Chapter 11
The Management of Market Risk

Introduction

Chief Risk Officer (CRO)

- Credit Risk Officer

- Operations Risk Office

- Market Risk Officer

  - Policies & Procedure

    - defining responsibilities

    - ensuring disciplined risk measurement

    - approving new operations

- **Market Risk Measurement**

  - ◆ create risk-measurement report

- **Market Risk Management**

  - ◆ inventory age limits

  - ◆ concentration limits

  - ◆ stop-loss limits

  - ◆ limits on position size

  - ◆ principles for setting limits

  - ◆ setting VaR limit

Establishing Policies And Procedures

- Staff: with a background in audit, operations, and financial reporting

- Task: ensure the trading operation is well controlled

  - Defining Responsibilities

    - 定義那個部門要報告那些風險,那些部門要負責控制風險

    - 確立risk management group (settlements group 和 accounting group) 與 trading group 分立之原則

    - There is always a formal delegation of authority (a document specifies which products may be traded by each individual and desk) before trading transaction

- **Ensuring Disciplined Risk Measurement**
  - 訂立 risk measurement (reporting) 之規則、程序、模型、流程，以確保risk measurement report之正確度與可信度。例如，trader 是不能接觸或更改有關於他部位的 risk measurement system
  - 訂立驗證新的risk measurement model之規則。例如，何時或如何測試此模型，規定誰可以使用此模型等

- Approving New Operations
  - 有新產品，新模型，新交易對手時，要擬定新 policies。
    - 例如，為什麼要引進新產品？誰會來交易此產品？如何 risk-monitor此產品，accounting system要如何修改來加入此產品
    - 此外，確認新評價模型是否正確，並看那些產品適合那些評價模型
    - 與settlement group共同決定新交易對手之deliver與 settlement是否reliable，與credit group 共同決定交易對手的default probability有多大

Creating Risk-Measurement Reports

- Staff: with background in quantitative skills, information technology

- Task: generate report to internal and external constituencies, that costs significant effort because of short time available and massive data processing for the risk calculator

- Internal constituencies: risk management, senior management, and traders
  - For senior management, total risk and the main source of risk need to be known and the reports are used to ensure that the risks match the amount of available capital
  - The traders use the reports to better understand their risk and let them see their position is correlated with the rest of the bank
  - The daily reports for internal management includes absolute position, available EC, P&L, sensitivity, stress, scenario reports, stand-alone VaR, VaRC etc. (p.167)

- **External constituencies: regulators, rating agency, and investors**
  - The external reports are generated monthly or quarterly and include bank-level VaR, back-testing results, and available capital being held
  - Investors use the report to ensure that the bank has adequate risk controls and that the risk is commensurate with their expected return
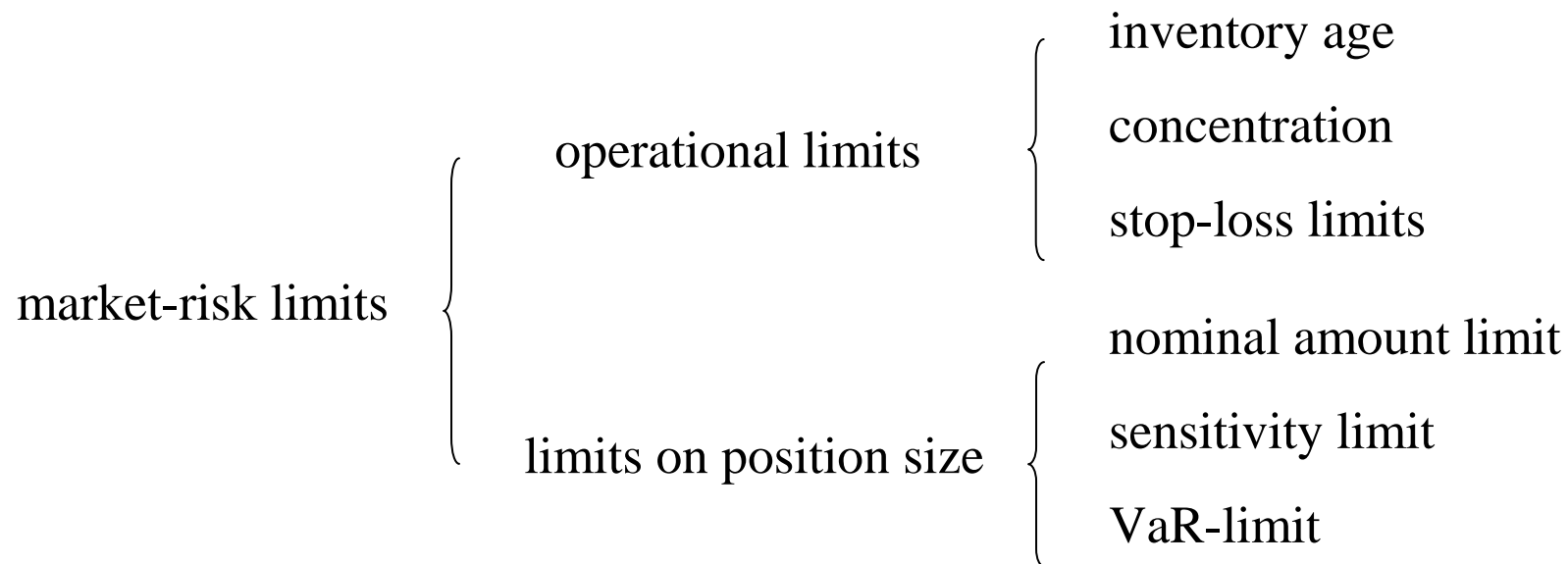
- **The main things to be noted when reading reports from risk management group:**
  - 看會計的P&L與用VaR (or risk) calculator中的 sensitivity算的是否一致
  - 比較VaR與交易之淨值是否合理
  - 看不同desk的VaR分配情況
  - 比較Parametric and Monte Carlo VaR (看是否有 nonlinearity)
  - 比較Monte Carlo and Historical VaR (看分配的假設是 否穩定或依然正確)
  - Stress tests 中是否有nonlinearity之變化情況
  - 比較VaR與scenario tests (若差距大，表示此scenario已 不在用來計算VaR的歷史資料中)
  - 範例：p.168 Figure 11-2, p.169 Figure 11-3

Management Market Risk And Risk Limits

- Staff: has background in both quantitative skills and ex-traders
- Task: risk managers通常沒法直接控制 trader 去降低其投資組合之風險，但當發現excessive risk，可以提醒trader或senior management，或是調整trader的risk limits
  - A bank's framework of limits is the mechanism by which senior management controls the total risk that can be taken
  - The limits tell each trader and trading group the maximum amount risk that they can risk
  - The bank allocates its risk capacity to its business groups to derive the greatest risk-adjusted return

■ There are two types of risk limits in trading operations:

1. counterparty-credit limits (discussed in later chapters)

2. market-risk limits

market-risk limits

operational limits
- inventory age
- concentration
- stop-loss limits

limits on position size
- nominal amount limit
- sensitivity limit
- VaR-limit

- Inventory Age Limits：證券不可持有太久，避免投資不流動的東西而賺取超額報酬，或是避免交易員一直不承認損失

- Concentration Limits：不可將雞蛋放在同一個籃子，同一種securities不可做太多，例如，限制投資某種貨幣之額度；限制某支股票佔整個投資組合之比例；或是考慮流動性，限制投資某公司股票佔公司所有股份之比例

- Stop-Loss Limits：設定停損點 (例如損失了15%即出清所有投資組合)，常常在執行此limit的同時，順便將trader停權2周，做cooling-off
  ★台灣的銀行有些採用 (預定賺多少錢)／(月停損)＞4 加上 (預定賺多少錢)／(年停損)＞2 之停損策略

◆ Nominal Amount 與 Sensitivity Limits

Nominal amount limit: A limit on the nominal amount simply specifies the total amount of securities that a trader/desk or portfolio can hold

Sensitivity limit: Sensitivity limits restrict measures such as the duration of a bond portfolio, the beta of an equities portfolio, or the Greeks of an options portfolio

★ For controlling risk, neither of these methods are as good as VaR limits, but the advantages of these methods are

- providing familiar, traditional risk metrics to the trader
- 萬一在算VaR時算錯時,提供一個較安全的限制
- easily and quickly calculated,適合用在交易頻繁之desk

- ◆ Principles for setting limits
  - ❑ VaR limit與sensitivity limit是risk-based limit，但nominal limit 不是
  - ❑ limit可在不同之lower level units 間調配
  - ❑ limit要搭配公司之比較利益來做限制
  - ❑ 不同之sub portfolio之limit最好不要互相影響，不然一個sub portfolio的改變，可能使得全部sub portfolio的limit (一般 VaR 可，但VaRC就會互相影響)
  - ❑ 可同時訂立hard and soft limits
  - ★ VaR can be used to create a limits framework that conforms to above principles

◆ Setting VaR Limits

從法規面來看，Required Capital $= 3 \times \sqrt{10} \times \mathrm{VaR}_{99\%}$

$$\Rightarrow \ \mathrm{VaR}_{99\%} \ \ \mathrm{limit} = \frac{\mathrm{Available \ \ Capital}}{3 \times \sqrt{10}}$$

＊ $\mathrm{VaR}_{99\%}$ limit 是由available capital反推出最大之 VaR，此亦為整個銀行的VaR的最大限制，稱為 VaRL

◆ 若只有2個sub portfolios，則

$$VaRL^2_{All} = VaRL^2_1 + VaRL^2_2 + 2\rho_{1,2}VaRL_1 \cdot VaRL_2$$

p.173 table 11-1：
assume VaRL$_{all}$ = 100， $\rho_{1,2}$ = 0.3
r1 = \$1.5 / per VaR
r2 = \$1.3 / per VaR
分配 VaRL1與 VaRL2，使得return最大化

◆ 當然銀行不只2種assets，但可依照上述規則，層層分割 VaRL，即可得到各個sub portfolio (或各個部門) 的VaRL

◆ 當各部門得知自己之VaRL後，可轉成其它之limits

例：債券部 $VaR = 2.32 \times Duration \, \$ \times \sigma_r$

$$\Rightarrow Duration \; limit = \frac{VaR \;\; limit}{2.32\sigma_r}$$