The Actuarial Profession
making financial sense of the future

Risk Management in other Industries
Mark Train

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How many times have you heard this statement?

"Banks have been doing risk management much better and for much longer than insurance companies. Insurance companies must be able to learn from them"
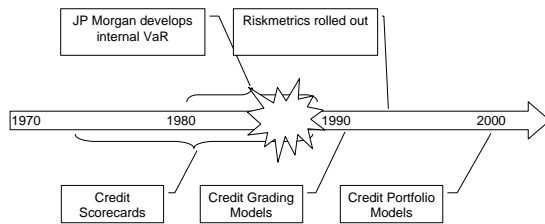

Working Party Objectives

- to review methodologies in other industries
  - focus on the banking industry
- to identify whether any of these methodologies could potentially be applied in the insurance industry
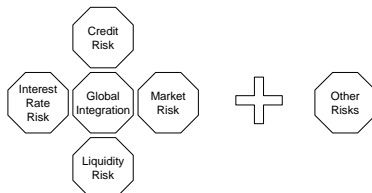- Communicate with Chris O'Brian's working party

Approach to our Work

- Interviews
  - Banks, Consultancies, Academics
- Review Bank's Disclosures
- Literature

A Brief History of RM in Banks

| JP Morgan develops internal VaR | Riskmetrics rolled out |

| 1970 | 1980 | 1990 | 2000 |

| Credit Scorecards | Credit Grading Models | Credit Portfolio Models |

Risk Management Organisation

Credit Risk

Interest Rate Risk — Global Integration — Market Risk   Other Risks
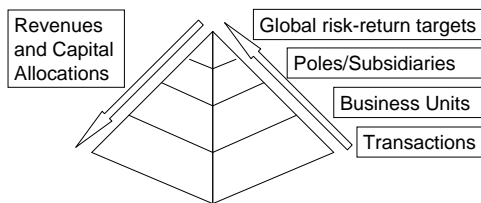
Liquidity Risk

- Now sufficient common ground across risks to capture them in a single framework
- Methodologies, techniques and implementations
- Borders between risks are progressively disappearing

Example – Convergence of Market and Credit Risk

- Ability to hedge credit risk with credit derivatives
- "Buy and Hold" culture is changing – credit risk management is closer to "trading"
- Portfolio view of credit risk
- VaR and portfolio models apply gradually to all risks

Risk Management Organisational Structure

Basic Building Blocks of RM Processes

Revenues and Capital Allocations

Global risk-return targets
Poles/Subsidiaries
Business Units
Transactions

Some Risk Definitions

Market — Arises from possibility of losses resulting from unfavourable market movements. i.e. perceived value of an instrument changes
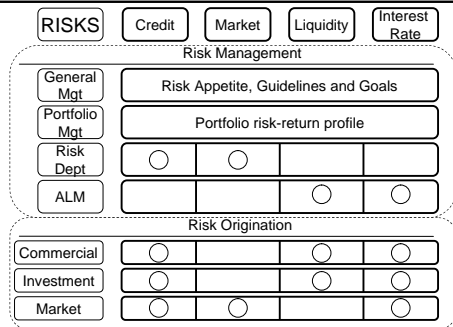
Credit — Arises from default – failure to honour a promise to make a payment

Grey Area between market and credit – in banking a change in value of corporate bonds due to widening of credit spreads is considered market risk.

If credit quality of issuer falls causing individual security to fall, this is considered as credit risk.

Risk Management Organisational Structure

RISKS	Credit	Market	Liquidity	Interest Rate

Risk Management

General Mgt	Risk Appetite, Guidelines and Goals			
Portfolio Mgt	Portfolio risk-return profile			
Risk Dept	○	○		
ALM			○	○

Risk Origination

Commercial	○		○	○
Investment	○		○	○
Market	○	○		○

Role of Risk Department

- Monitoring and control of all risks (Credit, Market and ALM)
- Decision making
- Credit Policy
- Setting Limits
- Development of internal tools and databases
- Risk adjusted performance measures
- Portfolio actions
- Reporting to General Management

Role of ALM Function

- Liquidity and interest rate management
- Measure and control liquidity and interest rate risk
- Compliance
- Hedging
- Transfer Pricing systems
- Asset Liability Committee
- Reporting to General Management

Role of Portfolio Management

■ Trading Credit Risk
■ Portfolio Restructuring
■ Securitisation
■ Portfolio actions and reporting
■ Reporting to General Management

Role of Credit Risk Management

■ Credit Policy
■ Setting credit risk limits and delegations
■ Credit Administration (credit applications and documentation)
■ Credit decisions (credit committee)
■ Watch lists
■ Early warning systems
■ Reporting to General Management

Role of Market Risk Management

■ Market Risk Policy
■ Setting limits
■ Measure and Control of risks
■ Compliance
■ Monitoring
■ Hedging
■ Reporting to General Management

What are the basic building blocks of risk models

- Primary goal of risk management is to enhance risk-return profiles
  - Transaction level
  - Portfolio level

Risk Drivers and Transaction Risk

Portfolio Risk

Top-down & Bottom-up tools

Risk & Return Measures

Overview of Asset Liability Management

- ALM deals with management of market risks from structural positions
  - Structural Interest rate - Borrowing short and lending long
  - Funding liquidity risks
  - Funds Transfer pricing
- Implicit embedded options make value dependent on customer behaviour
- Difference in yields on prime-based assets and market-based assets

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ALM – Interest Rate Risk

- Use of GAP reports
  - Contractual-Maturity Gap
  - Repricing Gap
  - Effective-Maturity Gap
- Economic Capital calculated from GAP report
  - Parametric VaR
  - Rate-shift scenarios
  - Monte Carlo Simulation
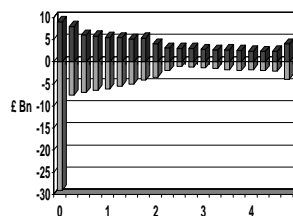
Economic Capital from Monte Carlo Simulation

```
         ┌──────────────────────┐
         │   Randomly Create    │◄──┐
    ┌───►│   Interest Rates     │   │
    │    └──────────────────────┘   │
    │         │         │           │
    │  ┌──────────────┐ ┌──────────────┐
    │  │Calculate     │ │Calculate     │
    │  │Changes in    │ │Changes in    │
    │  │Balances      │ │Prime Rates   │
    │  └──────────────┘ └──────────────┘
    │         │         │
    │    ┌──────────────────────┐
Repeat for  │ Calculate Payments │
next year   └──────────────────────┘
    │              │
    │    ┌──────────────────────┐
    │    │ Calculate NPV for    │
Repeat for  │ Scenario             │
next        └──────────────────────┘
scenario           │
         ┌──────────────────────┐
         │    Calculate         │
         │ Distribution of NPVs │
         └──────────────────────┘
```
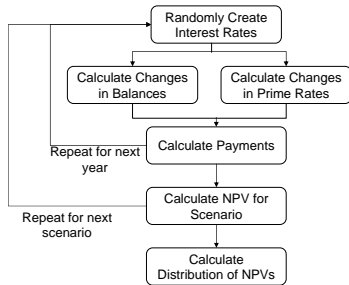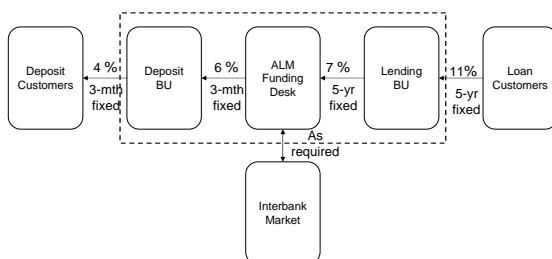

ALM – Funding-Liquidity Risk

- Arises from mismatches between structural assets and liabilities
- Expected funding requirements – scheduled payments and average of other payment behaviour
- Unusual funding requirements - (e.g. 2 std deviations distribution for customer behaviour)
  - Covered from discretionary sources
- Crisis funding requirements & Economic Capital
  - Fire sale discounts on assets

ALM – Funds Transfer Pricing

```
┌──────────┐  4%  ┌─────────┐  6%  ┌──────────┐  7%  ┌─────────┐ 11% ┌──────────┐
│ Deposit  │◄────►│ Deposit │◄────►│   ALM    │◄────►│ Lending │◄───►│  Loan    │
│Customers │3-mth │   BU    │3-mth │ Funding  │5-yr  │   BU    │5-yr │Customers │
│          │fixed │         │fixed │  Desk    │fixed │         │fixed│          │
└──────────┘      └─────────┘      └──────────┘      └─────────┘     └──────────┘
                                        │ As
                                        │ required
                                   ┌──────────┐
                                   │ Interbank│
                                   │  Market  │
                                   └──────────┘
```

Overview of Market Risk

- VaR commonly used
  - One day measure
  - Good for describing what happens on "bad" days but not "terrible" days
  - Stress and scenario testing needed to avoid "terrible" days
- Three main methods for calculating VaR
  - Parametric
  - Historical Simulation
  - Monte Carlo Simulation

Parametric VaR

- Defined set of risk factors sufficient to value portfolio (e.g. interest rates, FX rates, equity markets)
- Sensitivity of value of each instrument to each risk factor
- Historical std deviations and correlations of risk factors
- Estimate std deviation of portfolio value
- Assume loss distribution is normal and calc 99% VaR

Historical Simulation VaR

- Market data for all risk factors over 250 days
- Calculates daily % change for each risk factor
- Apply to today's risk factors
- Value portfolio using full non-linear models
- Choose 3rd worst day as 99% VaR

Monte Carlo Simulation VaR

- Calculate Covariance Matrix for all risk factors
- Decompose Covariance Matrix
- Create random scenarios
- Value portfolio under each scenario using full non-linear pricing models
- Read off 1% worst result for 99% VaR

Comparison of VaR methodologies

	Parametric	Monte Carlo	Historic Sims
Computation Speed	✓✓✓	✗	✓
Capture Non-Linearity	✗	✓✓✓	✓✓✓
Capture Non-Normality	✗	✓	✓✓✓
Independence from historic data	✓✓	✓✓	✗

Overview of Credit Risk

- Losses due to Default
    - Expected Loss and Unexpected Loss (Std Deviation)
    - Require EAD, LIED and PD
- Losses due to Default and Downgrades
    - Estimate change in value due to grade changes
    - Probabilities of grade changes
- Extend to multiple years

Estimating Parameter Values for PD, EAD & LIED

- Probability of Default (PD)
  - Expert Credit Grading
  - Quantitative scorecards based on customer data
  - Equity-based credit scoring
- Exposure at Default (EAD)
- Loss in the Event of Default (LIED)

Extension to a credit portfolio

- EL for portfolio are relatively straightforward
- Also need loss correlations
  - Historical correlations
  - Using asset correlations to estimate loss correlations
    - Merton model
    - Probability of default is probability equity price falls below zero
    - Thus, the higher the equity correlation the greater the default correlation
- Estimate UL for portfolio from loss correlations and individual ULs
- Calculate Beta distribution with EL and UL

Overview Inter-Risk Diversification and Aggregation

- Diversity of models
  - VaR calculator – Trading risks
  - Simulation model – ALM risks
  - Portfolio model – Credit risks
  - Specialised models – Operational risks
- Correlation matrix approach is quite common
- Methods of estimating correlations
  - Historical data
  - Historical equity prices of monoline companies
  - Simulation with "model points"

Observations/ Preliminary Conclusions

Insurance Industry	Banking Industry

- RBC/ICA has been the primary driver of integrated RM
- Top-down approach dominates
- Liability driven balance sheet

- RM developed to prevent losses or optimise risk-return
- Bottom-up approach dominates
- Balance sheet is driven by assets and liabilities

Observations/ Preliminary Conclusions
What can we learn from the banking industry?

- Risk Governance
- Operational Risk techniques
- Communication and KRIs
- Portfolio Credit Risks
- Funds Transfer Pricing operation
- Maintaining/updating bespoke pricing and real world scenario generators