

# **EXAMINATION**

4 November 2010 (am)

**Subject F105 — Finance & Investment Principles**

## **MARKING SCHEDULE**

## QUESTION 1

*Part (i) was straightforward bookwork and was generally well-answered. A number of students produced good, well-considered answers to part (ii) but overall the response was disappointing.*

Suggested solution:

i.

- Outperformance over the long term:
- Although many new ventures fail, those that survive generate extremely high returns.
- Performance is loosely correlated with other asset classes and hence private equity (PE) can be used for diversification.

ii.

- Establish whether local regulations permit investment in private equity and if so, what proportion of the fund may be invested in this asset class.
- Establish whether the fund's mandate permits private equity investment and if so, in what proportion.
- Consider the level of surplus in the pension fund:
- If in a healthy surplus, there may be more freedom to consider this investment than if the funding position is tight.
- Identify the assets (asset classes) which would be sold to allow this investment and how the changed allocation affects the fund's risk-return profile
- In particular, carefully evaluate the risks of a concentrated holding (12% of total assets) in the PE fund.
- Establish whether the pension fund trustees' risk appetite allows investment in private equity.
- Evaluate the macroeconomic outlook over the period of the private equity investment;
- success of start-up ventures will require a favourable economic environment.
- Confirm the availability of suitable investment opportunities;
- establish whether the PE fund managers have identified particular start-up ventures,
- and understand the business models of these companies
- to come to an informed view about the PE fund risk-return prospects.
- Interrogate the performance history of the PE fund.
- The results presented take account of returns on companies in which the fund is still invested: could the reported returns be affected by survivorship bias?

- The results apply over a very short history: ideally a longer performance history would be required.
- Consider the appropriate risk adjustment to be made to these performance figures.
- The historic return needs to be put in context against returns on other asset classes, inflation and risk-free rates.
- Evaluate the strength of the management team, their individual experience and track records.
- Establish the required term of PE fund investment:
  - i.e. for how long are funds committed,
  - what are early disinvestment penalties,
  - what is the call-down period,
  - when are returns expected to be paid.
- Consider the retirement fund liquidity needs:
  - however, as the age profile is young, liquidity needs may be low.
- Establish the PE fund management fees.
- Overall, it is unlikely that a sufficiently compelling case could be made to persuade the trustees to invest as much as 12% of the fund's assets in the PE fund.

## QUESTION 2

*Question 2 was very poorly-answered. Many candidates appeared not to have heard of the Merton model, and missed out on what should have been relatively easy marks for well-prepared candidates.*

Suggested solution:

$$d_1 = \frac{\log\left(\frac{100}{60.45}\right) + 8\left(0.08 + \frac{0.4^2}{2}\right)}{0.4\sqrt{8}} = 1.576277$$

$$d_2 = d_1 - 0.4\sqrt{8} = 0.444906$$

$$\Phi(d_1) = 0.6277 \times 0.94295 + 0.3723 \times 0.94179 = 0.94252$$

$$\Phi(d_2) = 0.4906 \times 0.67364 + 0.5094 \times 0.67003 = 0.67180$$

$$D_0 = 100(1 - \Phi(d_1)) + 60.45 e^{-0.08 \times 8} \Phi(d_2) = 27.1617$$

$$r = \log\left(\frac{60.45}{27.1617}\right) + 8 = 10\%$$

ii.

- The Merton model assumes that asset prices follow a Geometric Brownian Motion, and hence that returns are normally distributed, ...
- which is unlikely to be a valid assumption for the company's assets:
- returns are likely to be skewed and leptokurtic.
  
- Markets may simply be inefficient (although unlikely to be grossly so).
  
- Market prices are always functions of supply and demand, and ...
- investors may demand a risk premium
- over and above the expected default risk.

### QUESTION 3

*At first sight the question appears to be straightforward, however most candidates were only able to obtain half of the marks available.*

*Part (i) was bookwork and it was generally well answered by the majority of candidates.*

*Part (ii) was generally well answered.*

*Part (iii) required application of the bookwork and it was poorly answered. Most candidates were able to explain the details of a core-satellite strategy, even though this was not asked. Hence, very few marks were scored as only the better students were able to expand their solutions beyond the more obvious benefits such as diversification and lower costs.*

*Part (iv) was a slight modification to the standard bookwork question and as such was poorly answered. Most candidates were only able to score the obvious marks on lower costs and diversification. The question specifically asked key benefits, rather than just a list of the advantages of index-tracking.*

*Part (v) required application of the bookwork and it was poorly answered. Whereas most candidates were able to describe the key features of the two indices, very few were able to comment on the merits of tracking these indices. Some candidates confused the merits of performance management with those of index tracking.*

Suggested solution:

- (i) The uses to which indices can be put include:
- a measure of short-term market movements;
  - providing a history of market movements and levels;
  - as a tool for estimating future movements in the market, based on past trends;
  - as a benchmark against which to assess the investment performance of portfolios;
  - valuing a notional portfolio;
  - analysing sub-sectors of the market;
  - as a basis for index funds which track the particular market; and
  - to provide the basis for the creation of derivative instruments relating to the market or a sub-section of the market.

(ii)

- Passive investment management aims to track an index and combines diversification with low cost and has historically outperformed most actively managed funds.
- Active investment management aims to outperform their benchmark by taking bets on the individual securities (i.e. under- or overweight compared to the benchmark, typically an index).

(iii)

### **Benefits of core-satellite**

- Core-satellite recognises that markets are largely efficient but that there are pockets of exploitable inefficiency, so it allows for the implementation of a view on the optimal split between active and passive management, and allows for the use of specialist satellite managers (e.g. hedge funds).
- Core-satellite stabilises the investment portfolio by providing greater portfolio diversification (as the typical index core is combined with lowly correlated active satellites) resulting in lower overall fund management and transaction costs.
- This provides the opportunity for the fund to allocate part of its “cost budget” to the actively managed satellites that are less constrained where the manager can demonstrate its value in generating alpha.
- After-tax returns could be improved through taking maximum advantage of capital gains discounts.
- Also the core being indexed allows for complementary derivative usage when necessary. So, for example if the fund needs at any stage to be more conservative and protect its asset values on the downside, the fund can put derivative far more easily and cheaply over the index component as there are both exchange-traded and more OTC derivatives on such contracts.

(iv)

**Key advantages of index tracking (passive investment) for the core:**

- Lower costs – Index tracking involves lower management and transaction costs.
- Applicability to virtually any market segment or asset class:
  - The same strengths that make indexing a good strategy for broad asset class exposure also apply to market segments within those asset classes.
  - Because investments in small-cap and international markets entail higher costs, the active manager has to overcome a higher hurdle to add value, making indexing an attractive alternative.
- Stability & transparency:
  - Because they are designed to track an index and hold the same securities (or a representative sample), index funds are transparent and easy to understand.
  - Consistent returns imply simpler ongoing portfolio management.
- Tax-efficiency:
  - Depending on the index, passive strategies typically realize lower capital gains than comparable active funds, making them potentially more tax-efficient.
- Diversification within a market segment:
  - Index funds often have more securities than a typical active fund, hence less exposure to the performance fluctuations of single investments.
- Risk control
  - Consistent returns imply lower levels of volatility.
- Index construction:
  - Differences in index construction can mean substantial differences in performance between benchmarks that may be tracking the same market segment.
  - Each index provider has its own definition of growth and value, as well as different parameters for large-cap versus mid- or small-cap.

(v)

DJIA:

- Unweighted arithmetic index,
- made up of 30 shares.
- Whereas it provides a quick guide to shares in the industrial sector, not representative of the US equity market.

S&P500:

- Weighted arithmetic index,
  - made up of 500 leading companies in the USA
  - representing a broad cross-section of all sectors of the market.
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- While the DJIA is the benchmark by which the US market is commonly measured, the S&P inherently provides greater diversification by indexing a much larger cross-section of the overall market.
  - Tracking S&P500 may require more frequent re-balancing as stocks move in and out of the index, could imply higher costs.
  - Even though the purpose of index tracking bears no resemblance to performance measurement, the S&P500 provides a better benchmark for performance (being more representative of a diversified fund's likely exposure), hence could be a better option to track for comparative purposes with other funds.

## QUESTION 4

*Most candidates fared well with the straightforward performance attribution in part (i). The answers on part (ii) were disappointing for the most part, with few candidates thinking broadly about the issues and providing answers sufficient to merit most of the marks on offer. Part (iii) was fairly well-answered.*

Suggested solution:

$$r_{AA} = (0.47 \times 0.16 + 0.42 \times 0.11 + 0.05 \times 0.32 + 0.06 \times 0.06) = 14.1\%$$

$$r_{NW} = (0.45 \times 0.15 + 0.45 \times 0.12 + 0.03 \times 0.21 + 0.07 \times 0.06) = 13.2\%$$

$$r_{AN} = 0.47 \times 0.15 + 0.42 \times 0.12 + 0.05 \times 0.21 + 0.06 \times 0.06 = 13.5\%$$

$$\text{Sector selection profit} = 13.5\% - 13.2\% = 0.3\%$$

$$\text{Stock selection profit} = 14.1\% - 13.5\% = 0.6\%$$

ii.

- The fund's property allocation already exceeds its benchmark significantly, and further exposure to property would lead to additional active risk.
- This over-allocation may be a function of the strong performance of the property market recently.
- If the trustees wish to consider additional property exposure, they ought to revisit the fund's benchmark.
- This is likely to come at the expense of equity exposure (both are long-term, real asset classes).
- The fund's property portfolio has strongly outperformed its benchmark; the sources of this outperformance should be thoroughly assessed, e.g. is it due to concentrated holdings of particular properties which have performed well over the year?
- The outperformance may have (in fact, is probably likely to have) been accompanied by increased risk.
- One year is too short a timeframe over which to assess the relative performance of the asset classes;
- a longer history should be evaluated.
- In any event, returns will be earned prospectively, and hence the trustees need to concern themselves with the outlook for property as an asset class going forward.

- other valid minor points include subjectivity of property valuations, benchmarking issues, statutory limits on property holdings, high costs of switching into property, liquidity considerations and tax considerations.
- Property can be subject to speculative bubbles and any decision to invest more heavily in property should be based on solid long-term fundamentals and not on assumed momentum of past performance.
- The risk preferences of members must be borne in mind:
- the option is presented as a medium-risk balanced fund, and greater exposure to property may fail to meet the requirements of being either medium-risk or balanced.
- other valid minor points include subjectivity of property valuations, benchmarking issues, statutory limits on property holdings, high costs of switching into property, liquidity considerations and tax considerations.

iii (a)

### ***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
- $\beta_p$  is the systematic risk of the portfolio.

### ***The Sharpe measure***

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

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

Sharpe =  $(0.13 - 0.07) / 0.19 = 0.31579$   
 Treynor =  $(0.13 - 0.07) / 1.15 = 0.05217$

(iii)(b)

The risk preferences of members must be borne in mind:

- When the portfolio under consideration represents all, or the overwhelming majority, of the investor's wealth, it is most appropriate to consider total risk, i.e. the standard deviation of portfolio returns and hence the Sharpe ratio is generally

considered to be a better measure of risk-adjusted performance in these circumstances.

- However, when the portfolio represents only a small portion of total wealth, performance should be adjusted for systematic risk and in such cases the Treynor measure is preferred.

(iii)(c)

- Both rely on the Modern Portfolio Theory/CAPM assumption that the second moment of the return distribution (variance of the portfolio or covariance with the market) is a sufficient indicator of investment risk.
- This assumes either quadratic investor utility functions,
- which are an unlikely representation of empirical utility,
- or elliptically symmetrical return distributions,
- whereas equity returns in practice are typically negatively skewed and leptokurtic.
- Both measures ignore actuarial risk.
- Neither measure focuses specifically on downside risk.

## QUESTION 5

*This question was largely bookwork. Many students failed to appreciate the broad definition of the VaR required for part (i) with the limitations required for part (ii) largely arising from the practical implementation of the measure.*

Suggested solution:

- i.
  - Value at Risk (VaR) generalises the likelihood of under-performing by providing a statistical measure of downside risk.
  - VaR assesses the:
    - potential losses on a portfolio;
    - over a given future time period; and
    - with a given degree of confidence.
  - It can be measured either in absolute terms or relative to a benchmark.

ii.

- The validity of assuming a normal distribution in calculating VaR – based on historical data, fund returns are not normally distributed but mostly fat-tailed.
- Where the tails of these distributions are used, the accuracy of the estimates can be considerably reduced by using the wrong distribution.
- The fat-tailed problem is exacerbated where the risk being measured has systematic bias or (in the case of an equity portfolio) has significant derivative exposure.
- The Gumbel, Frechet or Weibull distributions may be more appropriate in such cases.
- The further out in the tail we get, the more sensitive the results are to the assumptions and the modelling.
- Past performance may not be a reliable guide to future performance (given that the measure relies on historical data).
- A forward-looking VaR calculation requires Monte Carlo modelling techniques, which increases the complexity.
- If VaR is used to estimate extreme events, but the data is measured during normal market circumstances, then the results may be flawed.
- In extreme circumstances the correlations between shares and sectors and indeed markets do not behave as they have done in the past.
- VaR is limited to information regarding the underperformance at the level of probability chosen – no other info is provided.

## QUESTION 6

*The first part of the question was straight bookwork, while parts two and three required candidates to demonstrate some understanding of how derivatives are physically hedged. Some candidates didn't take into account the specific information given in the question when answering part (iii).*

Suggested solution:

i.

- Hedging – to reduce market risk.
- Speculation – aiming to increase returns through changes in the price of the underlying asset or due to changes in the volatility implied in the option price.

- Executing an arbitrage strategy – by using the option in conjunction with a combination of assets anticipating locking into a risk-free profit due to inefficiencies in the market.
- Portfolio (transition) management – altering the characteristics of a portfolio without disturbing the underlying assets
- Synthesizing an index – index tracking as part of a passive investment strategy.
- Generation of additional income.

ii.

- The issuer can find a back-to-back counterparty...
- who is looking to sell a put option.

Dealing in the underlying asset

- (or futures based on underlying, ...
- or asset closely correlated with underlying)
- to replicate a issuers obligation (short put option).
- Involves specifically selling short part of the underlying asset and holding the proceeds in cash.

iii.

- Short sell 1 unit of the underlying asset ...
- invest the proceeds and the option premium in cash.

Comment: The profit margins priced into the premium would be stripped out from the hedging portfolio. As the question asks for approximate portfolio, will accept either.

## QUESTION 7

*Parts (i), (ii) and (iv) were broadly satisfactorily answered, as would be expected since they were based on bookwork. Students clearly struggled with part (iii) which carried a substantial part of the marks. Obvious points such as duration mismatch risks, counterparty exposure and exposure limits were often missed. Credit was given for other valid points. With respect to part (iv) some students clearly did not understand the development of the PE over time. Those that did in many cases earned the bulk of their marks for this question on this section.*

Suggested solution:

i.

- The company will endeavour to issue the bond as cheaply as possible
- as well as market it at the lowest cost possible.
- The issue must also meet the company's requirements in respect of term,
- pattern and flexibility of funding.

An investment bank can assist the company in meeting these objectives through:

- Advising on the prices that they can charge – the bank will be knowledgeable of the market and will suggest appropriate issue prices and interest rates.
- Handle the marketing of the security issue to the public – including advertising to potential investors, maintaining records of applications and determining allocations, handling investor's money as well as issuing the securities.
- Seek to protect their reputation for honesty by checking and certifying the quality of the information offered – the bank will suffer reputational risk with an unsuccessful issue or one where investors are disappointed.
- Innovate security design and packaging to stimulate demand – the bank can apply their expertise and knowledge of investors to develop securities with features that will prove attractive.

ii.

The credit-related occurrence that triggers the payment on a credit default swap might include:

- bankruptcy (insolvency, winding-up, appointment of a receiver)
- a rating downgrade
- repudiation
- failure to pay
- cross-default

iii.

- The hedge fund manager should decide whether the 3% premium is commensurate with the risks inherent in the structure.
- There exists a settlement risk in that either during the bond trade or at default, the bonds are not delivered for settlement.
- Should the counter-party bank (X) itself be experiencing financial difficulties, the hedge fund may be swapping one risk for another, as it may not be able to trade the bonds issued by X.
- The exchange of Bank X bonds for SOL bonds raises numerous issues:
  - Should the bonds issued by X be delivered, there could be a subsequent default on the delivered bonds – what is the credit rating of these bonds?
  - The bonds delivered may be illiquid / unmarketable – reflected in credit rating?
  - The hedge fund may need a higher coupon and the redemption proceeds as anticipated, and cannot take up the bank's bonds as these do not match the liability needs.
  - The timing of the credit event that triggers the swap – i.e. the later the credit event occurs, the more favourable the terms of the CDS could be in that although only 50% of coupons are received, the extended term could be beneficial, (e.g. if SOL defaults one year before maturity).
- The hedge fund may be over-exposed to X in relation to its allowable internal risk limits.
- If payment is triggered by a credit event less severe than complete default or bankruptcy, the following should be taken into account:
  - Given that there is currently an economic recession, the outlook for the earnings of the hotel chain should improve, hence SOL may recover from its financial dilemma, and it may be worthwhile to retain the original bonds, anticipating full recovery.
  - It may thus be more valuable to the hedge fund to elect to receive the bank's bonds at a later stage, should another (more) severe credit event trigger the CDS.
- The redemption payment at par of the bonds issued by X – is it commensurate with the original redemption payment that would be received should SOL redeem its bonds (i.e. no CDS)?
- The settlement may not be suitable to the hedge funds required commitment timings. The impact may be requiring it to sell the bank bonds at an inopportune time when the Bank X bonds itself are trading at a discount to par.

iv.

- Historic P/E ratios may be used as a measure of how the valuation of one company varies relative to another during an economic cycle.
- An international hotel chain is sensitive to changes in the economy as it represents a cyclical company in the consumer services industry.

- While the economy is buoyant earnings are expected to rise and when the economy slows down, earnings are expected to fall.
- Hence the earnings are volatile.
- An investor will attempt to anticipate the future earnings profile.
- Even though the economy may be buoyant and earnings are higher, an investor may be allowing for an economic slowdown and therefore the P/E may be lower than the average for P/E for the company through the cycle.
- The converse will also hold, i.e. when the economy slows down, the P/E should be higher than the average P/E of the company through the cycle.