EXAMINERS' REPORT

June 2016 examinations

Subject F105 – Finance and Investment Fellowship Principles

INTRODUCTION

The attached report has been prepared by the subject's examiners. General comments are provided on the performance of candidates on each question. The solutions provided are an indication of the points sought by the examiners, and should not be taken as model solutions.

QUESTION 1

Candidates did not fare as well as expected on this reasonably straightforward question. Poor understanding of the basic form of multifactor models was frequently on evidence in part (i), with a common mistake including identifying a_i as the risk-free rate. Few candidates were able to explain adequately the potential use of such models in both active and passive portfolio management.

i.

A multifactor model of security returns attempts to explain the observed historical investment returns on security i by an equation of the form:

$R_i = a_i + b_{i,1}I_i + \cdots + b_{i,L}I_L + c_i$ (Marker's note: accepted formula expressed in terms of expected returns, but then candidates could not earn the half-mark below for identifying the random part of the unique return.)

where:

- R_i is the return on security i
- a_i and c_i are the constant and random parts respectively of the component of return unique to security i
- $I_1 \ldots I_L$ are the changes in a set of L factors that explain the variation of R_i about its expected return
- $b_{i,k}$ is the sensitivity of security i to factor k.

They therefore attempt to model the process generating investment returns as a function of several sources of systematic risk, which may be macroeconomic variables and/or company-specific factors.

[Max 4]

ii.

Active portfolio:

The multifactor models can be used to estimate the expected return on a share given a set of risk factors and its modeled sensitivities to those factors. This involves predicting the returns on those risk factors. If this understanding of the risk factors which contribute to the cross-section of returns and ability to predict the risk factors is better than that of competitors, we should be able to calculate a fair price for each security in the investment universe which, compared with the ruling market price, can be used to inform buy/sell decisions.

We can also use the model to quantify portfolio exposure to particular risk factors, and where desired to alter this exposure. This could for example facilitate better matching of liabilities, if we have a good sense of the liabilities' exposure to these risk factors.

Passive portfolio:

As opposed to full replication of an index by holding all stocks, partial replication aims at holding a sample of stocks which is expected to move in the same way as the full basket. The model could help to identify a representative sample of stocks included in the relevant index which have exposure to the risk factors which is virtually the same as that of the full basket, and would therefore be expected to move in tandem. Relative to full replication, this saves costs and avoids illiquid stocks.

iii.

Historical tracking error

$$= \sqrt{\frac{\sum_t (r_{p,t} - r_{i,t})^2}{n}}$$

$$= 0.15811\%\ p.m.$$

Annualised x $\sqrt{12} = 0.55\%\ p.a.$

(Some candidates may have come across a formula using the (n-1) divisor; use of this, with solution 0.6% p.a., was also accepted. While this is the way in which tracking error is usually calculated, credit was also given for an interpretation consistent with the definition in the notes as the "standard deviation of the individual monthly relative returns", which translated to 0.37% p.a.)

Investors may be concerned about the level of tracking error as they may expect this to be closer to zero, but this will depend on their expectations which will have been formed by *inter alia* the way in which the portfolio was marketed. Investors may also be placated that the fund has comfortably beaten the index (7.5% return over the period vs. 6.7%). However, six months is a very short period over which to draw conclusions. If the passive strategy is based on partial replication (as alluded to in part (ii)), the design of the passive portfolio would be expected by investors to result in a slightly higher tracking error than full replication.

QUESTION 2

This question was surprisingly poorly attempted. The vast majority of candidates did not answer the question set and discussed how liability hedging would be applied rather than the problems with its application. Furthermore, those candidates who did focus on the problems were unable to think broadly enough to generate sufficient separate points.

The fund may be in deficit, i.e. assets not available to purchase the instruments to match the liability cash-flows.
The fund may be too small to justify the implementation cost of liability hedging.
There may be "gaps" in the asset cash-flows to meet the liability payments. This may require reinvestment of asset proceeds or disinvestment of assets at unfavourable times creating an imperfect hedge.

Government bonds may be too expensive. Investing in non-government assets, e.g. corporate bonds, exposes the pension fund to credit risk. Although an economic balance sheet would reflect this risk through the economic capital requirement.

There are uncertainties in the liability payments that are extremely difficult to match:

- Mortality
- Inflation, particularly non-CPI related increases
- Discretionary payments, although helped by members' reasonable expectations
- Ad hoc expenses
- Winding-up expenses

There could be some difficulty in hedging cashflows and at the same time meeting statutory and other (e.g. financial reporting) requirements, depending on the valuation bases used.
The tax status of the asset may worsen for the pension fund. For example, bonds may become taxable for pension funds which were previously tax free. Asset proceeds would then be likely be insufficient to meet liability payments.

QUESTION 3

Most candidates made a reasonable attempt at this question.

i. *This question relates to bookwork and it was well attempted by those candidates who studied the bookwork.*

ii. *Answered well by the majority of candidates, although few were able to provide comment about the issues relating to the transfer of ownership and rights and obligations.*

iii. *Answered well by the majority of candidates.*

iv. *This proved to be the most challenging part of the question resulting in the least marks being scored. Very few candidates were able to provide realistic limits and conditions. Whereas the examination papers form a useful revision tool, it was*

notable how some candidates "copied and pasted" model solutions to questions in previous examination papers which are completely unrelated to the question in this instance, resulting in no marks being scored.

i. The hedge fund index could have suffered from various data biases which may have artificially improved performance statistics:

- Survivorship bias – the possible exclusion from the data of funds that have failed during the period (i.e. the inclusion of only the "survivors", those funds still in business).

  When the emphasis is on survivors, average returns will be overestimated and volatility will be underestimated. Also, when a fund is added to a database, data vendors tend to "backfill" that fund's performance history.

- Selection bias – funds with a good history are more likely to apply for inclusion. Backfilling will then cause a significant upward bias.

- Marking to market bias – since the underlying securities may be relatively illiquid, funds will typically use either the latest reported price or their own estimate of the current market price for valuation. The use of "stale" prices can lead to underestimation of true variances and correlation.

ii.

Securities lending is the act of lending a security to an investor (e.g. a hedge fund). It requires the borrower (e.g. the hedge fund) to put up collateral (e.g. cash, letter of credit).

When the security is loaned, the title and ownership may be transferred to the borrower alternatively all rights and obligations attaching to the security may be transferred.

iii.

A short selling investment strategy may be implemented in terms of which securities are borrowed in order to immediately sell them, or in terms of a futures contract where there is an obligation to deliver the actual securities at settlement, – the borrower expects to profit through this strategy by selling or delivering the securities and repurchasing it a lower price, returning the securities to the lender.

iv.

Limits and conditions of securities lending in the hedge fund deed should include:

- The hedge fund manager may lend or offer to lend securities limited to a percentage of the market value of all securities in the portfolio.
- Collateral security for the securities loaned must have a minimum aggregate value of the securities loaned.
- Restrictions on collateral, such as cash only, or suitable haircuts (e.g. investment valued at 90% of its market value) applied for other types of collateral e.g. equities.
- Restriction on the time period loaned, e.g. 12 months.

- Inclusion of a "right of recall" clause, stipulating the terms and conditions of a recall.
- Fee income earned from securities lending must be administered for the benefit of investors.
- Proper disclosure and financial reporting on the securities lent, the value thereof and the composition and nature of the collateral security held in respect of the loan.
- A legal loan agreement (contract) between the transacting parties must be in place.
- Compliance with any regulatory requirements.

QUESTION 4

This question was poorly answered by many candidates. A surprising number of candidates based their answers for part (i) on the economically implausible assumption that shares would be issued on a one-for-one basis, regardless of the difference in share price. For part (iii), many simply listed the switch from risk-averse to risk-seeking behaviour around the reference point under Prospect Theory, which is clearly not the key relevant feature in this circumstance.

i.

Since St. Zita's has the higher P/E ratio (12x vs. 10x), it should be the acquirer and St. Vitus the target.

Further assumption: 2 shares in post-merger St. Zita's are issued for every three in St. Vitus, based on the relative share prices before the merger.

Total number of shares in issue: 500,000 + 1,200,000 * 2/3 = 1,300,000

Total earnings: 10*500,000 + 8*1,200,000 = $14.6m

Enhanced EPS post-merger = 14.6m / 1.3m = $11.23.

ii.

In the case of the enhanced EPS, it could be argued that this is simply sleight of hand, with illusory benefits for shareholders. Though EPS has indeed increased, there is no increase in the earnings of the combined entity nor in its market value, unless shareholders reward the merger by pushing up the share price through increased demand for the combined stock (assumed not to be the case here).

As for diversification, shareholders can achieve this more quickly and easily themselves by diversifying their portfolios (e.g. buying the shares of the two companies in the desired proportions) than by the companies going through a costly process of merging. There may arguably also be a loss of management focus post-merger given how different the two businesses are in nature (although we have implicitly assumed that this is not the case, or at least that shareholders do not perceive it to be the case).

iii.

The key relevant feature of Prospect Theory is loss aversion: investors place greater weight on losses than on the corresponding gains.

If they fall prey to mental accounting, the holdings in the two stocks may be viewed as separate entities rather than as a combined portfolio. In this case, a $100 loss in one and a $100 profit in the other would be treated as a net negative outcome, rather than the neutral outcome that would be assigned to the breakeven of the combined stock.

QUESTION 5

The syllabus requires of candidates to demonstrate a knowledge and understanding of the characteristics of specialist financial instruments, which include conventional bonds with embedded options. However, almost no candidate managed to successfully attempt this question resulting in very few marks being scored.

i. Most candidates could define a callable bond, but most failed to outline the reasons for issuing such a bond.

ii. Most candidates were able to identify the key risks but failed to describe the key risks as required by the question. E.g. citing unfavourable market movements as a trigger for call risk in itself is not enough: candidates must elaborate on these "unfavourable market movements" to be awarded the full credit. In terms of compensation, most candidates were able to at least mention higher coupon rates.

i.

A callable bond allows the issuer to buy back the bond at a predetermined price at certain times in the future.

The call feature is positive for the issuer of the bond as it allows the issuer to essentially refinance debt at more favorable terms when interest rates fall, or it may repay the debt where a it has a certain future income of which the timing of receipt maybe uncertain.

The issuer may issue a callable bond when it is confident about its business resulting in an improvement of its credit quality, lowering their borrowing costs. Once the market factors in the improved credit quality, the issuer can call the (expensive) bond and replace it with a bond which pays lower coupons.

ii.

(Note – a description of each risk is required to score full marks)

- Call risk – for the investor, means the risk that a callable bond is called when interest rates decrease (prices high). For the investor the call feature represents a drawback as it causes the price behavior of this security to exhibit negative convexity when interest rate levels fall, which limits the capital appreciation potential of the bonds when interest rates fall, and may result in reinvestment risk for the investor.

- Credit risk – for the investor, means the risk of default of the bond resulting in the embedded option being worthless, although the callable bond was priced to allow for the option.

Compensation for these risks could be offered to the investor through:

- A greater return potential as callable bonds are usually priced at a discount to par and may pay higher coupons compared to other similar non-callable fixed income securities;

- The predetermined price at which the bond may be called would typically be greater than the principal amount of the bond;

- The variation of the lockout period (i.e. the period from the date of issue during which the bond cannot be called) – a longer lockout period may offer greater protection to the investor.

QUESTION 6

Examiner Comments:

This was reasonably well answered. Most students got full marks for Part (i). Many students did well in Part (ii). The answers to Part (iii) were quite varied, with some students doing well but many did not read the details of the question properly and therefore made irrelevant comments. The question asked for "limitations of the proposed index" and yet some students commented on the advantages of the proposed method. Some were confused about the implied weightings being used.

i. Possible reasons include:
   - Provide a measure of market movements
   - Provide a history of market movements and levels
   - Provide a tool for estimating future market movements based on past trends
   - Provide a benchmark against which investors can assess the performance of their own collections

- Analysis of sub-sectors of the market (oil paintings, sketches etc) if indices of sub-sectors are created
- Provide a basis for the creation of derivative instruments relating to the market
- It's a marketing exercise for the firm, which may lead to additional opportunities for offering advice on including this asset class in a diversified portfolio.

ii. Difficulties include:

- Lack of reliable and up-to-date data on art prices:
  - Uniqueness of each piece
  - Market value is only known once a sale occurs
  - Estimation of value is subjective and expensive (depends on number of artworks included in the index)
  - Sales may be very infrequent for particular pieces / types of art
  - Sale prices may be confidential (esp if not done through an auction)
- Heterogeneity of artwork (e.g. by type of art, age, artist)
  - The problem of having useful price data is magnified by heterogeneity – it becomes difficult to group properties into homogeneous groups and still have sufficient price data for each group.

iii. Limitations:

- While there is some attempt to create homogenous baskets, constituents will still be unique and heterogenous. This creates a problem of heterogeneity over time as basket constituents are changed over time.
- Heterogeneity over time will be exacerbated by frequent changes to basket constituents.
- The index is effectively price-weighted, with price changes of the most expensive art pieces carrying the most weight. The appropriateness of this depends on the purpose of the index – if it is to be used for performance measurement then this might not be appropriate if most portfolios are not able to gain exposure to these pieces.
- The usefulness of the index will depend on how the panel choose basket constituents and whether this process is disclosed.
  - Some panel experts decisions may be influenced by vested interests.
  - Changes to panel members may influence basket construction
  - If the overall index is dominated by a particular art-type (e.g. expensive contemporary oil paintings), then it won't be a useful barometer of art prices in general.
- If index price changes are mostly dependant on subjective price estimates (due to lack of actual price data) then the usefulness of the index is limited, as those estimates could be wrong.
- Dealing costs, storage costs, insurance costs are ignored in the index, while actual returns could be substantially affected by these costs, and this limits the value of comparisons with other asset classes.

- It will be near impossible for any investor to replicate the basket, making the overall index useless as a means for measuring investment performance for such investors.
    - Indices per art-type might be slightly more useful to collectors of specific types of art (e.g. modern oil paintings)

QUESTION 7

Overall, this question resulted in a wide spread of marks. Very few candidates, however, performed well in each sub-question.

i. Pure bookwork, where better prepared candidates scored full marks.

ii. This sub-question tested whether candidates were able to think broadly and sensibly. The range in marks was very wide. The two major downfalls of candidates were:
   a. Not considering enough sensible grouping characteristics; and/or
   b. Recommending more esoteric valuation methodologies, although credit was awarded for clear explanations of alternative valuation methodologies.

iii. This applied bookwork question was very poorly attempted. Candidates generally ignored the directive to "discuss", resulting in lack of depth in the answers.

i. Operating leverage
Financial leverage
Asset leverage
Capital structure
Liquidity

- asset leverage (quality, market value and diversification of assets, exposure to investment and credit risk)
- capital structure (including holding company capital structure, where relevant)
- liquidity (quick and current ratios, operational and net cashflows).

ii. Value = Discounted value of coupons
+ Discounted value of redemption proceeds

The coupon and redemption proceeds are fixed in nominal monetary terms. The only variable affecting the value is the discount rate.

You will need to find listed and traded bonds that are most similar to the debt, provided they exist. You could then determine the traded yield for each of these similar bonds. You would also need to examine the reasons for the outliers of the traded yields and possibly exclude these. You could then take an average of these yields as the basis for your discount rate (credit for any sensible suggestion). A margin must be added to the discount rate to reflect the additional illiquidity premium of unlisted debt.

The easiest initial grouping is by instrument similarity criteria:

- Term to redemption similar to debt
- Conventional fixed interest
- Principal repaid at redemption
- No embedded derivative features, e.g. cannot be converted into equity
- Market value similar to debt, this will need to be done iteratively through recalculated discount rates
- Seniority similar to debt
- USD denominated
- Marketability

The second grouping is by issuer similarity criteria:

- Company only
- "Financials" industry
- Same sub-sector
- Similar balance sheet size, particularly Shareholder's Equity
- Similar income statement size
- Similar credit worthiness / credit rating

The very large, developed economy suggests a deep and liquid listed bond market. This should provide enough participants to allow for multiple grouping criteria. There needs to be sufficient bonds, however, to ensure that anomalies can be recognized and removed.

iii. You expect future defaults to exceed historic levels. This is particularly true if the economy is entering a trough. The asset management sector of the Financials industry is also likely to be cyclical. There may be structural changes to the economy or industry and sector increasing the risk of default. For example, a structural sector change could be legislation capping asset management fees.

Compensation for the risk of higher defaults, i.e. a credit risk premium.

A residual that includes the compensation for the liquidity risk- typically referred to as an illiquidity premium. This is likely to be more significant for private debt.

You may have different criteria in determining similarity of entities.

You may be determining historical default rates over different periods. Different economic cycles, different sector and industry trade cycles, and structural changes to the economy, sector and industry can have major effects on historic default rates.

You may have different calculation methodologies.

You are incentivised to demand a higher coupon as this results in more investment income for your firm.

QUESTION 8

Examiner Comments:

Despite this being a basic performance attribution question, it was done badly by most students. Of particular concern is the fact that most students stumbled in Part (i). The approach adopted (or attempted) by most students was to calculate a TWRR by asset class and then calculate a weighted fund return. This approach implies constant re-balancing, and the question explicitly stated that there was to be no rebalancing. Some students even stated "no rebalancing" as an assumption, but then their method implied constant re-balancing. This shows an alarming deficit of understanding and thinking skills for students attempting this exam. Equally alarming were the very weak attempts for Part (ii), suggesting that students accepted they were out of their depths. Even allowing for the incorrect approach in Part (i), students made various other errors in Part (ii) leading to very low marks. Most students attempted Part (iii) but focussed only on comments relating to under/over performance, and none of the wider implications. Most students did well in Part (iv).

i. $Fund_0$=200 $Fund_{0.5}$=225 $CF_{0.5}$=15 $Fund_1$=247
Calculating time-weighted rate of return (TWRR):
Actual return = 225/200*247/(225+15)-1=15.78%

For the benchmark fund return:
A simplistic (but not correct) approach is to calculate a weighted average return from asset class returns i.e.
Benchmark return=10%*Equity return+70%*Bonds return+20%*Cash return=12.95% where Equity return=I^E_1/I^E_0=270.6/151.3=78.85% etc. This approach assumes constant rebalancing to keep the weights constant, while the question states that there is no rebalancing during the year, so this approach is not correct.

For the benchmark fund return we need to calculate benchmark fund values:
$Fund_0$=200 $Fund_{0.5}$=213.68 $CF_{0.5}$=15 $Fund_1$=241.65
Calculating time-weighted rate of return (TWRR):
Return = 213.68/200*241.65/(213.68+15)-1=12.90%
Where:
$Fund_0$= $Fund^E_0$+$Fund^B_0$+$Fund^C_0$=20+140+40=200
$Fund_{0.5}$=$Fund^E_{0.5}$+$Fund^B_{0.5}$+$Fund^C_{0.5}$=20*($I^E_{0.5}/I^E_0$)+140*($I^B_{0.5}/I^B_0$)+40*($I^C_{0.5}/I^C_0$) = 27.81+145+40.87=213.68
$Fund_1$= $Fund^E_1$+$Fund^B_1$+$Fund^C_1$= [$Fund^E_{0.5}$+$CF^E_{0.5}$]* $I^E_1/I^E_{0.5}$+[$Fund^B_{0.5}$+$CF^B_{0.5}$]* $I^B_1/I^B_{0.5}$+[$Fund^C_{0.5}$+$CF^C_{0.5}$]* $I^C_1/I^C_{0.5}$
Note that $CF^E_{0.5}$=10%*(120-105)=1.5, $CF^B_{0.5}$=10.5, $CF^C_{0.5}$=3

ii. The outperformance = 15.78%-12.90%=2.88%

To assess the stock selection impact, calculate the fund return assuming actual asset allocation and benchmark stock return:
$Fund_0$=200 $Fund_{0.5}$=217.23 $CF_{0.5}$=15 $Fund_1$=248.94
Calculating time-weighted rate of return (TWRR):
Return = 217.23/200*248.94/(217.23+15)-1=16.43%%
Where:
$Fund_0$= $Fund^E_0$+$Fund^B_0$+$Fund^C_0$=30+130+40=200
$Fund_{0.5}$=$Fund^E_{0.5}$+$Fund^B_{0.5}$+$Fund^C_{0.5}$=30*$I^E_{0.5}/I^E_0$+130*$I^B_{0.5}/I^B_0$+40*$I^C_{0.5}/I^C_0$
=41.72+134.64+40.87=217.23
$Fund_1$= $Fund^E_1$+$Fund^B_1$+$Fund^C_1$= [$Fund^E_{0.5}$+$CF^E_{0.5}$]* $I^E_1/I^E_{0.5}$+[$Fund^B_{0.5}$+$CF^B_{0.5}$]* $I^B_1/I^B_{0.5}$+[$Fund^C_{0.5}$+$CF^C_{0.5}$]* $I^C_1/I^C_{0.5}$
= 55.58+148.48+44.87=248.94
Hence stock selection impact = 15.78% - 16.43% = -0.65%
Therefore sector selection impact = 2.88%-(-0.65%) = 3.53%

Calculating sector selection impact first will yield slightly different results:
Sector selection impact = 3.50%
Stock selection impact = -0.62%

An alternative route to similar results would involve calculating an effective weight for each asset class as follows:

$$w_{E,A} = \frac{30 + 0.5 \times 1.5}{200 + 0.5 \times 15} = 0.1482$$

$$w_{B,A} = \frac{130 + 0.5 \times 10.5}{200 + 0.5 \times 15} = 0.6518$$

$$w_{C,A} = \frac{40 + 0.5 \times 3}{200 + 0.5 \times 15} = 0.2$$

Then sector selection impact is calculated as:

$$\sum_{i=E,B,C} (w_{i,A} - w_{i,B})(r_{i,B} - r_{T,B}) = 3.51\%$$

And stock selection impact is calculated as:

$$\sum_{i=E,B,C} w_{i,A}(r_{i,A} - r_{i,B}) = -0.62\%$$

Partial credit should be given for this application with no weight adjustment (i.e. using the actual weights at the start of the year).

iii. Comment:

- Positive sector selection impact was the result of a significant deviation from the benchmark.
- This is of concern given the weak solvency position of the insurer, as an unfavourable outcome could have resulted in insolvency. One would want to minimise active risk of any form for this insurer.
- This points to either weak risk control or inadequate mandate given the current financial position of the company.
- Performance is being measured over a short period, so not much can be inferred about the fund manager's skills.
- A risk adjusted measure should be calculated to assess the level of risk undertaken by the fund manager.

iv. Usefulness of the suggestion: comparisons with other insurers are common and necessary. However, in this case there may be some significant limitations:

- Investment performance by other insurers may not be available
- Even if available, a comparison might not be valid as insurers may differ by:
  - Financial strength/solvency: an insurer with a stronger solvency may have a more aggressive investment strategy;
  - Liability profiles (by type and term) may differ, requiring different matching assets;
  - Differing liquidity needs e.g. due to different business acquisition plans;
  - Directors/shareholders may have different risk tolerances, being reflected in different mandates;
  - Different investment restrictions and ethical policies.

