1. Building Blocks of Risk Management

FRM Part 1: Foundations of Risk Management

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1 Learning Objectives

The following are the learning objectives covered by chapter 1:

- **LO 1.a**: Explain the concept of risk and compare risk management with risk taking.
- **LO 1.b**: Evaluate, compare, and apply tools and procedures used to measure and manage risk, quantitative measures, qualitative risk management, and enterprise risk management.
- **LO 1.c**: Distinguish between expected loss and unexpected loss and provide examples of each.
- **LO 1.d**:Interpret relationship between risk and reward and explain how conflicts of interest can impact risk management
- **LO 1.e**: Describe and differentiate between the key classes of risk, explain how each can arise and assess the potential impact of each type of risk on an organization.
- **LO 1.f**: Explain how risk factors can interact with each other and describe challenges in aggregating risk exposures.

2 Typology of Risk and Risk Interactions

Risk is the uncertainty surrounding outcomes is the uncertainty surrounding outcomes. It is not related to the size of a potential loss and the variability of risk is of most concern.

Risk taking is the active acceptance of incremental risk in the pursuit of incremental gains.

In general we're concerned with certain categories of risk:

1. **Market risk** - refers to the fact that market prices and rates are continuously in a state of change and include the following key forms:
    - *interest rate risk* - the uncertainty from changes in interest rate levels
    - *equity price risk* - refers to the volatility of stock prices, includes the following:
        - *general market risk* - risk that an asset class will fall in value leading to a fall in value of an individual asset or portfolio; can't be diversified away
        - *specific market risk* - risk that an individual asset will fall in value more than the general asset class due to company-specific factors; we mitigate this by holding assets with less than perfect correlation

- *foreign Exchange Risk* - monetary loses from either fully or partially unhedged currency positions, caused by imperfect correlations in price movements and changes international interest rates

- *commodity price risk* - price volatility of commodities due to the concentration of specific commodities in the hands of relatively few market participants, the lack of trading liquidity increases the price volatility compared to financial securities and commodities may experience significant price discontinuities

Market risk may also suffer from *basis risk* which is the potential risk arising from mismatches in a hedged position

2. **Credit risk** - refers to a loss suffered by one party whereby the counterparty fails to meet its contractual (financial) obligations.

   Credit risk is driven by the *probability of default*, *exposure amount at time of default*, and the amount that can be recovered at time of default. There are four sub types of concern:

   - *default risk* - potential of nonpayment of interest and/or principal on a loan by the borrower

   - *bankruptcy risk* - the chance a counterparty will stop operating completely; the risk is that the liquidation value of any collateral might be insufficient to recover a loss flowing from default
   - *downgrade risk* - considers the decreased creditworthiness of a counterparty (Note: a private contract might not be recognized by a ratings agency and thus no downgrade risk exists)
     - downgrade risk may lead to default risk, which in turn may lead to liquidation of collateral being insufficient for recovery

   - *settlement risk* - known as Herstatt risk or counterparty risk, at settlement data, one party refuses to pay and fulfill its obligations
     - recovery rate refers to the amount that can be repaid given one party defaults and the loss given default is the amount the lending party will lose if the recovery rate is insufficient to cover the financial obligations of the defaulting party

3. **Liquidity risk** - there are two types of liquidity risk we consider:

   - *funding risk* - the risk that a firm can't access enough liquid cash and assets to meet its obligations, can't pay down or refinance depth to satisfy the counterparty or fund capital withdrawals

   - *market liquidity risk* - also known as trading liquidity risk, the risk of a loss in asset value when markets temporarily seize up
     - this can lead to the seller to be forced to sell an asset at abnormally low prices, potentially resulting in huge loses

4. **Operational risk** - losses resulting from inadequate or failed internal processes, people, and systems or from external events

5. **Business and Strategic risk**

   - *business risk* - variability in inputs that influence revenues or cost structures

   - *strategic risk* - risks involving a firm's long-term direction which is often accompanied by major investments of capital, human resources and management reputation

6. **Reputation risk** - danger a firm will suffer a sudden fall in its market standing or brand with economic consequences

7. **Legal and Regulatory**
    - *legal risk* - potential for litigation to create uncertainty for a firm
    - *regulatory risk* - uncertainty surrounding actions of government entities

3 The Risk Management Process

The key questions to ask in pursuit of reward:

1. Is the risk commensurate with the reward?
2. Can we lower the risk and still get the reward?

The classic risk management process:

- identify the risks
- analyze and measure the risks
- assess the effects of the risk
- manage the risk

Risk management culminates in a series of choices:

- avoid risk - some risks can be sidestepped altogether
- retain risk - some risks ca be retained within a firm's risk appetite
- mitigate risk - we can reduce exposure, frequency, and severity to certain risks
- transfer risk - some risks can be transferred to a third-party with a derivative product, structural product, or by paying a premium

An enhanced risk management strategy can avoid or mitigate non-essential or value-destroying exposure and instead provide more value-creating opportunities.

4 Identifying Risks: Knowns and Unknowns

As risk managers, we can't only focus on known and measurable risks, we also have to think about the unknown risks.

In 1921, economist Knight made a distinction between risk and uncertainty. "Knightian risk" refers to *unmeasurable uncertainty*; we're not able to know all the information needed to obtain the probability of an event. This is also known as *irreducible uncertainty*.

In turn, *risk* is decision making when the outcome of the decision is unknown, but we can fairly accurately quantify the probability associated with each outcome.

In the image above, we want to move our risks toward the most inner circle as much as possible. The most inner circle is easily quantifiable and expected. As we go outwards, the we're unable quantify the uncertainty until the outermost circle where we don't know what we don't know. This area can be catastrophic.

5 Quantitative Risk Metrics

Expected loss is the *average* loss a position taken might expect to incur from a position or portfolio. This type of loss is amenable to statistical measurement over a relatively short period of time with a fair degree of confidence.

Expected loss is a function of:

- the probability of the risk event occurring
- the firm's exposure to the risk event
- the severity of the loss if the risk event occurs

As an example, consider credit risk where the risk event is the counterparty defaulting. Here the probability of default is the probability of the risk event occurring. The lender's exposure at time of default is the exposure to the risk event. The lender's loss given default is the severity of the loss if the risk event occurs.

The goal for the risk manager is to measure the amount of expected loss and make sure the portfolio doesn't lose its predictable quality.

The magnitude of loss that departs from the average (expected loss) is our *unexpected loss*.

Value at Risk (VaR) is a quantitative measure that calculates an estimated loss amount given a certain probability of occurrence. (Note: This section doesn't go into detail on this measurement but simply alerts to its existence.)

The Jorion definition of VaR is the work expected loss over a given horizon under normal market conditions given a level of confidence. (Keyword: normal)

The issue with VaR is that it fails to quantify the risk in the tails of a distribution. *Expected shortfall* attempts to overcome issues with VaR by calculating the average of all the loses greater than the VaR.

Economic capital is the amount of liquid capital needed to cover unexpected loses.

6 Qualitative Risk Assessment

Scenario analysis considers potential future risk factors an the associated alternative outcomes, typically comparing the best-case and worse-case scenarios ("what-if scenarios).

Stress testing is a form of scenario analysis that examines a financial outcome based on a given "stress" on the entity. We'll adjust one parameter at a time to estimate the impact on the firm. Some parameters we can use for the above include:

- historically sourced data - observable but past trend aren't guaranteed to continue
- estimated variable - hypothetical forecast based on risk manager's assumptions, this type of testing introduces estimation error and model risk

7 Risk Aggregation and Interactions

Key: Understanding risk aggregation and its strength and weaknesses.

There are many ways to attempt to aggregate risk (VaR, the Greeks, ES, scenario analysis.)

Independent risk factors that are correlated pose a significant danger as they can spill over into different categories of risk which in the worst case can compound unexpected loss.

Risk aggregation attempts to measure all risks at the enterprise level.

Risk-adjusted return on capital RAROC is a measure of economic capital.

$$\text{RAROC} = \text{After-tax risk adjusted expected return / economic capital.}$$

Note: Again, this is just an introduction and not getting down to computing it or using it yet.

One important application of RAROC is to compare calculated value to the cost of equity.