use of collateral to mitigate counterparty credit risk in the OTC derivatives.

- Consider transactions between companies A and B
 - These might be governed by an ISDA Master agreement with a credit support annex (CSA)
 - The CSA might require A to post collateral with B equal to the value to B of its outstanding transactions with B when this value is positive.
 - If A defaults, B is entitled to take possession of the collateral
 - The transactions are not settled daily and interest is paid on cash collateral

Bilateral Clearing vs Central Counterparty



Clearing is a post-trade activity and aims to reduce risk.

Bilateral clearing means two parties to a trade, make their own arrangements to reduce their exposure to each other's default.

A CCP (central counterparty) is entity that provides a guarantee to both parties in a trade that if one party defaulted before the discharge of its obligations, the CCP would fulfil the financial obligations to the remaining party as agreed at the time of the trade.

Derivatives Mishaps and What We Can Learn From Them

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Big Losses by Financial Institutions

- **Allied Irish Bank (\$700 million)**
- **Amaranth (\$6 billion)**
- **Barings (\$1 billion)**
- **Daiwa (\$1 billion)**
- **Enron Counterparties (Several over \$1 billion)**
- **Kidder Peabody (\$350 million)**
- **LTCM (\$4 billion)**
- **Midland Bank (\$500 million)**
- **Société Générale (\$7 billion)**
- **Subprime Mortgages (up to \$40 billion)**

Big Losses by Non-Financial Corporations

- **Allied Lyons (\$150 million)**
- **Gibsons Greetings (\$20 million)**
- **Hammersmith and Fulham (\$600 million)**
- **Metallgesellschaft (\$1.8 billion)**
- **Orange County (\$2 billion)**
- **Procter and Gamble (\$90 million)**
- **Shell (\$1 billion)**
- **Sumitomo (\$2 billion)**

The Credit Crisis

Starting in 2007, the United States experienced the worst financial crisis since the 1930s.

It resulted in the threat of total collapse of large financial institutions, the bailout of banks by national governments, and downturns in stock markets around the world.

The housing market suffered, resulting in evictions, foreclosures and prolonged unemployment.

The crisis played a significant role in the failure of key businesses, declines in consumer wealth estimated in trillions of US dollars, and a downturn in economic activity leading to the 2008–2012 global recession and contributing to the European sovereign-debt crisis.

Background

The bank collapse of the 1930s and the ensuing Great Depression had introduced some institutional changes aimed at making banking system less fragile

These are

- Central bank as lender of last resort
- Deposit insurance
- Separation of commercial banking and investment banking (Glass-Steagall Act 1933)

Changes

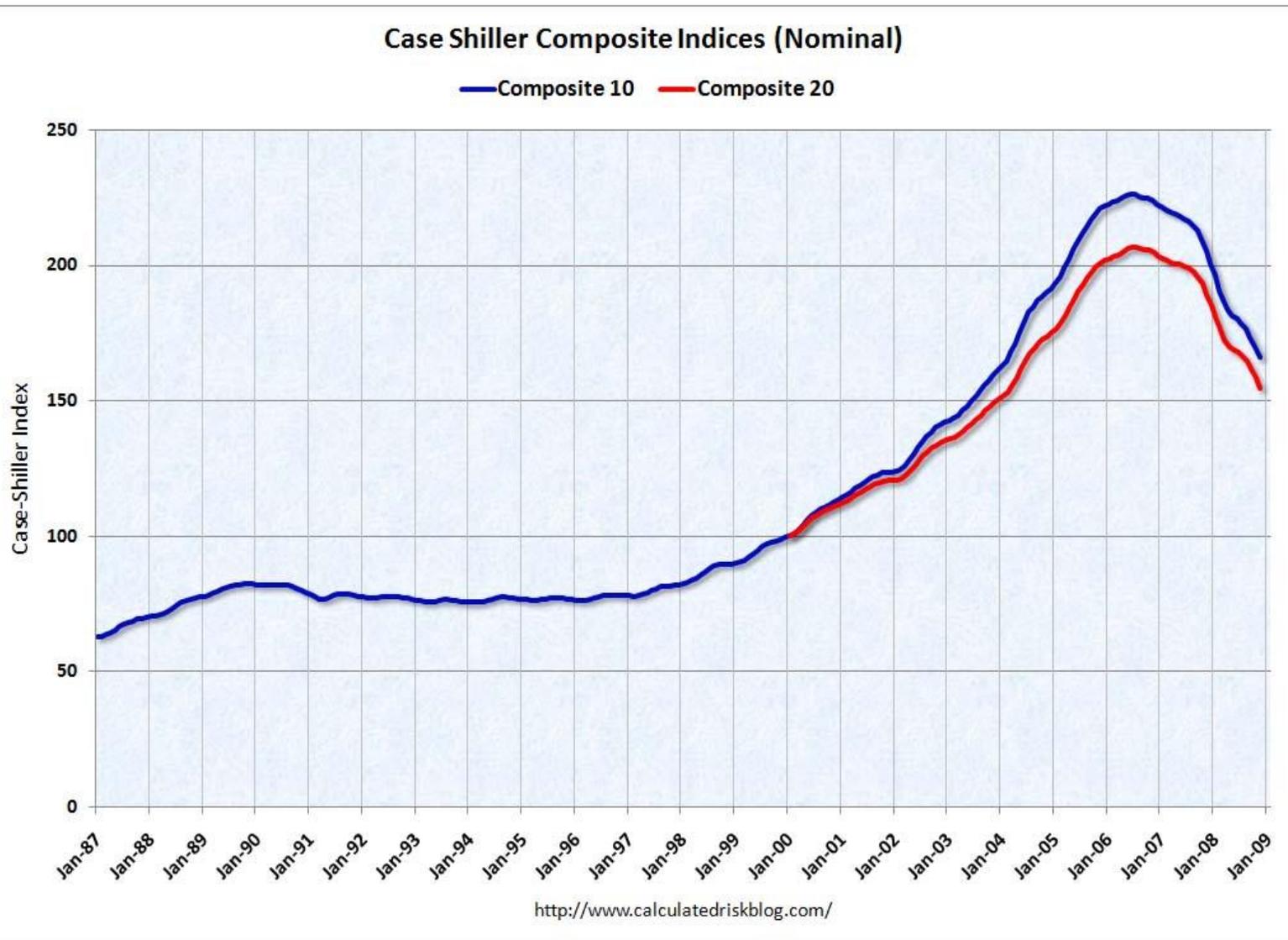
Repeal of the Glass-Steagall act in 1999 (Clinton-Rubin)

- This allowed commercial banks to take on all the activities investment banks had been taking
- i.e. Underwriting and holding of securities/derivatives
- They became universal banks
- They could now hold the assets that regularly are gripped by bubbles and crashes
- Their balance sheets became extremely sensitive to these bubbles (hi-tech bubble, housing bubble, general stock market bubble)

THE U.S. HOUSING MARKET

- The 2000 to 2006 period was characterized by a huge increase in what is termed subprime mortgage lending
- The amount lent as a percentage of the house price increased.
- Selling of Adjustable Rate Mortgages (ARMs) - a low "teaser" rate of interest that would last for two or three years and be followed by a higher rate.
- One of the features of the US housing market is that mortgages are non-recourse in many states. This means that, when there is a default, the lender is able to take possession of the house, but other assets of the borrower are off-limits. Consequently, the borrower has a free American-style put option.
- Many mortgage holders found they could no longer afford mortgages when teaser rates ended.
- Some exercised their implicit put options and "walked away" from their houses and their mortgage obligations. This reinforced the downward trend in house prices.

THE U.S. HOUSING MARKET



Little happened with economic fundamentals in US

warranting a doubling of house prices in six years

Prices increased fuelled by easy credit

Securitisation of Subprime Mortgages –Credit Derivatives

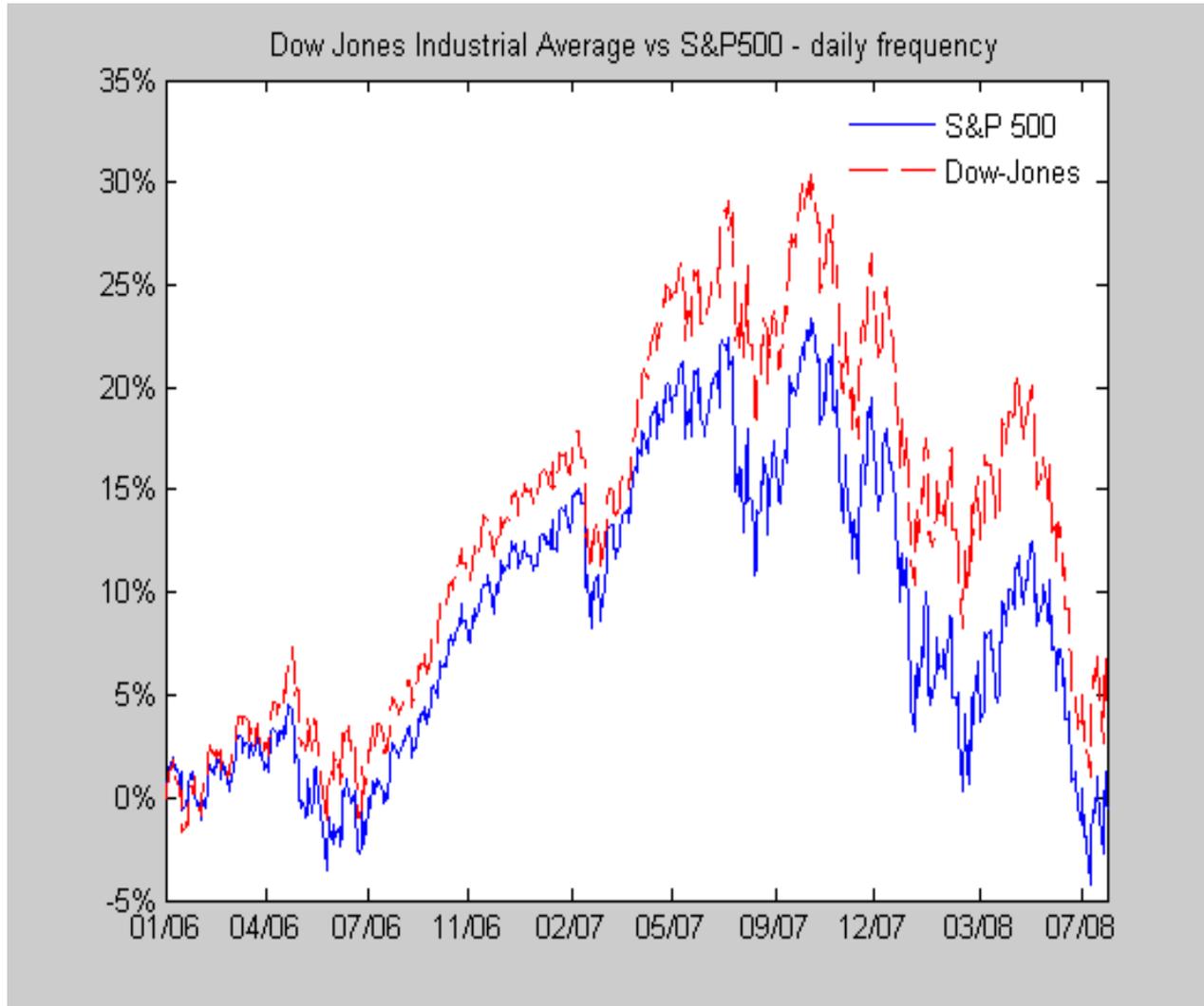
Mortgage originators profitably transferred credit risk to investors via products like Asset Backed Securities and Collateralized Debt Obligations

- **Asset Backed Securities (ABS) were created from a portfolio of mortgages, where usually the income from the assets is tranching i.e income is first used to pay the promised return to the senior tranche, then to the next most senior tranche, and so on**
- **ABS Collateralized Debt Obligations-An ABS from the mezzanine tranches of different ABSs that were created from subprime mortgages.**

The products bought by investors were complex and in many instances investors and rating agencies had inaccurate or incomplete information about the quality of the underlying assets.

Subprime specialists/hedge funds/Banks suffered losses in the implosion of the subprime losses

US stock market 2006-08



In July 2006 US stock market capitalization was \$11.5 trillion

One year later it was \$15 trillion

What happened between July 2006 and July 2007 to warrant an increase of 30%?

What happened to US economy so that \$3.5 trillion was added to the value of US corporations in just one year?

While GDP increased by only 5% (\$650 billion)

Nothing new had happened- fundamentals of the economy was the same but there was easy money

The downturn

Then came the downturn with the credit crisisWhat happened?

- **Rating agencies started downgrading securitised debt**
- **Subprime mortgages/hedge funds/Banks faced increasing losses**
- **Capital and Money Market faced Paralysis**
- **Banks stopped lending to each other in fear of counterparty risk**
- **Liquidty dried up**
- **Stock prices dropped by 30%**

The crisis spread rapidly from the United States to other countries and from financial markets to the real economy

Lessons for All Users of Derivatives

- **Risk must be quantified and risk limits defined**
- **Exceeding risk limits not acceptable even when profits result**
- **Do not assume that a trader with a good track record will always be right**
- **Be diversified**
- **Scenario analysis and stress testing is important**

Lessons for Financial Institutions

- **Do not give too much independence to star traders**
- **Separate the front middle and back office**
- **Models can be wrong**
- **Be conservative in recognizing inception profits**
- **Check for appropriateness before selling products to customers**
- **Liquidity risk is important**
- **There are dangers when many are following the same strategy**

Lessons for Financial Institutions

- **Beware of potential liquidity problems when long-term funding requirements are financed with short-term liabilities**
- **Market transparency is important**
- **Manage incentives**
- **Never ignore risk management, even when times are good**

Lessons for Non-Financial Corporations

- **It is important to fully understand the products you trade**
- **Beware of hedgers becoming speculators**