Lecture

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Chapter: Unit 3 Chp 2

Chapter Name: Portfolio performance measurement

Topics to be covered:

1. Introduction
2. The Money-Weighted Rate of Return (MWRR)
3. Time-Weighted Rate of Return (TWRR)
4. Comparison of Money-Weighted Return and Time-Weighted Return
5. Linked Internal Rate of Return (LIRR)
6. Comparison of portfolio performance with an index
7. Comparison of portfolio performance with a benchmark portfolio
8. Risk-adjusted performance measures
9. The Treynor measure
10. The Sharpe measure

Topics to be covered:

11. The Jensen measure
12. Pre-specified standard deviation
13. Performance attribution
14. Uses of performance measurement
15. Limitations of performance measurement
16. Relative merits of different ways of assessing portfolios

1 Introduction

- Actuaries and Investment Managers often need to assess the returns achieved by particular investments, investment funds or investment portfolios, whether or not they work directly in the investment field.

- Indeed, the measurement of investment performance against the investment objectives is the key element in the monitoring of the asset management process. It is crucial to both assessing the success or otherwise of the process in meeting the investment objectives and also to identifying the underlying reasons for any success or failure — and thereby indicating how the process can be improved in future

2 The Money-Weighted Rate of Return (MWRR)

- The money-weighted rate of return (MWRR) is useful as an absolute measure of the achieved return. It can be compared with the actuarial assumptions underlying the fund to see whether the achieved return is higher or lower than that expected.

- The standard formula for calculating the MWRR is:

$$V_0(1+i)^T + \sum_t C_t(1+i)^{T-t} = V_T$$

2 The Money-Weighted Rate of Return (MWRR)

Cashflow vs investment income

- Cashflow in the above formula represents the excess of contributions received over claims and expenses paid. It is the money moving into (or out of) the fund.

Tax and expenses

- For rates of return net of tax and expenses, V_T and all disinvestments should be net of tax and expenses.

Basic problem with the MWRR

- The money-weighted rate of return is not a good basis for comparing two different fund managers. The main reason for this is that the rate of return can be heavily influenced by the timing and size of cashflows. The payments into and out of a particular fund are not usually within the control of the investment manager, so rates of return influenced by cashflows are not very useful when comparing investment managers.

3 Time-weighted rate of return (TWRR)

- The time-weighted rate of return overcomes the basic problem associated with money-weighted rates of return. Theoretically, it is usable as a basis for comparing different investment managers because the timing and size of cashflows will not distort the rates calculated.

- It is calculated by
  i. assessing the fund value at each time there is a cashflow in or out
  ii. calculating the return achieved for each period between cashflows
  iii. linking these returns together to give the time-weighted rate of return

- Note that the amount of money invested at each time will not affect the result.

4 Comparisons of time-weighted return and money-weighted returns

- The time-weighted rate of return and the money-weighted rate of return will be very similar when either the:
  - cashflows during the valuation period are small relative to the funds involved or
  - the rate of return is stable over the period.

- When neither of these conditions hold. the two rates of return can be very different

Impracticality of time-weighted rate of return

- The problem with using the time-weighted rate of return in practice is the amount of data that is required: fund values are needed for every occasion on which there is a cashflow. This is often impracticable in practice.

- A practical compromise solution is to use the linked internal rate of return as an approximation for the time-weighted rate of return: this is often done using quarterly sub-intervals.

5 Linked internal rate of return (LIRR)

- The LWR for a fund over a given year is found using the following process:
  i. Determine the value of the fund at various dates throughout the year (eg at monthly or quarterly intervals).
  ii. For each inter-valuation period calculate the money-weighted rate of return.
  iii. Link the inter-valuation MWRRs together to get the linked internal rate of return for the year.

6 Comparison of portfolio performance with an index

- The performance of a portfolio is often compared with the returns that would have been available from a published market index.

- Active fund managers in particular are keen to show that their portfolios have ''beaten" the index. If the fund managers could not show this, then investors might decide to stop paying fees to the active fund manager and invest their funds in the same way as the index (ie by investing in index tracker funds with lower expenses).

6 Comparison of portfolio performance with an index

How to do the assessment

- There are two basic ways in which to compare the performance of a portfolio with an index:
  i. By comparing the actual value of the portfolio at the end of a defined period with the value that would have been achieved had the initial value of the portfolio and subsequent net new money been invested in the same way as the index.
  ii. By comparing the time-weighted return from each (or the linked internal rate of return as an approximation to the time-weighted rate of return).

- In practice the method chosen and the type of return calculated will depend partly on the data available.

7 Comparison of portfolio performance with a benchmark portfolio

- Assessing the performance of a portfolio against a predetermined benchmark portfolio (often called a "notional fund") is similar to assessing against a published index.

- The only difference is that rather than develop a notional fund based on a particular market index, the notional fund is defined in some other. predetermined manner (eg a mix of more than one index, such as 50% in a fixed interest index and 50% in an equity index).

7 Comparison of portfolio performance with a benchmark portfolio

Worked example

- The trustees of a pension scheme decide (after advice from the scheme actuary on the nature of the liabilities) that the assets should be invested 60% in domestic equities. 15% in overseas equities and 25% in fixed interest securities.
- The trustees appoint a fund manager who is given some freedom to move away from the benchmark within some parameters (eg within a maximum tacking error).
- Although the fund manager has some freedom. the regular performance assessments will be based on the 60115/25 benchmark portfolio. For each sector. the most appropriate index will be used.
- At the start of the year, the pension scheme's assets will be notionally invested in the indices in the 6015/25 proportions and subsequent net cashflows will be invested in the same proportions. The final total of the notional fund can then be compared with the final total of the actual fund.
- The fund manager will hope that the actual portfolio exceeds the notional fund.

7 Comparison of portfolio performance with a benchmark portfolio

Complications

- There are, inevitably, various issues which may make the assessment more complex.

Cashflows, investment income, tax and expenses

- These are the four standard issues that we have mentioned throughout this chapter. They are all relevant here.

- For the comparison of the actual fund with the notional fund to be valid, we must make appropriate allowance within the notional fund for:
  - contributions in and repayments out, as actually experienced by the portfolio
  - investment income and capital gains, as would have been experienced in the notional fund
  - taxes on income and capital gains. as would have been experienced in the notional fund
  - expenses. as would have been experienced in the notional find

7 Comparison of portfolio performance with a benchmark portfolio

Maintaining the notional 60/15/25 split

- The initial split of the notional fund is simple: just follow the split as defined by the trustees. However, it is not so straightforward once the market values of the different sectors start to move in different directions. For example, a fund that starts at 60/15/25 might soon move to 65/13/22 if domestic equities increase rapidly in value. Should the notional fund be rebalanced or left in the new proportions?

- In specifying the benchmark portfolio it is necessary to set out how new money and investment income are to be invested and how often the benchmark is to be rebalanced. Care will need to be taken that the calculations allow correctly for these factors.

7 Comparison of portfolio performance with a benchmark portfolio

Maintaining the notional 60/15/25 split

- A pragmatic basis to follow is as follows:
  - the notional fund starts with the 60/15/25 split
  - all investment
  - income from a particular sector is reinvested within that sector
  - all contributions in and payments out are split in the 60/15/25 split
  - no attempt is made to rebalance the notional fund during the period of assessment (eg one year).

- This basis is effectively the same as the trustees saying to the fund manager. “Divide the fund into three distinct sub-funds. Keep the three funds separate during the year. Split all cashflows by the original proportions of 60/15/25.”

8 Risk-adjusted performance measures

- The measurement of the investment performance of portfolios usually concentrates on the return, often relative to some benchmark. However, in order to get a true picture of performance we also need to pay attention to the risk dimension.
- This is because the investment return achieved will typically depend on the risk incurred by the investor.
- MPT and the CAPM give us a framework for doing this.
- The risk-adjusted performance measures are not very commonly used in the UK but their use is more widespread in the USA. One problem with the measures described below is that they only allow for risk defined in terms of variance of return and do not allow for actuarial risk or downside risk.

8 Risk-adjusted performance measures

- The appropriate measure of risk for an investor to use, within the MPT framework, depends on whether the portfolio being considered represents all his assets or just a part of them. Where the portfolio represents the whole of the investor's wealth the appropriate measure is the standard deviation. If it is a subset of his assets, the appropriate measure is the portfolio beta.

- The reason for this is that the beta of a portfolio is a measure of its risk relative to a well-diversified portfolio and adjusting the return using beta tells us how good the manager is at picking out-performing securities, given the level of systematic risk assumed. Using standard deviation to adjust the return allows us to measure how well-diversified the whole portfolio is as well as how good the manager is at individual stocks that produce an excess return relative to their betas.

- Four risk-adjusted return measures can be specified according to whether beta or standard deviation is the appropriate measure of risk and according to whether the required level of risk is pre-specified or not.

9 The Treynor measure

- This is a measure of reward per unit systematic risk defined as:

$$T = \frac{R_p - r}{\beta_p}$$

- where:
  - R_p is the return on the portfolio
  - r is the risk free rate of return over the period
  - β_p is the systematic risk of the portfolio.

10 The Sharpe measure

- This is similar to the Treynor measure but uses standard deviation:

$$S = \frac{R_p - r}{\sigma_p}$$

- Where σ_p is the standard deviation of the portfolio, and the other terms are as defined above.

- The Treynor and Sharpe measures measure out-performance compared to the CAPM per unit risk. ie as a proportion of the return predicted by the CAPM. They can therefore be used to compare investment managers who have taken differing levels of risk.

11 The Jensen measure

- Where risk is pre-specified the appropriate measure is the return relative to a benchmark portfolio with the same degree of risk. If beta is the appropriate risk measure, the expected return R_b on the benchmark is given by the CAPM as:

$$\boldsymbol{R_b = r + \beta_p(R_m - r)}$$

- Where R_m is the return on the market portfolio.

- The Jensen measure is:

$$\boldsymbol{J = R_p - R_b}$$

12 Pre-specified standard deviation

- If the standard deviation of the portfolio return is pre-specified the return on the benchmark portfolio is given by:

$$\boldsymbol{R_b = r + \frac{R_m - r}{\sigma_m}\sigma_p}$$

- and the differential return measure is $R_p - R_b$.

- These last two measures therefore measure out-performance compared to the CAPM in terms of the absolute amount by which the actual return exceeds that predicted by the CAPM at the pre-specified level of risk.

13 Performance attribution

- Fundamentally, there are two ways that a fund manager can out-perform a benchmark portfolio:
  i. by choosing the right investment sectors (eg equities, property, fixed interest)
  ii. having chosen the sector, choosing the right stocks (eg IBM, Microsoft).

- Some investment managers may be very good at sector selection, while others may be very good at stock selection. If we analyse the performance of a portfolio into the components of stock and sector selection, then we will be better placed to understand the relative strengths and weaknesses of each investment manager.

- This process of attributing performance to stock and sector selection is called performance attribution or attribution analysis.

13 Performance attribution

How to find the sector and stock components

- Suppose that we want to carry out the analysis for a particular portfolio over a given year. We start by considering the size of the actual fund (in monetary units) at the end of the year. This is the amount that has been generated from:
  - the actual sector split (eg 68/11/21)
  - the actual stocks chosen by the fund manager.
- Call this amount $Fundvalue_{actual/actual}$ or F_{AA}.

- Now consider the end of year amount that would have been generated by the notional benchmark portfolio that we discussed earlier (60/15/25) . This is the amount that would have been generated from:
  - the notional sector split (eg 60/15/25)
  - the notional stocks (eg the market indices for each sector).
- Call this amount $Fundvalue_{notional/notional}$ or F_{NN}

- Then $F_{AA} - F_{NN}$ is the overall amount of profit (or loss if negative) generated by the find manager's choice of sectors and stocks.

13 Performance attribution

How to find the sector and stock components

- Now consider another notional fund, which we will call $Fundvalue_{actual/notional}, or\ F_{AN}$ calculated from:
  - the actual sector split chosen by the fund manager
  - the notional stocks (eg the market indices for each sector).

- This will give us the fund that would have been achieved if the fund manager had followed his/her strategic decisions on the allocation of funds between sectors, but had invested in the overall market rather than the stocks actually chosen.

- Having generated this intermediate notional fund we can now calculate the sector selection profit and the stock selection profit:
  - stock selection profit = $F_{AA} — F_{AN}$
  - sector selection profit = $F_{AN} - F_{NN}$

13 Performance attribution

How to find the sector and stock components

- The stock selection profit is the amount of out-performance achieved by virtue of the actual stocks selected. It is therefore the difference between the performance of the actual fund and the performance of a notional fund invested in the same actual sector split, but with stocks selected as per the underlying sector indices.

- Likewise, the sector selection profit is the amount of out-performance achieved by virtue of the actual sectors selected. It is therefore the difference between the performance of a notional fund invested in the same actual sector split. but with stocks selected as per the underlying sector indices, and the benchmark fund with notional sectors and notional stocks.

- Note that by adding together the stock selection profit and the sector selection profit you get the total amount by which the portfolio out-performed the notional fund. ie the F_{AN} terms cancel out.

- It is normally the case that the simplest notional fund to design will involve an actual sector split and notional stock selection. This is determined by the information available.

13 Performance attribution

- The overall investment performance of a fund can be divided into:
- **sector selection:** ie the extent to which the fund's proportions in the various sectors will have affected performance. (Sector selection performance is sometimes known as asset allocation performance.)
- **stock selection:** ie within any one sector, have the selected stocks performed better or worse than the sector as a whole?

13 Performance attribution

- As an example, consider a pension fund that is only invested in two sectors, UK equities and gilts. Suppose the trustees' guidelines to the investment manager are that the proportions of the fund invested in equities and gilts should be 85% and 15% respectively. The investment manager is permitted to depart to some extent from these guidelines and the actual proportions adopted were 90% and 10%.

- Let:
- F = the actual fund value at the end of the year
- N_1 = the fund produced if 85% of the fund and 15% of the fund had been invested in the FTSE All-Share Index and the Over 15-Year Gilt Index respectively
- N_2 = the fund produced if 90% of the fund and 10% of the fund had been invested in the FTSE All-Share Index and the Over 15-Year Gilt Index respectively

- Then the overall relative performance:
- $= F - N_1$
- $= (F - N_2) + (N_2 - N_1)$
- $= stock\ selection\ performance + sector\ selection\ performance$

14 Uses of performance measurement

- There are various reasons why the performance of an investment portfolio will be measured.

To improve future performance

- First, data collected during performance monitoring can form the inputs for planning future strategy. ie by finding out what has been successful in the past. investors should be better able to determine what might perform best in the future.
- Secondly, if fund managers know that their performance is being measured, it might give them an extra incentive to maximise the returns of the funds they manage.

Comparison of the rate achieved against a target rate

- Many funds will have one or more *larger rates of return. For example, the trustees of a pension fund will want to know the rate of return achieved on the investments compared with the rate of return assumed in the actuarial valuation.
- Similarly, the actuaries and managers of a life insurance company will need to know what rate of return has been achieved on the fund compared with the rate assumed in premium rate, bonus distribution and reserve calculations.

14 Uses of performance measurement

Comparison against the performance of other portfolios, an index and/or a benchmark portfolio

- Those responsible for the funds will want to know how the performance of the portfolio compares with other portfolios. On the basis of this information, they are able to make decisions regarding the future investment of the assets. eg should a new fund manager be hired?
- Also, by analysing the performance against a notional portfolio, it may be possible to identify some relative strengths and/or weaknesses of individual fund managers leg in sector or stock selection).

- There may also be other factors that depend on the performance of the fund. For example, the fees paid to the fund manager may be linked to the performance of the fund.

To appraise and remunerate investment managers

- Following from the above, performance measures can be used in the appraisal and remuneration of managers.

15 Limitations of performance measurement

- There are several limitations and disadvantages of portfolio performance measurement.

Projection of past results

- The fact that a particular result was attained in the past does not mean that it will occur in the future. There is a random element in investment returns and it may be difficult to determine how much a fund manager's results are due to method and how much to luck. Furthermore a technique that proved successful in a particular set of circumstances may not work so well in changed circumstances in the future.
- So, past performance may be a poor guide to the future and it may not be easy to distinguish good luck from skill.

Risk

- In the long term we would expect a riskier strategy to produce higher average returns. The measurement of relative performance should therefore take account of the degree of risk taken on by a fund manager.
- When a fund manager invests largely in high-risk investments. there are likely to be implications for the relative performance of the fund manager in performance measurement tables:
  - In the very long term, the manager should achieve a higher rate of return.
  - In short-term periods. the results will probably be more volatile. There may be some periods of excellent results and other periods of very poor results.

15 Limitations of performance measurement

Timescale

- Determining the frequency of performance measurement calculations requires a delicate balance between assessing performance frequently enough so that problems can be spotted and corrected and avoiding spurious conclusions based on too short a measurement period.

- It might take five years to obtain data that gives a reliable verdict on a particular fund manager. However. the trustees of a pension fund should not have to wait for five years before they realise that the assets are being poorly managed.

- In practice. may pension fund investment valuations are carried out each quarter, with analyses over a variety of periods (eg 3 months, 1 year. 3 y ears. 5 years, 10 years).

- The users of these analyses therefore have:
  - the regular data they need to stay informed
  - the longer-term data to help make judgements.

- They should resist the temptation of making bold conclusions from the very short-term data.

15 Limitations of performance measurement

Differing fund objectives

- Different funds may have different objectives and constraints. Comparisons between such funds may not be valid.

- The main difference will often be that the liabilities underlying one fund may differ from those underlying another. There may also be other reasons why different funds cannot be directly compared:
  - different constraints imposed by the directors or trustees
  - different taxation positions (eg this may apply for insurance companies where the tax positions may vary from one office to another).

- Comparisons between different unit-linked funds and collective investment vehicles is clearly sensible only if they have similar investment objectives.

- You may also come across "different cashflow" and "different size of fund" as reasons why different funds cannot be validly compared. In practice. these two factors should not really invalidate comparison between the investment returns achieved by different

15 Limitations of performance measurement

Impact on fund manager behaviour

- Knowledge of how and how often he will be assessed is likely to influence the investment strategy of a manager. This may not be in the fund's best interests. For example, frequent monitoring can encourage a short-term approach to investment.

- Some people will argue that this may mean that the long-term performance of the fund could be sacrificed. Others would argue that it is not a problem because the long run is simply a series of short runs.

- More generally, the investment management decisions should be driven entirely a desire to meet the investor's objectives. It is therefore important to ensure that the mandate given to the investment manager is consistent with the investor's objectives.

Cost

- Users of performance measurement services must balance the value of the service against the cost. Also, for a number of assets leg property), valuation is difficult, time-consuming and very subjective. Detailed, frequent calculations based on subjective valuations are inappropriate.

16 Relative merits of different ways of assessing portfolios

Performance relative to published indices

- The main advantage of assessing the performance relative to published indices is that it is relatively easy to do. By definition, the data for published indices is readily available - and it should be reliably accurate.

- However, this advantage can be easily outweighed by a major potential disadvantage: the published index might not be appropriate. There may be no single index which is consistent with the objectives of the investor.

- For example, comparing the returns achieved by a life insurance company's with-profit fund with the returns achieved from an index holding of domestic equities will not be appropriate because the objectives and constraints imposed on the insurance company would probably make a 100% holding in domestic equities inappropriate.

16 Relative merits of different ways of assessing portfolios

Performance relative to other portfolios

- This type of comparison is appropriate if the funds being compared have the same objectives and the same factors influencing investment strategy. It also gives an indication of the cost or benefit of following a particular strategy. relative to that adopted by other funds.

- For example, considering pension funds, it would be quite sensible to compare the returns achieved by different pension funds where the:
  - funds have the same liability profile (by type and term)
  - funds have similar levels of solvency
  - funds are of similar size
  - fund managers have been given similar levels of freedom by the trustees (or at least, similar instructions)
  - fund managers have adopted the same level of risk
  - funds have similar levels of cashflow (although use of time-weighted rate of return should mean that differences will not invalidate comparison).

16 Relative merits of different ways of assessing portfolios

Performance relative to other portfolios

- Taken to these extremes. you may find that. for each pension scheme, there are very few other pension schemes that can be used for a valid comparison. In practice. the comparisons tend to be driven more by what data is available.

- However, it may be totally inappropriate to compare the performance of funds that have very different investment objectives, eg insurance company with-profit funds because:
  - there is generally more variation in the type and term of liabilities
  - the investors may have quite different tax positions
  - the data is generally not widely available.

- Overall. performance measurement relative to other portfolios is not ideal.

16 Relative merits of different ways of assessing portfolios

Performance relative to a benchmark portfolio

- Benchmark portfolios can be constructed to reflect the objectives of the fund. They should also be constructed in such a way that the data necessary for comparisons is easily obtained.

- They can therefore overcome the problems we identified with the other two forms of comparison.

- By having a benchmark portfolio that reflects the liabilities of the fund, the danger of giving the fund manager conflicting objectives is also avoided. This would occur where the basis for assessment encourages the fund manager to adopt a strategy that is not necessarily consistent with the objectives of the fund.

Thank You!