Actuarial Society of India

Examinations

May 2006

SA6 –Investment

Indicative Solution

Sol 1a)
(i)(a) MVRR

Throughout we use: $(1+i)^t = 1+it$

Manager A

Manager B

$300(1 ? i) ? 40(1 ? i)^{0.5} ? 360$ *Gives i ? 6.3%*

Assumptions
   - ? Cash flows occur, on average, halfway through the year

   - ? Gross investment income is either reinvested or counted within benefit outgo

(b) Comparison with benchmark

Benchmark A

The Mumbai BSE All-share index dividend yield gives, in effect, dividends over the last 12 months. This suggests that we should just use the year-end figure:

$$\frac{1,363.79}{1,187.70}(1.0435) ? 1 ? 19.8\%$$

Benchmark B

$$\frac{142.45 ? 13.43}{132.50} ? 1 ? 17.6\%$$

Manager A seems to have out-performed the benchmark by 1.8%

The approximate historic running yield on the equity fund calculated at the end of the year is just under 3 per cent. This is less than the figure of 4.35 per cent for the market. The manager seems to have benefited from investing in low yielding (and volatile?) stocks in a rising market.

Manager B seems to have under-performed the market by a long way (11.3 per cent

(c) Limitations

The figures are money-weighted rather than time-weighted. It might be that the contribution income was received near the top of the market for the gilt manager and near the bottom of the market for the equity manager. This would explain part of their relative performance.

No adjustment is made for the risks taken. It might be that the equity manager was in riskier stocks (this is suggested by the low running yield) and the gilt manager in less risky stocks. Again this would help explain their over-and under-performance.

The figures are only for one year. A five-year period might be a more sensible timescale over which to try and asses performance. Otherwise there is a little we can do to distinguish luck from skill.

It might be useful to have more detailed information (for example, to identify gilt maturity and equity industry sector selection effects separately from stock selection effects; also quarter by quarter performance.

Assuming that cash flows occurred half way through the year makes the calculations approximate rather than accurate. Similarly, there may be a small distortion because we have ignored expenses.

(8)

(ii) Overall return

$$1,100(1+i)+200(1+i)0.5 = 1,1510 \qquad \text{Gives I ? 17.5 \%}$$

(2)

(iii) Comment on overall return

The return is less than the median return by 2.3%.

This is partly the result of the poor gilt performance.

It may also be a result of investing more in gilts than other funds (this fund had about 25 per cent of its assets in gilts, which is much higher than most funds). Gilts under-performed the median scheme.

It may also be result of not investing in other high return assets.

The return relative return on a risk-adjusted basis may not look so bad.

The return is probably higher than needed to meet the growth in the liabilities.

(6)

Sol 1b)

(i) <u>**Fixed Benchmarks:**</u>
They have a solid basis of a long term asset allocation policy.

They have a propensity to re-balance towards value – forces selling of rising markets and buying of falling markets.

This is advantageous if the markets are rising and falling on sentiment rather than as a result of underlying economic trends.

However, this may prove to be a disadvantage where there is a longer-term trend.

Can be used to improve diversification.

<u>Capitalization weighted benchmarks based on the market size:</u>

Will be affected both by breadth of market and also by stock prices.

They will automatically capture new developments in markets *e.g.,* public to private enterprise such as mass privatizations.

Their weakness is that they re-inforce trends in the markets so that if prices rise through sentiment rather than fundamentals, they will encourage buying that sentiment and selling stocks that are out of favour.

Can lose diversification.

<u>Re-balancing due to constituent changes and capital changes will be an issue</u>
<u>GDP weightage benchmarks:</u>

This will grant greater economic exposure in a portfolio to countries which have poor stock market representation relative to the size of other economies and vice versa.

They may be little correlation between a country or regional GDP and its investible securities.

With globalisation of companies, the country of quotation may not be relevant to the weight applied.

The securities bought may not reflect the underlying regional GDP.

Increase risk of being incorrectly weighted to smaller markets.

Real time comparable data may be hard come by/not available regularly or at the same tie for each market.

All of the above have advantages and disadvantages, these is no absolutely correct answer.

(3x4=12)

Sol 1c)
Unquoted Securities

Advantages:

Diversification, although if the unquoted companies operate in the similar industries to quoted companies in which the fund invests there may be less diversification than first thought.

Potentially higher returns as the security may be less well researched leading to pricing anomalies.

Unquoted companies are often small and therefore can still grow rapidly even in relatively mature industries.

Disadvantages:

The risks will be higher as often the company and the management will have no track record.

The investment will be very illiquid and may need to be held for long time.

It will be difficult to value.

The company may be more dependent on one person.

It will require specialist knowledge to invest in this area, this will mean higher management fees. It is unlikely that the in-house team will possess the necessary skills, therefore, a third party fund manager will need to be employed, thus increasing costs.

The companies are likely to be less financially stable and will have less ability to raise additional capital should the need arise.

Commodities

Advantage:
Investment in commodities would provide diversification for the pension fund.

It is possible to make significant profits from investing in commodities in short periods, however, there is also the opportunity to lose large amount in equally short periods.

Disadvantages:

Like investing in unquoted securities, the Trustees will almost certainly need to employ third party fund managers.

Use of commodity shares (mining, exploration companies) gives less diversification from equity market than physical would.

Institutions do not invest directly in commodities as this would involve shipping and storage of large amounts of material and institutions do not have the necessary skills or facilities.

Commodities do not naturally fit into an asset liability model as they are neither real assets or fixed rate assets, therefore, unless the Trustees can identify an institution with a very good record in this area there is little to justify investing in this are.

(5)

(ii) Unquoted companies

As with quoted equities the Trustees, with the help of their advisors, should investigate the fund managers that invest in unquoted securities. Investing in unquoted equities requires a different skill set to investing in quoted equities.

In order to diversify the risk a portfolio of unquoted securities need to be purchased.

The easiest way for this to occur is via some form of collective vehicle.

The collective vehicle may be quoted *e.g.* an investment trust.

Or it may itself be unquoted.

If unquoted then liquidity is likely to be very low.

And valuations will be infrequent.

The fees charged to manage venture capital investments are generally higher than those charged to manage quoted investments.

Commodities

Should an institution wish to gain exposure to commodity price movements it can do so in 3 ways.

The most obvious is via commodity derivatives which are widely traded on major exchanges such as LIFFE and the Chicago Mercantile Exchange.

Options and futures are also available.

The futures which are available to trade fall into five main categories.

Alternatively institutional investors do invest in companies whose share price is influenced by commodity prices.

Typical examples of this is the oil and mining companies.

Investing in these companies also overcome to problems of investing directly in the commodity itself and are generally less volatile than the commodity futures.

There are, however, a number of disadvantages if these companies are used as a proxy for commodity investment, these are:

It is unlikely that there will be exposure to just one commodity.

The company's management may alter the exposure via acquisitions or disposals or by hedging its position.

The company's share price may be influenced by other factors.

The company will incur various operating expenses which will dilute the overall return.

(8)

(iii) Given that unquoted companies are not traded frequently a market based price is not available.

One solution would be to value the company at book cost, however, this would not take account of any changes (good or bad) that had occurred since acquisition.

The company could be compared to a similar quoted company and a valuation arrived at by putting the unquoted company on the same PE, or yield *etc.* Any such valuation would then need to be revised downwards to take account of the lack of liquidity.

A DCF valuation cold be used with the weighted cost of capital being increased to take account of the increased risk/reduced liquidity.

(4)

Sol 1d)

(i)   If the assets of the scheme are valued at market value and the liabilities using the yield on a long-dated government bond then there is significant potential for surpluses and deficits where a substantial proportion of the fund is invested in equities.

A significant deficit can arise from fall in equity values and a fall in long-term interest rates.

Likewise a significant surplus can arise form a rise in equity values and a rise in long-term interest rates.

Swing in the value of a sponsoring company's defined benefit pension scheme surplus/deficit could give rise to significant volatility in the balance sheet of the sponsoring employer.

If the size of the pension scheme surplus or deficit is large relative to the net asset value of the company, then the balance sheet volatility will be all the more extreme.

Such volatility could cause the company to go bust or at the very minimum it could force it to cut its dividend.

The company may wish to persuade the trustees of the pension scheme to reduce the volatility of assets backing the scheme.

(6)

(ii)   The scheme could match the liabilities of the scheme with bonds rather than equities.

This would reduce the size of the mis-match between assets and liabilities and hence the size of deficits and surplus.

In turn this should reduce balance sheet volatility.

If funding rates implicitly assume a higher rate of return on equities compared with long dated government bonds, then this approach would suggest a higher funding rate for the sponsoring employer.

Higher funding rates will impact on the P&L account of the sponsoring employer.

The sponsoring employer is being asked to trade a higher funding rate to reduce balance sheet volatility.

(4)

Sol 1e)

(i)   First we have to calculate β;s of two investment trusts.

$$\beta_i = \frac{Cov(R_i, R_m)}{V_m}$$

$$\beta_A = \frac{(0.75)(0.1678)(0.1221)}{(0.1221)^2} = \frac{0.015366}{0.014908}$$
$$= 1.0307$$

$$\beta_B = \frac{(0.36)(0.2363)(0.1221)}{(0.1221)^2} = \frac{0.010358}{0.014908}$$
$$= 0.69673$$

Investment trust A

Treynor measure	$= \dfrac{0.14 - 0.085}{1.0307} = 0.05336$

Sharpe measures	$? \dfrac{0.14\ ?\ 0.085}{0.1678}\ ?\ 0.32777$
Jenson measure	$? \ 0.14\ ?\ (0.85\ ?\ 1.0307(0.13\ ?\ 0.085)$ $?\ ?\ 0.008619$
Prespecified SD	$? \ 0.14\ ?\ \left?\ 0.085\ ?\ \dfrac{0.13\ ?\ 0.085}{0.1221}\ x\ 0.1678\ \right?$ $?\ ?\ 0.00684$
Investment trust B	
Treynor measure	$? \dfrac{0.15\ ?\ 0.085}{0.69673}\ ?\ 0.09329$
Sharpe measures	$? \dfrac{0.15\ ?\ 0.085}{0.2363}\ ?\ 0.27507$
Jenson measure	$? \ 0.15\ ?\ (0.085\ ?\ 0.6967(0.13\ ?\ 0.085)$ $?\ ?\ 0.03364$
Prespecified SD	$? \ 0.15\ ?\ \left?\ 0.085\ ?\ \dfrac{0.13\ ?\ 0.085}{0.1221}\ x\ 0.2363\ \right?$ $?\ ?\ 0.022088$

(10)

(ii) Comments

    (a) On the basis of SD of return (Sharpe and Prespecified SD Trust A outperforms B.

    (b) On the basis of systemic risk (Treynor and Jenson) Trust B outperforms A.

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Limitation

    (a) The data is based only on 3 years. There is no guarantee that the same will hold in future.

    (b) It is not known whether the returns are gross or net.

    (c) We have not considered the suitability on the basis of life office liability.

    (d) The Treynor and Jenson measure are based on the validity of the capital asset pricing.

(5)

[70]

Sol 2)

(i) Problems of making a large Indian - US equity switch in a short time period

The possibility of shifting market prices (on sale of the existing Indian equity portfolio, on the purchase of US equities and possibly on the currency trade).

The time needed to effect the change and the difficulty of making sure that the timing of deals is advantageous.

The dealing and research costs involved (including equity and currency market bid-offer spreads and commission).

The possibility of the crystallization of capital gains leading to a tax liability if the investment fund is subject to tax.

(4)

(ii) How derivatives can make the switching process easier

The fund could:
- ? Sell FSE 100 futures
- ? Buy US dollars forward (in exchange for sterling)
- ? Buy S&P 500 futures.

If the switch is tactical, there will be a saving in the round-trip dealing costs (because dealing costs are lower on derivatives than on the underlying securities.

If the switch is strategic the fund will benefit form having greater time to make the individual stock selection decisions.

In either case, there should be less of a market impact problem because the derivatives markets are very liquid.

(4)

(iii) Calculation of number of contracts

$$\frac{300,000,000}{1,000 \times 500}$$

(2)

= 600 contracts

(iv) Exposure to technology
300 x 0.3 = $90m (*i.e.,* 22.5% of the total $400m US equities)

(2)

(v) Discussion of methods to eliminate technology weighting

Short sell technology stocks with a value equivalent to $90m. (This is permitted in the US, although it may not be permitted by the investment funds own constitution).

Buy traded put options on technology stocks (this will cost some money, but will only remove the down-side exposure, leaving up-side exposure to the sector).

Write trade call options on technology stocks (this will generate some income, but will only remove the up-side exposure, leaving the down-side exposure to the sector).

Arrange on OTC deal (*e.g.* a forward sale) of a sub-index representing technology stocks. (This may result in some cross-hedging and basis risk). There are NASDAQ sub-indices aimed at allowing exposure to the technology sector.

Using a factor computer model of share sensitivities it may be possible to work out a way of removing the exposure in an indirect way (based on short sales and/or derivatives).

(5)

(vi) How to reduce dollar exposure (and problems)

Rather than buying $300 million dollars forward (as described in (ii)), buy whatever lower amount will result in a 50% exposure.

Care will be needed to allow for dividend payments and the fact the margin accounts will probably be maintained in dollars.

The hedge is unlikely to be precise. For example, without knowing the future value of the S&P index it is not possible to hedge 50% of the future currency exposure.

(vii) Types of derivative order

There are three basic types. These can be described as follows:

?   Market order: An order for immediate executive given to a broker to buy or sell at the best obtainable price. This will be executed immediately and in full.

? Stop order: An orer to buy or sell at the market when and if a specified lprice is reached. One the market has reached the designated price, the order is executed at the best price possible, even if this is less favourable than the stop price. This order type is driven by the market level, and will be executed in full when the market reaches a designation price.

? Limit order: An order given to a broker by a customer that specified a price; the order can be executed only at the designated price, or better. In other words, the details of the price to be paid or received can be stipulated, and the order will not be processed if the required price is not met.

(3)

(viii) Calendar spread

A calendar spread is created by selling a call option with a certain exercise price and buying a longer maturity call option with the same exercise price.

For example, in the table given, the trader would choose to sell March Call options for 34 and buy June calls for 47, both with strike price of 400. An equally acceptable answer to this part of the question would be to sell March Call for 10 and buy June Calls for 21 both with strike price of 450.
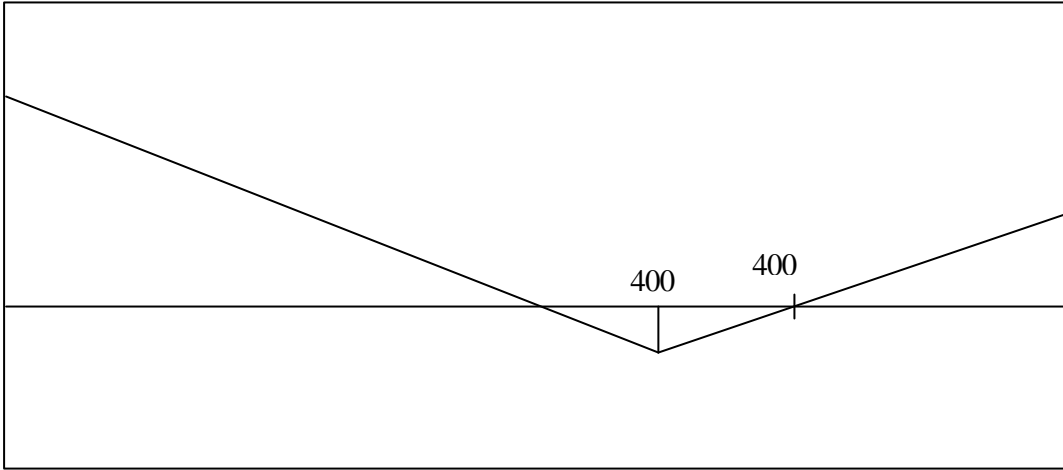
Constructing a strap

A strap consists of a long position in two calls and one put with the same exercise price and expiry date.

Using the table in the question, and selecting March calls and puts with strike price of 400, the diagram would look as follows:

[Note the lowest point of the graph is given by 2 calls at 72 each plus one put at 27 which gives 99 total loss (if all options expiry worthless).

At 450p, each call is worth 50p and the put is worthless giving a profit of 50 + 50- 99 = 1, and so on]

Chart: Strap payoff diagram

(6)

[30]

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