



Class: TY BSc

Subject : Risk Management & Investment Management - II

Chapter: Unit 2 Chapter 1

Chapter Name: Portfolio Construction

Topics to be covered:

1. Strategic benchmarks and tactical asset allocation
2. Active return and active risk
3. Structural risk
4. The use of multifactor models
5. Measures of risk relative to a benchmark
6. Information ratio
7. Downside risk
8. Active and strategic risks
9. Value at Risk
10. Stress Testing

1 Strategic benchmarks and tactical asset allocation

Two conflicting objectives

In managing an investment fund established to cover liabilities, managers will typically face two conflicting objectives:

- i. To ensure security (solvency) and stability of costs
 - ii. To achieve high long-term investments returns (in order to reduce cost)
- The first objective encourages the matching of liabilities to assets, while the second encourages a move away from a matches position into assets which are expected to generate higher returns.

1 Strategic benchmarks and tactical asset allocation

Two-stage process

The investment policy therefore needs to reflect the extent to which the risks of lower stability and security are to be taken on in order to aim for higher returns. This will typically involve a two-stage process:

- i. Establishing an appropriate asset mix for the fund – the **strategic benchmark**. The **strategic** (or **policy**) **risk** of the fund is the risk of poor performance of the strategic benchmark relative to the value of the liabilities.
- ii. The tactical implementation of this strategy by the selection of one or more managers and a decision on the appropriate level of risk that these managers should take relative to the strategic benchmark. This is known as the **active** (or **manager** or **implementation**) risk.

1 Strategic benchmarks and tactical asset allocation

Two-stage process

- The extent to which risk can be taken in this way will be determined by the risk appetite of the fund. For an insurance company this will be influenced by the level of free reserves, and for a pension fund this might be determined by the risk appetite of the trustees and the level of the surplus.
- In practice, strategic risk may reflect both the risk of the matches benchmark relative to the liabilities and the risk taken by the strategic benchmark relative to the matched benchmark.
- Each individual fund manager will be given a strategic benchmark by the fund directors or trustees, which for the domestic equities might be an appropriate equity index. The zero-active risk approach would be simply to track the index.
- However, the fund could allow an amount of active risk to be taken by the fund manager in an attempt to out-perform the index.

2 Active return and active risk

- The return that an active manager achieves relative to his particular strategic benchmark can be defined as **active return** or **relative return**.
- Thus, if the active manager achieves a total return of 4% compared to a benchmark total return of 3%, then he has achieved an active return of +1%.
- In general, the active returns achieved are uncertain and will vary between time periods. It is this uncertainty that represents the active risk, which is often measured in terms of the standard deviation of the active return (though other measures of risk could also be used).
- Generally, the more active the manager's approach – ie the greater the deviation from the benchmark-then the greater the active risk, and hopefully also the active return.

3 Structural risk

- There may also be some **structural risk** associated with any mismatch between the aggregate of the portfolio benchmarks and the total fund benchmark.
- The overall risk is the “sum” of the active, strategic and structural risks. For schemes that are not very small, structural risks can be made very small, particularly if “peer group” benchmarking is avoided.
- Style identification can be used to ensure that the best managers (within each style) are picked while keeping the fund as a whole “style neutral” (unless an exposure to style risk is particularly wanted).

4 The use of multifactor models

Use in active management

- Multifactor models can be used to estimate the appropriate expected return on a share given a set of risk factors and its estimated factor returns (the coefficients of the risk factors used in the model).
- If the risk factors can be predicted with greater accuracy than the market, then the outperforming shares or sectors can be identified. When the model is used to calculate expected return, this can then be compared with the expected return based on a discounted dividend or PE ratio model.
- If the expected return indicated by the multifactor model is lower than that indicated by the current share price the share appears cheap.

Use in passive management

- Multifactor models can also be used to identify and control the exposure of a portfolio to the different risk factors and to change the risk profile of the portfolio to better match the exposure of the liabilities.

5 Measures of risk relative to a benchmark

Historical tracking error

- Until fairly recently, most attention has been devoted to measuring and managing active risk. The most usual backwards risk measure adopted is the **retrospective** or **backwards-looking tracking error**- the annualized standard deviation of the difference between portfolio return and benchmark return, based on observed relative performance.
- Historical tracking error may be calculated in different ways. The timescale used can vary (both the total period length and the frequency) and the weightings attached to different sub-periods can vary. Such features must be considered when comparing results.

5 Measures of risk relative to a benchmark

Forward-looking tracking error

- The equivalent prospective measure is the **forward-looking tracking error**- an estimate of the standard deviation of returns (relative to the benchmark)) that the portfolio might experience in the future if it's current structure were to remain unaltered. This measure is derived by quantitative modelling techniques and depends on assumption including:
 - i. the likely future volatility of individual stocks or markets relative to the benchmark.
 - ii. correlations between different stocks and/or markets.

5 Measures of risk relative to a benchmark

Active money

- The deviation from the benchmark portfolio for a specific position is usually termed the **active money** of that position in isolation.
- If all the active money positions are zero, then the fund is being run in a perfectly passive, index-like fashion.
- However, the active money of a particular stock does not provide a complete picture of the “risk” of such a position versus the benchmark since some stocks may be much more likely to perform very differently to the benchmark than others.

6 Information ratio

- To combine historical risk and historical return (relative to a benchmark) a commonly used statistic is the **information ratio** – the ratio between the relative return and the historical tracking error.
- The **relative return**, over any quarter say, is defined as the difference between the actual portfolio return and the benchmark return over that quarter. So the tracking error represents the standard deviation of the relative return.
- Relative return is also sometimes referred to as **active return**, as it results from the active management of the portfolio compared to a particular benchmark.

6 Information ratio

- Strictly speaking , the information ratio relates the **mean** of the relative return to the historical tracking error, ie the **standard deviation** of the relative return, where both are calculated over the same time period.
- It can therefore be written as:

$$IR = \frac{\text{mean}(\text{relative return})}{\text{std devn}(\text{relative return})}$$

- In practice, fund managers may advertise their services based on the historical information ratios that they have achieved in the recent past. Additionally, if the estimates of the means, variances and covariances of the prospective returns on different securities are available, then it will be possible to estimate prospective information ratios for different portfolio choices.
- In addition, the information ratio can play a useful role in allowing us to estimate how efficiently additional risk can be converted into additional return, as part of the risk budgeting process.

7 Downside risk

- The main argument against the use of standard deviation or variance as a measure of investment risk is that most investors do not dislike uncertainty of returns per se, rather they dislike the possibility of low returns. Downside risk measures are therefore sometimes used in practice.
- Downside risk measures can involve identifying the worst period under-performances in a specified past period, looking at the frequency with which under-performance has been experienced, or calculating the **downward semi-standard deviation** (the standard deviation of returns below the benchmark).

8 Active and strategic risks

- Empirical evidence suggests that the total tracking error associated with active management and management selection is of the order of 0% pa to 5% pa with a median figure of about 2%pa.
- Measurement of strategic risk has been complicated by the fact that the value of the liabilities may not be well-defined or objectively determined.
- However, recent trends toward the adoption of more market-related approaches to valuing liabilities has meant that liability values have become more identifiable.
- With this has come the realisation that funds were taking much greater strategic risks-anything from 5% to 20% pa.

9 Value at Risk

- **Value at Risk (VaR)** generalises the likelihood of under-performing by providing a statistical measure of downside risk. VaR assesses the:
 - i. potential losses on a portfolio
 - ii. over a given future time period
 - iii. with a given degree of confidence
- It can be measured either in absolute terms or relative to a benchmark. Again, the VaR is based on assumptions that may not be immediately apparent. In particular, it is frequently calculated assuming a normal distribution of returns.
- Unfortunately, portfolios exposed to credit risk, systematic bias or derivatives may exhibit non-normal distributions. The usefulness of VaR in these situations depends on modelling skewed or fat-tailed distributions of returns, either in the form of statistical distributions (such as the Gumbel, Frechet or Weibull distributions) or via Monte Carlo simulations.
- However, the further one gets out into the “tails” of the distributions, the more lacking the data material and, hence, the more arbitrary the choice of the underlying probability becomes.

10 Stress testing

- VaR methodology does not take into account the simultaneous increase in asset return volatilities and correlations that is often observed during extreme market events.
- The risks that are incurred by extreme market events can be identified and investigated by the process of **financial stress testing**.
- This involves subjecting a portfolio to extreme market moves by radically changing the underlying portfolio assumptions and characteristics, in order to gain insight into portfolio sensitivities to predefined risk factors. This pertains in particular to asset correlations and volatilities.

10 Stress testing

- There are two types of stress test:
 - i. to identify “weak areas” in the portfolio and investigate the effects of localised stress situations by looking at the effect of different combinations of correlations and volatilities.
 - ii. to gauge the impact of major market turmoil affecting all model parameters, while ensuring consistency between correlations while they are “stressed”.
- A major part of establishing a comprehensive stress testing framework should therefore focus on constructing stress test scenarios that apply to the specific portfolio.
- These scenarios should be tailored to reveal weaknesses in the portfolio structure in terms of risk exposure and sensitivity, and should this focus on the risk factors that the portfolio is most exposed to.

Summary

- In managing an investment fund established to cover liabilities, managers will typically face two conflicting objectives: i) To ensure security (solvency) and stability of costs & ii) To achieve high long-term investments returns (in order to reduce cost).
- The **strategic** (or **policy**) **risk** of the fund is the risk of poor performance of the strategic benchmark relative to the value of the liabilities. The tactical implementation of this strategy is known as the **active** (or **manager** or **implementation**) risk.
- The return that an active manager achieves relative to his particular strategic benchmark can be defined as **active return** or **relative return**.
- There may also be some **structural risk** associated with any mismatch between the aggregate of the portfolio benchmarks and the total fund benchmark.
- Multifactor models can be used to estimate the appropriate expected return on a share given a set of risk factors and it's estimated factor returns (the coefficients of the risk factors used in the model).
- Multifactor models can also be used to identify and control the exposure of a portfolio to the different risk factors and to change the risk profile of the portfolio to better match the exposure of the liabilities.
- The most usual backwards risk measure adopted is the **retrospective** or **backwards-looking tracking error**- the annualized standard deviation of the difference between portfolio return and benchmark return, based on observed relative performance.
- The equivalent prospective measure is the **forward-looking tracking error**- an estimate of the standard deviation of returns (relative to the benchmark)) that the portfolio might experience in the future if it's current structure were to remain unaltered.

Summary

- The deviation from the benchmark portfolio for a specific position is usually termed the **active money** of that position in isolation.
- To combine historical risk and historical return (relative to a benchmark) a commonly used statistic is the **information ratio** – the ratio between the relative return and the historical tracking error.
- The **relative return** (or active return) , over any quarter say, is defined as the difference between the actual portfolio return and the benchmark return over that quarter. So the tracking error represents the standard deviation of the relative return.
- Strictly speaking , the information ratio relates the **mean** of the relative return to the historical tracking error, ie the **standard deviation** of the relative return, where both are calculated over the same time period.
- $$IR = \frac{\text{mean}(\text{relative return})}{\text{std devn}(\text{relative return})}$$
- Downside risk measures can involve identifying the worst period under-performances in a specified past period, looking at the frequency with which under-performance has been experienced, or calculating the **downward semi-standard deviation** (the standard deviation of returns below the benchmark).
- **Value at Risk (VaR)** generalises the likelihood of under-performing by providing a statistical measure of downside risk. VaR assesses the: i) potential losses on a portfolio ; ii) over a given future time period & iii) with a given degree of confidence
- The risks that are incurred by extreme market events can be identified and investigated by the process of **financial stress testing**.