LEHMAN BROTHERS

Market Risk Management

Risk Equity
and
Risk Appetite Models

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CONFIDENTIAL

Risk Equity and Risk Appetite Models

Executive Summary

Background

The Purpose of Equity

- Equity represents a cushion to absorb economic losses. The maintenance of the appropriate level of equity is central to the Firm's ability to raise capital and to transact with credit-worthy counterparties.

- The amount of equity required by the Firm is determined by the level of potential economic losses to which the Firm is exposed. These economic losses may arise from specific positions and counterparties, as well as general operating business or legal risk. In addition, equity may be reserved by management for purposes of investing in new activities and ventures.

Equity Model

- The Model determines the amount of required equity at the Firm level, and for each of the Firm's businesses, on both a global and a regional basis. It is measured on a fully diversified, after-tax basis.

- Following are the components of economic risk that are quantified in the Model for each business unit:

    - Market risk
    - Event risk
    - Counterparty credit risk

- Operating risk
- Legal risk
- Risk associated with other corporate assets such as buildings

Market risk

- Market risk measures the potential mark to market loss on positions from adverse moves in all risk factors. Market risk is measured using historical simulation.

Event risk

- Event risk measures the potential loss associated with occurrences which are beyond those measured in market risk. These are losses associated with a downgrade for High Grade bonds, a default for the High Yield business, loss on sub-prime residential whole loans and residuals in event of increased default, loss due to deal break in the M&A risk arbitrage business, dividend risk in equity derivatives, or loss on real estate backed loans

Counterparty credit risk

- Counterparty credit risk measures the potential loss across all of the Firm's forward settlement, financing and derivative transactions due to counterparty default.

Diversification benefit

- The Model measures loss from these economic risks on an after tax basis at the business unit level. In aggregating the economic risks across business units, products and divisions, the benefit for the diversification of risks across businesses and divisions is taken into account. It is not allocated back to the lower levels.

Regulated Entities

- Regulated legal entities, including entities which are required to maintain capital for rating agency compliance, are required to maintain a minimum level of equity capital. In determining the amount of capital utilized by a business operating in a regulated entity, the after tax economic risk capital is compared to the regulatory equity and the greater of the two is allocated to the business.

Operating Risk

- Operating risk measures business risk. If the adjusted cost base of the business is greater than the adjusted revenue base, additional equity is required to sustain the business through the cycle. On the other hand, if a business can produce positive net income through the cycle, this amount reduces the required equity from positional risk.

- For purposes of calculating the Operating Components of equity the following assumptions are used:

  - Revenues
    - 25% decrease of institutional flow per quarter for three quarters
    - 70% decrease in equity origination & leverage finance per quarter for three quarters
    - 40% decrease in M&A fees per quarter for three quarters
    - 20% decrease in high grade origination per quarter for three quarters

  - Expenses
    - 25% reduction in compensation & benefits
    - 10% reduction in support and control compensation
    - 9.4% reduction in the variable component of non-personnel expenses
    - no change in the fixed component of non-personnel expenses

Legal Risk

- Legal risk measures the potential loss arising from litigation with investors, customers and employees, net of applicable insurance recoveries.

Corporate Assets

- The equity associated with other assets in the Firm, for example buildings, is allocated to each business.

i) RISK APPETITE

The risk appetite represents the loss the Firm is prepared to incur over one year due to market, event and credit risks. It is defined and measured at a 95 percent level of confidence.

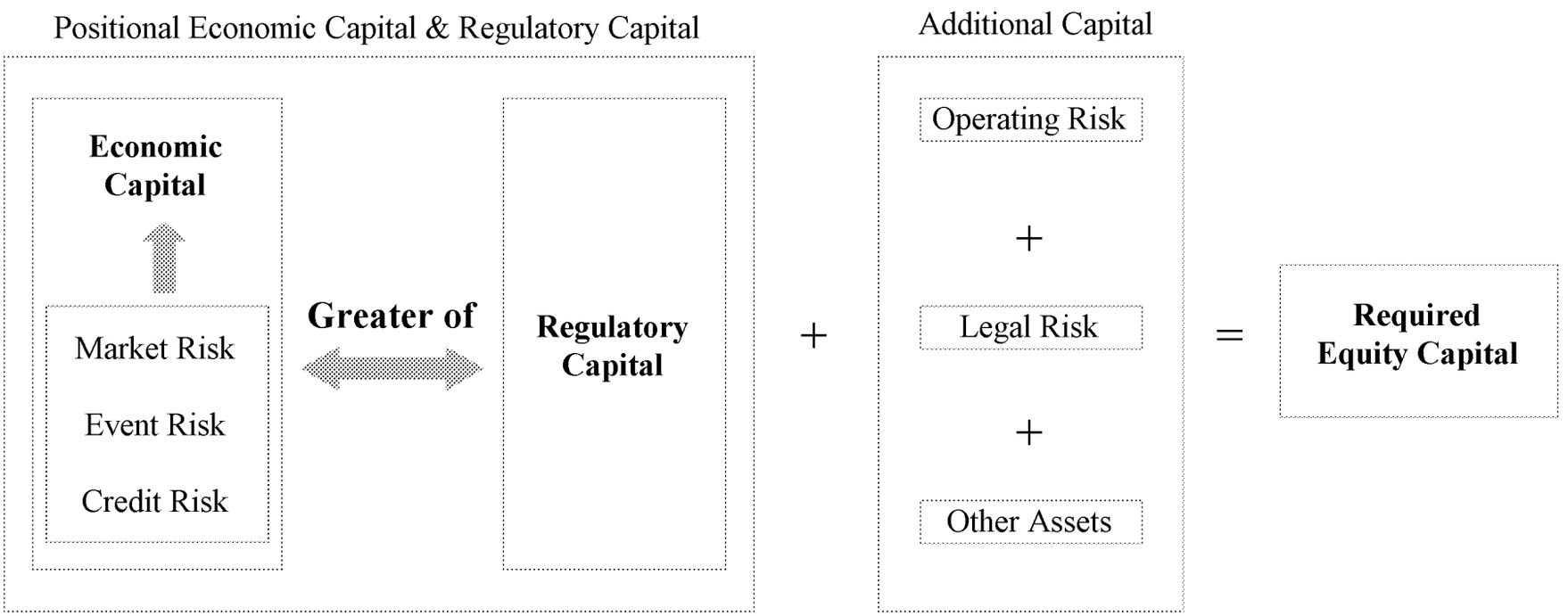
The relationship between Daily VaR and equity requirement to risk appetite is outlined in the graph below:

Daily VaR		Risk Appetite		Equity Requirement
95% confidence	⇐	95% confidence	⇒	99.5% confidence
One day horizon		One year horizon		Longer horizon depending on the nature of the trade
Market Risk		Market Risk Event Risk Credit Risk		Market Risk Event Risk Credit Risk Regulatory Capital Operating Risk Legal Risk Corporate Assets
Pretax		Pretax		After tax

ii) METHODOLOGY FOR MEASURING RISK

The equity capital is the greater of the economic capital to cover market/event/credit risks and the requlatory capital requirement, as well as additional capital required for operating/legal/other corporate assets.

Equity Capital, Economic Capital, and Regulatory Capital



Market Risk

Market risk measures the potential mark-to-market loss on current positions from adverse moves in all risk factors. Market risk is measured using historical simulation.

Market risk is composed of linear, nonlinear and issue-specific risks.

- Linear risk is measured by calculating the sensitivities of all products to the relevant risk factors – the level and shape of the yield curves, credit spreads, basis, foreign exchange, etc. – and then simulating a walk-back through time to determine the P&L impact of changes in these relevant risk factors on the current portfolio.

- Nonlinear risk is computed based upon the stress matrices of P&L changes provided by the front-office pricing systems for various derivative products. The stress matrices of a portfolio are generated by stressing two major risk factors at a time and revaluing the whole portfolio. Then bi-linear interpolations are used to obtain nonlinear P&L vectors.

- Issue-specific risk captures the idiosyncratic risk of individual issues. It is assumed to be independent of other risk factors and to have a normal distribution with zero mean.

To calculate the total risk of a portfolio, the linear and nonlinear P&L vectors are first aggregated to obtain the total P&L vector, and then this vector is combined (or convoluted) with the normal distribution of P&L due to the issue-specific risk. The result gives a combined daily P&L distribution due to all measurable market risks.

For Risk Appetite, the annual market risk is calculated by scaling up the daily market risk as defined as the lower 5 percentile tail of the daily P&L distribution. Historical market data is weighted to emphasize more recent history.

For Risk Equity, the market risk is defined as the lower 0.5 percentile tail of the annual P&L distribution, derived from the daily P&L distribution assuming it to be identical and independent from day to day, which is equivalent to assuming that the exposures of the portfolio (not the portfolio itself) are stationary from day to day. Historical market data is not weighted to capture market moves for the whole historical period used in the simulation.

Simulation of Linear Risk: Conceptual Framework

$$[\text{Historical Time Series}] \times [\text{Sensitivity Vector}] = [\text{Simulated P \& L}]$$

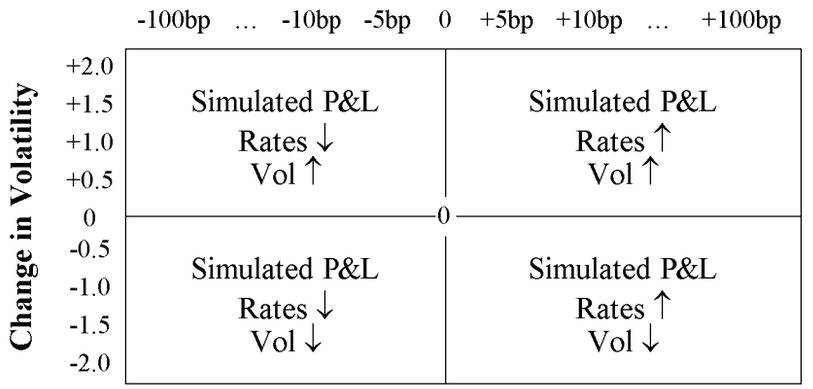
$$\begin{matrix} \underline{\text{O/N}} & \underline{\text{1Yr}} & \cdots & \underline{\text{30Yr}} \end{matrix}$$

$$\begin{bmatrix} D_1 & D_1 & \cdots & D_1 \\ D_2 & D_2 & \cdots & D_2 \\ & & \cdots & \\ \vdots & \vdots & & \vdots \\ & & & \\ & & & \\ & & & \\ D_N & D_N & \cdots & D_N \end{bmatrix} \times \begin{bmatrix} S_{O/N} \\ S_{1Yr} \\ \vdots \\ \\ \\ \\ S_{30Yr} \end{bmatrix} = \begin{bmatrix} P\&L_1 \\ P\&L_2 \\ \vdots \\ \\ \\ \\ P\&L_N \end{bmatrix}$$

Nonlinear risks are calculated via stress matrices which tabulate full revaluations.

Framework for Simulation of Nonlinear Risk

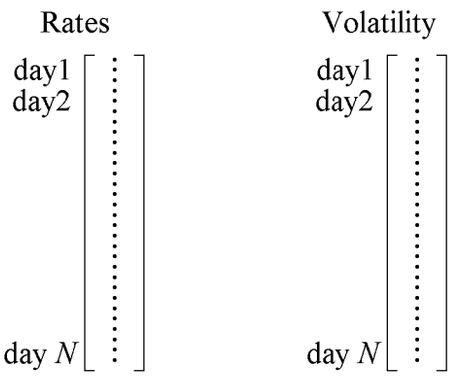
Change in Underlying Benchmark Interest Rate



Step 1:

Revalue portfolio for changes in rates and volatility. Each observation in the table represents the change in the portfolio P&L due to a simultaneous change in the benchmark interest rate and implied volatility.

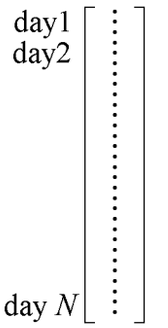
Historical Time Series



Step 2:

Taking a time series of actual simultaneous changes in rates and in vol over the past four years and, using the matrix as a look-up table, we create a simulated P&L vector.

Simulated P&L



Step 3:

Vector of simulated P&Ls from Step 2.

Market risk is then determined by taking all of the simulated P&L vectors, representing both linear and nonlinear exposure, and adding the P&Ls for each day over the past four years.

In an unweighted scheme, each of the simulated P&L is assumed to have equal probability of occurrence. In a weighted scheme, the probabilities are assumed different. In our VaR & risk appetite calculations, the probabilities (or weights) are assumed to decay exponentially going back in time, giving emphasis to more recent market data.

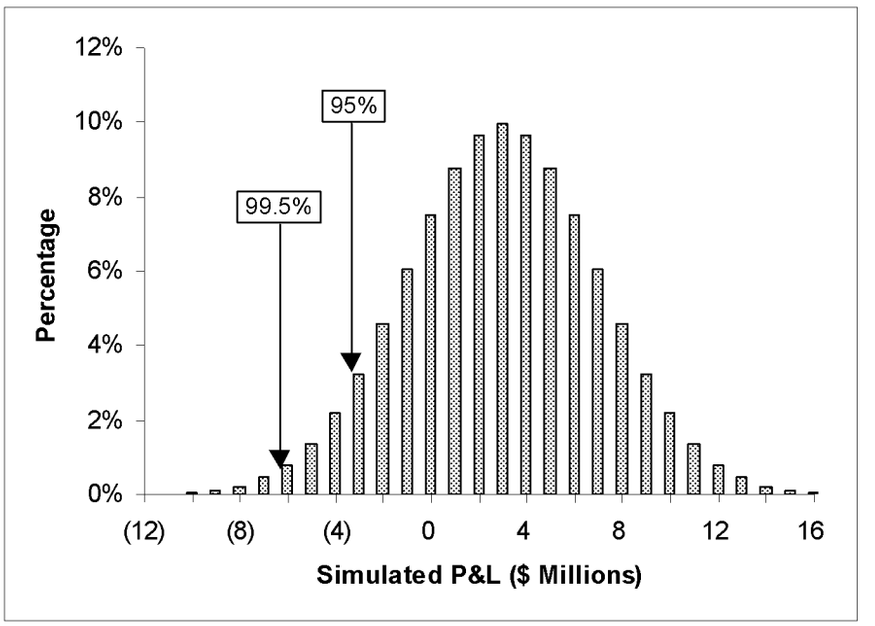
The combined P&L vector together with the assumed corresponding probability vector is used to obtain the empirical P&L distribution (histogram). Then, the desired quantile of the distribution is selected to represent risk at a certain confidence level.

Combining Linear and Nonlinear Risk

$$\begin{bmatrix}\text{Linear}\\ \text{Simulated}\\ \text{P \& L}\end{bmatrix} + \begin{bmatrix}\text{Nonlinear}\\ \text{Simulated}\\ \text{P \& L}\end{bmatrix} = \begin{bmatrix}\text{Total}\\ \text{Simulated}\\ \text{P \& L}\end{bmatrix} \Leftrightarrow [\text{Probability}]$$

$$\begin{matrix}\text{day 1}\\ \text{day 2}\\ \\ \\ \\ \text{day N}\end{matrix}\begin{bmatrix}\cdot\\ \cdot\\ \vdots\\ \\ \\ \vdots\\ \cdot\end{bmatrix} + \begin{matrix}\text{day 1}\\ \text{day 2}\\ \\ \\ \\ \text{day N}\end{matrix}\begin{bmatrix}\cdot\\ \cdot\\ \vdots\\ \\ \\ \vdots\\ \cdot\end{bmatrix} = \begin{matrix}\text{day 1}\\ \text{day 2}\\ \\ \\ \\ \text{day N}\end{matrix}\begin{bmatrix}\cdot\\ \cdot\\ \vdots\\ \\ \\ \vdots\\ \cdot\end{bmatrix} \Leftrightarrow \begin{matrix}\text{day 1}\\ \text{day 2}\\ \\ \\ \\ \text{day N}\end{matrix}\begin{bmatrix}p_1\\ p_2\\ \vdots\\ \\ \\ \vdots\\ p_N\end{bmatrix}$$

Histogram of Simulated P&Ls (unweighted scheme)



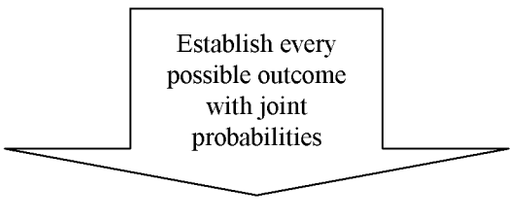
Event Risk

Event risk measures the potential loss associated with occurrences which are beyond those measured in "regular" markets. These are losses associated with downgrades of High Grade credits, defaults of High Yield credits, loss on sub-prime residential whole loans and residuals in event of increased default, loss due to deal break in the M&A risk arbitrage business, dividend risk in equity derivatives, or loss on real estate backed loans.

Downgrade, default and M&A deal break events are assumed to be mutually independent. This implies that the probability of each combination of events and non-events is equal to the product of probabilities of the events and non-events.

High Yield Event Risk: Conceptual Framework

Bond	"ABC"	"XYZ"	"KLM"
Rating	Ba	B	Baa
Default Probability	1.23%	6.80%	0.14%
No Default Probability	98.77%	93.20%	99.86%
Position Market Value ($MM)	25.0	15.0	30.0
Exposure after 30% Recovery ($MM)	17.5	10.5	21.0

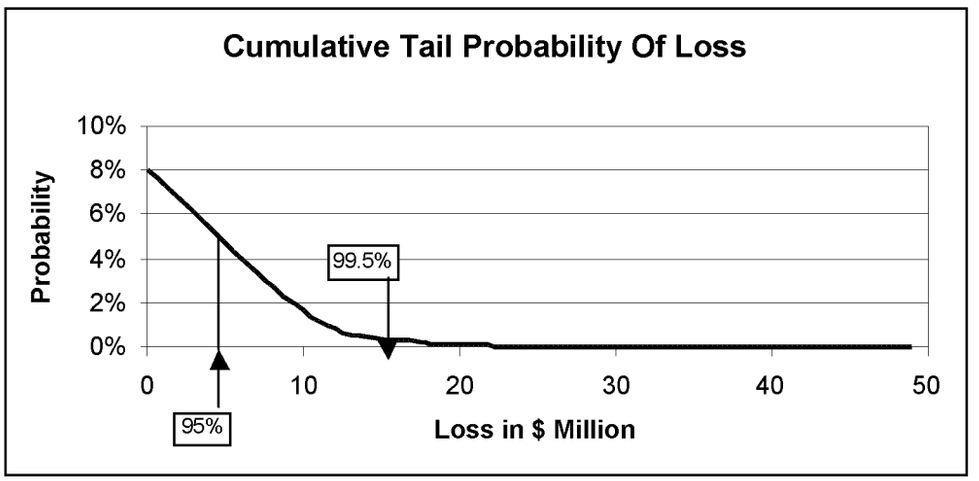


Possible Combinations ($2^3 = 8$)	Loss Table			Number of Bonds Default	Portfolio Exposure ($MM)	Joint Probability
1	17.5	10.5	21.0	3	49.0	0.00012%
2	17.5	10.5	-	2	28.0	0.08352%
3	17.5	-	21.0	2	38.5	0.00160%
4	-	10.5	21.0	2	31.5	0.00940%
5	17.5	-	-	1	17.5	1.14476%
6	-	10.5	-	1	10.5	6.70696%
7	-	-	21.0	1	21.0	0.12888%
8	-	-	-	0	0.0	91.92476%

We then rank total exposures along with their joint possibilities of occurrence in descending order and create a cumulative probability from which we cut a tail at 95 and 99.5 percent.

Exposure Sorted in Descending Order

Portfolio Exposure ($MM)	Joint Probability	Cumulative Probability	
49.0	0.00012%	100.00000%	
38.5	0.00160%	99.99988%	
31.5	0.00940%	99.99828%	
28.0	0.08352%	99.98888%	
21.0	0.12888%	99.90535%	
17.5	1.14476%	99.77648%	99.5% CI (0.5% Tail)
10.5	6.70696%	98.63172%	95% CI (5% Tail)
0.0	91.92476%	91.92476%	



Real Estate Event Risk

For real estate and related loans, event risk measures the probability weighted capital value loss due to real estate downturns. This is measured by simulating a "walk-back" through time to determine the P&L impact of shocks in the real estate market on today's portfolio.

Commercial Event Risk: Conceptual Framework

Step 1: Revalue each property to simulate P&L impact (7 possible property types, 56 Metropolitan Statistical Areas, or MSAs).

$$\left[\begin{array}{c}\text{Market Value}\\ \text{of Property}\end{array}\right] \times \left[\begin{array}{c}\text{Historical Time Series of}\\ \text{Property Value Changes}\end{array}\right] - \left[\begin{array}{c}\text{Senior Debt}\\ \text{if applicable}\end{array}\right] - \left[\begin{array}{c}\text{Lehman Loan}\\ \text{MTM Basis}\end{array}\right] = \left[\text{Simulated P \& L for each loan}\right]$$

Example: Lehman holds the first lien

Property value = $100mm, 80% LTV loan marked at 90[(1)] so our "basis" is $72 million.

- if the property value goes below $72 million, we show a dollar-for-dollar loss below $72 million
- if the property value goes to $90 million, we have no loss and a "pull-to-par" of $8 million

Example: Lehman holds the second lien

Property value = $100 million, 1st mortgage (with a 3rd party) is $60 million, Lehman holds the mezz of $25 million with a basis of $22 million.

- if the property goes to $90 million, we show no loss and a pull-to-par of $3 million
- if the property value goes to $80 million, we have a loss of $2 million

(1) *Origination fees and positive carry applied to reduce basis*

Step 2: We then take the simulated P&Ls and aggregate losses across property types within MSAs. By doing this we take the conservative assumption of perfect correlation across these property types. (Note that each observation in the simulated P&L vector is either a loss or a zero i.e., we do not take the benefit of any gains on property values.) This results in up to 56 simulated P&L vectors, with 59 observations in each (Q4, 2004 going back to Q1, 1990).

New York Simulated P&L	Chicago Simulated P&L	Boston Simulated P&L
$\begin{bmatrix} P\&L_1 \\ P\&L_2 \\ \vdots \\ \vdots \\ P\&L_{59} \end{bmatrix}$	$\begin{bmatrix} P\&L_1 \\ P\&L_2 \\ \vdots \\ \vdots \\ P\&L_{59} \end{bmatrix}$	$\begin{bmatrix} P\&L_1 \\ P\&L_2 \\ \vdots \\ \vdots \\ P\&L_{59} \end{bmatrix}$

Step 3: Lastly, we aggregate across MSAs using the same approach as described above where we take the total exposures and calculate the joint probabilities and then create a cumulative probability distribution from which we cut a tail at any given confidence level.

Credit Risk

Counterparty credit risk measures the total potential loss that the Firm might suffer over a one-year time horizon. This potential loss is measured across all of the Firm's forward settlement, financing and derivative transactions with its customers.

The potential loss on the portfolio is measured in a three-step process:

1) The potential exposure profile for each and all counterparties is calculated at the 95% confidence level.

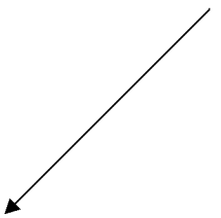
2) Each counterparty is assigned a historical survival curve based on its internal credit rating and a recovery rate based on its industry description.

3) At a business level, the defaults across different counterparties are assumed independent. The portfolio loss distribution is derived using the same combinatorics procedure as in the high yield event risk. From this distribution the potential portfolio loss at the desired confidence level (95% for Risk Appetite, 99.5% for Risk Equity) is calculated. This procedure is repeated for each year to up to 30 years & the worst-year loss at the desired confidence level is selected.

Diversification and Correlation: Conceptual Framework

We allow for the benefit of diversification in aggregating risk across businesses while recognizing correlations exist across risk categories within businesses.

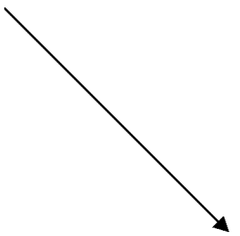
Diversification



Within Market Risk across businesses and divisions

- Diversification benefits arise from businesses functioning as part of a larger unit
  - regional businesses => global businesses
  - global businesses => divisions
  - divisions => firm

Correlation



Within businesses across the risk categories described above

- Correlation exists
  - Market risk
  - Event risk
  - Credit risk

Diversification and Correlation: Conceptual Framework (Cont.)

Regional businesses => Global businesses

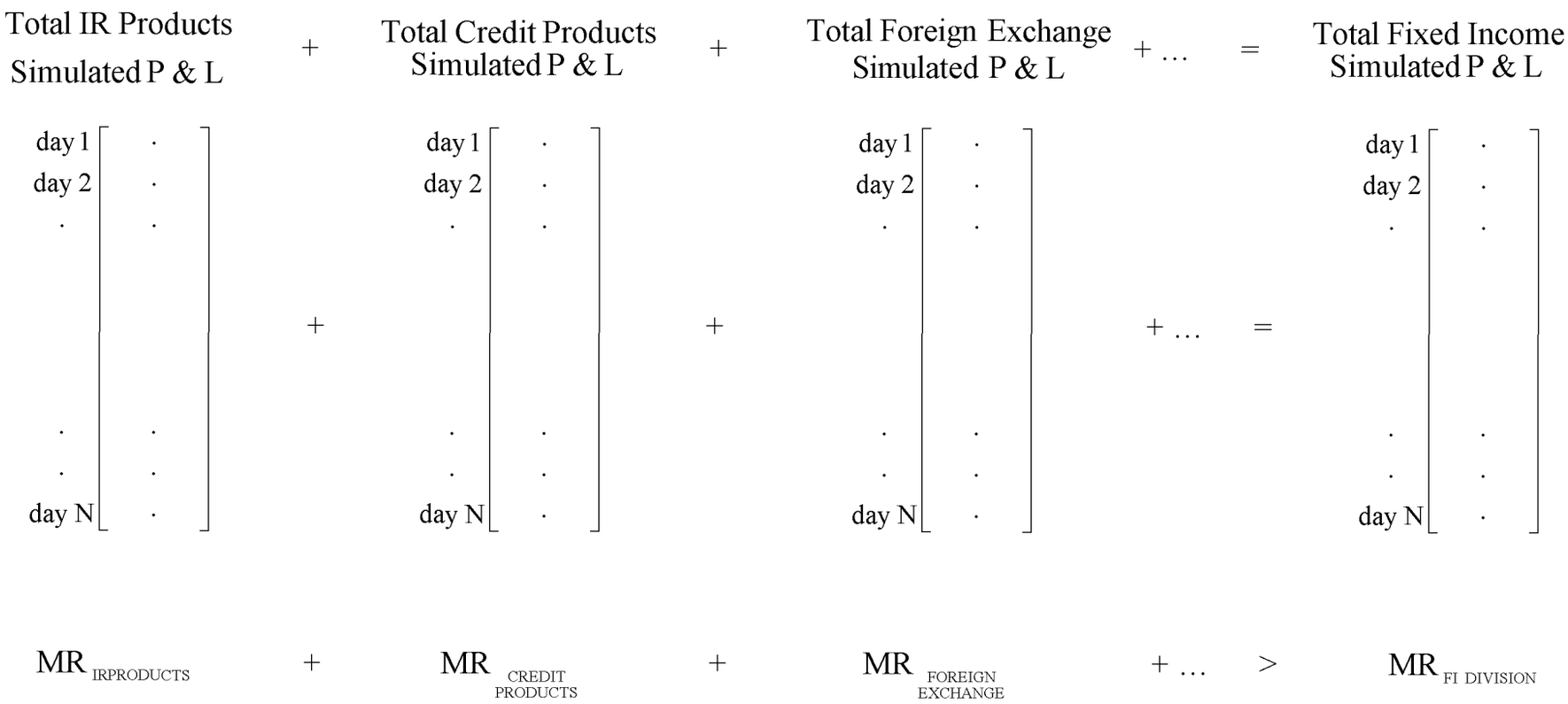
Interest Rate Products America Total Simulated P & L	+	Interest Rate Products Europe Total Simulated P & L	+	Interest Rate Products Asia Total Simulated P & L	=	Total Interest Rate Products Simulated P & L
day 1 · day 2 · . . . . . . day N ·	+	day 1 · day 2 · . . . . . . day N ·	+	day 1 · day 2 · . . . . . . day N ·	=	day 1 · day 2 · . . . . . . day N ·

For each simulated P&L we cut a tail to get market risk as described above. Diversification exists because in most cases the sum of the market risk estimated from each simulated P&L distribution is greater than the sum of the market risk estimated from the combined total simulated P&L distribution. The difference is the diversification benefit.

$$MR_{AMERICA} + MR_{EUROPE} + MR_{ASIA} > MR_{TOTAL}$$

Diversification and Correlation: Conceptual Framework (Cont.)

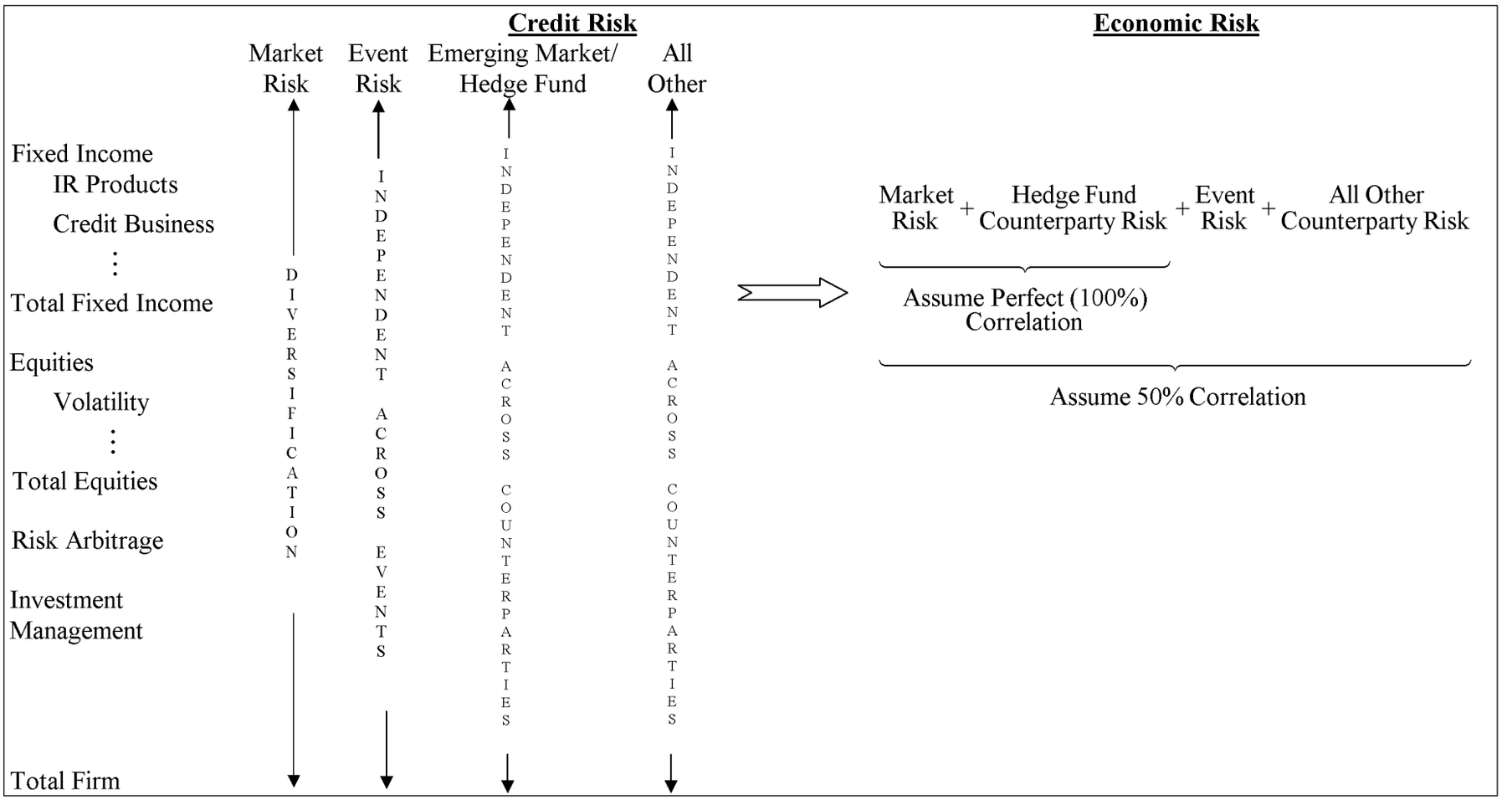
Global businesses => Divisions



We have reviewed how we assess market risk (both linear and nonlinear), event risk, and credit risk, and how we determine a diversification benefit for market risk across businesses. Event risk and counterparty exposures across businesses are assumed to be independent.

Within a business, market and credit risk with Emerging Market and Hedge Fund counterparties are assumed to be perfectly correlated while market risk is assumed to be 50 percent correlated with event and counterparty risk.

Correlation: Conceptual Framework



Regulated Entities

Regulated legal entities, including entities which are required to maintain capital for rating agency compliance, are required to maintain a minimum level of equity capital. In determining the amount of capital utilized by a business operating in a regulated entity, the after tax economic risk capital due to market, event, & credit risks is compared to the regulatory equity and the greater is allocated to the business.

In addition to quantifying the positional risk, the potential loss from the ongoing operation of the businesses and legal risk are quantified.

Operating Risk

Operating risk measures the potential gain or loss associated with the operating economics of a business beyond the potential losses arising from positional and counterparty risks. To the extent that the adjusted cost base of the business is greater than an adjusted revenue base, additional equity is required to sustain the business cross cycle. Likewise, to the extent that a business which can produce positive net income after tax cross cycle, this amount reduces the required equity from positional risk.

For purposes of calculating the Operating Components of equity the following assumptions are used:

- Revenues
  - 25% decrease of institutional flow for three quarters
  - 70% decrease in equity origination and leverage finance for three quarters
  - 40% decrease in M&A fees for three quarters
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- Expenses
  - 25% reduction in compensation
  - 10% reduction in support and control compensation
  - 9.4% reduction in the variable component of non-personnel expenses
  - no change in the fixed component of non-personnel expenses

Legal Risk

Legal risk measures the potential loss arising from litigation from investors, customers and employees, net of applicable insurance recoveries.

- Previous securities industry settled cases were reviewed to determine current applicability and damage compared with coverage under our insurance indemnities (i.e. NASDAQ, Yield burning)

Corporate Assets

The equity associated with other assets in the Firm, for example the buildings, are allocated to each business as part of the operating component of equity.

- Equity is assigned to the corporate assets based on assumed debt/equity ratio and allocated to the businesses by drivers (i.e., compensation, headcount, etc.)