EXAMINERS' REPORT

June 2023 examinations

Subject F105 — Finance and Investment Fellowship Principles

INTRODUCTION

The attached report has been prepared by the subject's Principal Examiner. 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

i. Derivatives can be used to:

- control credit risk and reduce market risk (hedging);
- increase risk in order to enhance returns (speculation);
- exploiting anomalies in pricing (arbitrage);
- switch asset allocations between different asset classes without disturbing the underlying assets, as part of transition (portfolio) management; and
- Generate an income through selling options.

ii. The payoffs equal:

a. $\max(S_T - 110, 0)$
b. $\max(90 - S_T, 0)$

For $S_T < 90$:
$0 + (90 - S_T) - 10 = 80 - S_T$

For $90 < S_T < 110$:
$0 + 0 - 10 = -10$

For $S_T > 110$:
$(S_T - 110) + 0 - 10 = S_T - 120$

- The investor will make a profit when the share price drops below R80 or rises above R120 – therefore the investor expects the share price to be quite volatile.

iii.

- In the case of traded options, and in the case of over-the-counter options where both parties agree to this, once the contracts are issued, the clearing house becomes the counterparty to each party.
- This removes the exposure of the possibility of default from the seller of the options.
- Initial margin will be deposited by the seller of the options.
- If the margin account balance falls below a certain level, the seller will be required to deposit additional margin, protecting the clearing house against default.
- When an investor buys an option, the premium is paid upfront and there is no possibility of future liabilities, therefore no need for a margin account. On the other hand, when an investor sells an option, there are potential future liabilities and margins are required to protect against risk of default.

iv.

- The value of a call is positively correlated with the underlying share price and the value of the put is negatively related.
- Following a dividend payment, it is expected that the share price will decrease by the amount of the dividend on the day that the share goes ex-dividend.
- Therefore any action that affects the share price (e.g. dividend payment) will have a differential impact on calls and puts:
    - The value of the put will increase and
    - The value if the call will decrease.

Examiner comments:

Candidates performed well in this question. Part (i) was a bookwork question and a fair number of candidates scored full marks. In part (ii) the payoff of the strategy and not of the underlying options separately had to be provided. It must be noted in part (iii) that only the option writer is subject to margining, not the buyer. An alternative explanation provided by candidates in part (iv), which was also awarded marks, was to refer to dividends accruing to the put option holder (assuming he or she holds the underlying stock), and similarly, lost out on by the holder of the call option.

QUESTION 2

i. Other main investor classes:

- individual investors ('households').
- managers of short-term and long-term mass savings products ('financial intermediaries').
- foreign investors.

The different categories, and investors within each category, will vary in their:

- time horizons.
- appetite for risk.
- taxation position.

ii. The company can issue commercial paper:

- Unsecured short-term notes issued directly by a company (no financial intermediation).
- It is a bearer document.
- Issued at a discount, terms vary from a few days to several months.
- Company would have to comply with minimum issuing standards.
- Effective rate of interest slightly higher than the equivalent risk-free rate.
- Size of margin depends on company's credit rating and marketability of the securities.
- Rating agencies publish ratings for commercial paper.

Any other relevant money market instruments were awarded marks.

Examiner comments:

This bookwork application question was relatively well answered by most candidates. Some of the instruments mentioned in (ii) (e.g. a bridging loan or certificates of deposit), were not considered appropriate options for this specific situation.

QUESTION 3

i. In terms of Prospect Theory:

- value is based on gains and losses relative to a reference point.
- when faced with potential gains, investors are generally risk averse.
- when faced with potential losses, investors can become risk seeking.
- asymmetric reaction to gains and losses – investors suffer more pain from a loss than pleasure from a gain of equal size.
- decisions made therefore depend on how a problem is framed.

ii. Behavioural biases:

a. Ambiguity aversion. Framing. The effect of options.
b. Overconfidence. Familiarity. Status quo bias.
c. (Myopic) Loss aversion. Regret aversion.

iii.

- Fixed costs of participation e.g. administrative costs and trading costs.
- Investor financial literacy and education.
- Costs to financial intermediaries for advice.
- General availability of financial information.
- Accessibility of the stock market to these relatively smaller investors.
- Size of the stock market and level of diversification offered.
- Level of liquidity of the stock market in the event where a disinvestment is required.
- Confidence and trust in the stock market and its returns.
- Level of wealth and disposable income.
- Level of consumer protection through financial regulation.
- Time horizon of the household.
- Availability of alternative financial products (some of which may themselves invest in the stock market).

Examiner comments:

This question was well answered. Candidates struggled the most with part (ii) although any relevant biases (stated without explanation) would have been awarded credit. A couple of candidates stated additional biases in answer to part (iii) rendering a misreading of the question.

QUESTION 4

i. Merits of a credit rating:

- Obtaining a credit rating involves a thorough investigation of the financial condition of an entity in order to assess the likelihood that the entity will fail to the meet the interest payments and the repayment of principal under a financing agreement – usually the issue of debt.
- Obtaining a credit rating can improve the attractiveness of a bond, attracting more investors and enhancing liquidity.
- This will enable the investor to assess the level of credit risk of the bond and whether this level of risk meets his risk appetite.
- It will help him determine whether the interest offered is adequate.
- The investment mandate might require inclusion of rated bonds only.

ii. Reasons why the bond was not rated:

- In this instance the issue was heavily oversubscribed, even in the absence of a rating, indicating sufficient investor appetite for a green bond without it – if the previous financing was a bond, existing investors may have indicated their appetite to reinvest.
- It may be costly to issue and maintain a credit rating from a recognised credit rating agency.
- No requirement to credit rate the bond from the listings authority.
- Lack of comparable instruments from other issuers in the market which may complicate the credit rating process.
- The short term of the bond doesn't justify any value-add gained from having it rated.
- The solar and wind projects seem to be in operational phase, with documented output and financials, which might make it easier for investors to assess the risk themselves.

iii. The investor would want to assess:

- The likelihood of losing some of their investment.
- The severity of any potential loss.
- Whether the interest rate received is adequate compensation for the risk of loss.

To determine this, he or she would have considered:

- the reason for the borrowing (purpose):
  - in this case to fund (re-finance) solar and wind power projects, i.e. energy generation.

- the expected source of repayment (payback):
  - possibly income from selling the power generated:
    - the projects are presumably operational so information about power production and income and expenditure (and projection) would be available.
  - possibility for the company to issue further bonds:
    - based on the lifetime of the projects, the bonds can be refinanced.

- the risks that could jeopardise the repayment (risks), considering:
  - the regulatory environment for renewal energy projects.
  - what other renewal energy projects are in the pipeline by other providers.
  - demand for renewable energy.
  - financial performance of the issuing company.
  - their skills and expertise to undertake such a project – this would have been demonstrated at this point, and maintenance contracts with reputable and experienced suppliers would be required.
  - any assets backing the issuance – presumably the projects.

- the structure of the borrowing (structure) – term of the bond and level and frequency of its coupons – three years, so relatively short.

Examiner comments:

Part (iii) was answered worse than parts (i) and (ii). In part (iii), most candidates mentioned the risk posed by the investment bank rather than the issuing company. The investment bank is merely the facilitator in this transaction.

Suggesting that the risk of getting a poor rating is a reason for rather not obtaining one in part (ii), suggests that there is the desire to not be truthful to investors. Also, a rating would have been obtained before the issue of the bond (i.e. before it was known it would be oversubscribed).

QUESTION 5

i. Attractiveness of passive investment management:

- A passive approach to investment management involves simply maintaining that asset allocation until there is a change in the required strategy.
- Index tracking aims to replicate the performance of a specified benchmark index with no active investment risk.
- This approach limits downside risk of poor manager performance, but it also removes the scope to benefit from good manager performance.
- Fees could generally be lower, but it depends on the asset class being tracked.
- Reliance is placed on the existence of a suitable index to track.
- It may be possible to gain better matching of an index through a derivative instrument but note that derivatives are often based on an investable index.
- No requirement to correctly identify managers who will consistently outperform, as more emphasis will be placed on the manager´s ability to remain within the agreed tracking error.

ii. Likely reasons for underperformance:

Costs and Fees:

- The investor must pay investment management fees, custody fees, audit fees, administration fees, levies which reduce investment returns.
- These fees are not taken into account when the JSE Top 40 index returns are calculated.

Rebalancing:

- The costs of rebalancing the portfolio due to new entrants, exits, mergers and acquisitions and changes in constituents' market capitalisations, affecting the index, must be borne by the investor (e.g. broker commission and duties).
- The timing and frequency of rebalancing could also result in an underperformance.

Dividends:

- The index includes reinvestment of gross dividends paid by the constituents, whereas the investor fund will receive dividends net of any withholding tax.
- When dividends are paid it might not be practical for the investor to invest such small amounts across the individual constituents according to their weighting, resulting in a cash holding.

Cash holding:

- The cash holding tends to underperform the JSE Top 40 index when markets rise, and *vice versa* in a falling market.
- The size of the cash holding will also be affected by any large cash inflows or outflows and the time it takes to invest/disinvest and its effect may be more pronounced when asset volatility is high.
- The fund return reported would be the money weighted return, which would be affected by the pattern of returns on the market over the period, weighed by fund size, which would vary over time.

iii. Stratified sampling:

- Stratified sampling entails purchasing a sample of the stocks in the index so that the proportions of the fund in the specified industry categories matches that of the index.
- Compared to full replication where all of the stocks in the index are held in proportion to their index weights, some mismatch is inevitable, hence the tracking error is likely to be larger.
- Fewer stocks are required to be purchased compared with full replication and this should result in lower transactions costs.
- The method should incorporate significant statistical analysis and research (e.g. using multifactor models) to identity the sample that best matches the performance of the index.
- …which will come at additional cost.
- There will be less 'forced' buying and selling involved.

Examiner comments:

Parts (i) and (iii) were more straightforward, bookwork-type questions and hence answered fairly well. Part (ii) proved to be the most difficult. Candidates in general did not articulate themselves well enough. For a "discuss" command verb, candidates are required to make proper arguments to demonstrate insight. Many for example would simply state tax as a reason for underperforming without explaining how tax is likely to affect the fund's return or not affect the index values. Very few referred to a cash holding or dividends.

QUESTION 6

i. Interest rate risk:

- The fixed rate nature of the asset means the bank cannot benefit from rising short-term interest rates.
- The bank faces an opportunity cost of lost profits that could have been earned if they were able to lend out money at a variable rate which at times could exceed the fixed rate.

ii. a.

- Under an interest rate swap, the bank can exchange the fixed rates that they receive via the repayments of the loans, for floating rates.
- Should interest rates rise, the bank will benefit from the exposure to floating rates.
- However, there is the possibility of making a loss should interest rates drop below the fixed rate.
- Its effectiveness is characterised by the fact that the swap market is deep and liquid; and swap pricing is competitive, with relatively small bid-offer spreads.
- Counterparty exposure and possible timing difference in payment might be introduced, although certain swap transactions may require collateral and possible central clearing.

b.

- A cap can in part provide protection, in that if short rates increase to above the strike rate (which can be set equal to the fixed rate on the loan), then the cap would pay the difference between the floating rate and the strike rate.
- If short rates drop below the strike rate, no loss will be suffered (as would on a swap).
- In terms of its effectiveness, caps cost money but allows for a profit if the fixed rate on remains below the short rates.
- Caps are OTC contracts with the bid-offer spread and liquidity being less favourable than for swaps.

iii. Price of caplet = $L \times P(0,T^*) \times \delta \times [F\,\Phi(d_1) - X\,\Phi(d_2)]$
For:

$$d_1 = \frac{\ln\left(\frac{F}{X}\right)+\frac{\sigma^2 T}{2}}{\sigma\sqrt{T}} \quad d_2 = \frac{\ln\left(\frac{F}{X}\right)-\frac{\sigma^2 T}{2}}{\sigma\sqrt{T}}$$

Where:

T = 4 quarters and T* = 5 quarters

$P(0,T^*) = (1+6\%/4\%)^{-4} \times (1+7\%/4)^{-1} = 0.92598$

$\delta = 0.25$; $F = 0.07/4$; X = strike price = 0.075/4
σ = interest rate volatility = $10\%/\sqrt{4} = 0.05$

d1 = [ln(0.07/0.075) + ½*0.05^2 *4] / (0.05*2) = -0.639929

d2 = [ln(0.07/0.075) − ½*0.05^2 *4] / (0.05*2) = -0.739929

$\Phi(d_1) \approx 1/[1+\exp(-1.7 \times -0.639929)]=0.25202$

$\Phi(d_2) \approx 1/[1+\exp(-1.7 \times -0.739929)]=0.221339$

Caplet price = 100 × 0.25 × 0.92598 × [0.07×0.25202– 0.075×0.221339] = R0.0241m

Working in years rather than quarters is also acceptable and would produce the same result.

Examiner comments:

Part (i) was reasonably well attempted, while candidates lost marks in part (ii) for not stating a sufficient number of points. Candidates scored very poorly in part (iii) and in many instances could not even be awarded part marks.

QUESTION 7

i.

Portfolio: $\frac{4,796}{4,800} - 1 = -0.0008 \equiv -0.08\%$
Benchmark: $0.6 \times \frac{138}{155} + 0.3 \times \frac{1,740}{1,600} + 0.1 \times (1.03) \times (1.0545) - 1 = -0.0309 \equiv -3.09\%$

ii.

a.

	Actual weights	Actual returns	Benchmark weights	Benchmark returns
Equity:	$\frac{2,400}{4,800} = 50\%$	$\frac{2,190}{2,400} - 1 = -8.75\%$	60%	$\frac{138}{155} - 1 = -10.97\%$
Bonds:	$\frac{1,800}{4,800} = 37.5\%$	$\frac{1,950}{1,800} - 1 = 8.33\%$	*30%*	$\frac{1,740}{1,600} - 1 = 8.75\%$
Cash:	$\frac{600}{4,800} = 12.5\%$	$\frac{656}{600} - 1 = 9.33\%$	*10%*	$(1.03) \times (1.0545) - 1 = 8.61\%$

Stock selection profits:

Equity	$0.5 \times (-0.0875 + 0.1097) = 0.01109 \equiv 1.1089\%$
Bonds	$0.375 \times (0.0833 - 0.0875) = -0.0016 \equiv -0.1562\%$
Cash	$0.125 \times (0.0933 - 0.0861) = 0.0009 \equiv 0.09\%$
Total stock:	$1.1089\% - 0.1562\% + 0.09\% = 1.0427\%$

b. Asset allocation profits: $-0.08\% + 3.09\% - 1.0427\% = 1.967\%$

Marks were also awarded if candidates calculated F_{NA} instead. Stock selection decision would then have contributed 1.28% and asset allocation decision 1.73% to the outperformance.

iii.

- The manager was able to outperform the benchmark by 3.01% suggesting he performed his task well.
- Positive sector allocation impact resulted from deviation from the benchmark.
- An under-allocation to equities that had a strong negative performance and an over-allocation to bonds and cash that each performed positively added to the sector selection outperformance.
- The manager also outperformed in stock selection on the equities asset class and in managing cash.
- This suggests that the manager should not be removed.
- We will need to determine if the returns provided reflect any deviation from the mandate of the fund.
- If there is no deviation, then given the positive stock selection, we would also need to further evaluate whether the returns are sufficient for any additional risk taken–measures such as a Sharp ratio, Treynor ratio and other risk measures may assist.
- The duration of investment is short at 1 year–it may not be sufficient time to draw long term conclusions and evaluate the managers skill.
- …Longer periods such as 3 to 5 year returns may need be considered before doing so.
- The current asset manager was only appointed a year ago–so likely too soon to incur the cost and process of making a change.
- There was an underperformance in the selection of bonds that may need to be investigated and further understood.
- …If the performance of bonds continues to suffer, then consider a specialist bond mandate with another asset manager.
- The alternative manager's 7% return may not be an appropriate comparison:
    - There may have been cash inflows and outflows during the year, skewing the returns and not making it comparable.
    - The benchmark and risk limits as per the mandate may be different (e.g. inclusion of overseas assets).
    - The current asset manager may be restricted by pension fund regulations related to the investment in certain asset classes.
    - The returns may be gross of fees and taxes.

Examiner comments:

The attempts for this question were fair although many candidates struggled with the attribution analysis in part (ii). Some candidates opted to take the approach of calculating the return on a notional portfolio assuming benchmark (actual) weights and actual (benchmark) returns. To determine what part of the outperformance is attributable to the stock/sector selection decision, one would then still need to take the difference between this portfolio's return and the actual/benchmark return. Attributing this further down to the underlying asset classes is not easy and hence the suggested approach as set out above is more appropriate.

QUESTION 8

i. The switch being considered is an ***anomaly switch*** due to the similar term/volatility of the bonds.

Yield differences / position relative to the yield curve:

- The manager needs to compare the current yield difference (e.g. 3.5 – 3.3 = 0.2) with past differences between these bonds.
- A sudden and unexpected change (e.g. from a long-term average of say 0.1) may suggest a temporary anomaly (bond B becoming cheaper relative to bond A).
- Alternatively, changes in the bonds' yield difference relative to the yield curve could be calculated. However, this method requires a stable method to fitting the yield curve.
- High-coupon bonds are likely to have higher gross yields compared to low-coupon bonds and a high gross yield in itself does not indicate that a bond is cheap. The manager should assess whether the difference in GRY is temporary or reflective of bond attractiveness.

Price ratios:

- The manager needs to compare the current price ratio (e.g. 115.6/110.7=1.044) with past differences between these bonds.
- A sudden and unexpected ratio change may suggest a temporary anomaly.
- Clean prices are used for the analysis to remove distortions in dirty prices caused by coupon payment timing differences.
- In this case the coupons are sufficiently similar that 'stabilised' price ratios should not be needed.

ii. Additional factors:

- Size of the switch and liquidity of bonds A and B: liquidity needs to be sufficiently large that the switch can be done without moving prices against the manager.
- Taxes to be incurred as a result of the switch e.g. capital gains taxes on selling A (and again on selling B in switching back) as taxes may reduce the net profit of the switch.
- Transaction costs relative to potential profit on the switch: if large, the risk of the switch may not be worthwhile.
- Possible reasons for the anomaly, and likelihood that the change could be permanent.
- Confirmation of anomalous market prices by a model of 'correct' prices or a yield model (such as a yield surface or par yield curve).
- Any special features of B that may make anything other than short-term holding undesirable.
- Length of time that the anomaly might last: longer periods increase the risk of completing the switch profitably due to other factors that might emerge and change prices.
- Potential profit (or loss) relative to the insurer's free assets, and insurer's risk tolerance.
- Any restrictions on such trading activity in the mandate established by the life company.
- Effect of the switch on the fund's duration and potential other trades to leave duration unaffected, including their likely costs.

Examiner comments:

Overall disappointing performance by candidates for a relatively straightforward question.

Part (i) was bookwork, and many candidates appeared weak, with very few seeming to understand that the application of yield differences and price ratios requires a comparison of the current position with the historic pattern. A few candidates thought that this is a policy switch, however the bonds were selected to be very similar in DMT.

While part (ii) was generally done better, most answers were short on points.

QUESTION 9

i.

a. Liability hedging is where the assets are chosen in such a way as to perform in the same way as the liabilities.

b. Liability Driven Investment (LDI) is the terminology used to describe an investment decision where the asset allocation is determined in whole or in part relative to a specific set of liabilities.

ii.

A real rate swap allows the fund to invest the assets in a portfolio of fixed-rate bonds (usually corporate bonds) and swap the fixed cashflows (coupon and redemption payments) from the bond portfolio in return for cashflows that match the timing and inflation characteristics of the pension payments.

A synthetic index-linked bond is a variation of the real rate swap whereby the fund still holds fixed-interest bonds (usually corporate bonds), but in this case swaps the fixed cashflows for payments that are indexed with CPI (i.e. a notional index-linked bond) in the same manner as the cashflows of an index-linked government bond.

Instances where a real rate swap would be more suitable:

- If the liability (e.g. pension) payments are CPI-linked up to a cap (i.e. LPI-linked), a rate swap would be more suitable.
- If the timing of liability payments isn't consistent with that of index-linked bonds, a real rate swap can be designed to be more appropriate.

iii. Advantages:

- There may not exist actual bonds, or bonds of sufficiently long term to match the liabilities, while synthetic bonds could be designed to be as long as needed.
- The actual bond may have greater credit risk, depending on the creditworthiness of the issuing government.

- The fund may be able to achieve a geared position with a synthetic bond, enabling under-funded DB schemes to fully match liabilities; this is not possible with actual bonds.
- The synthetic bond may be more liquid and have lower transaction costs than actual bonds.
- The synthetic bond might result in higher return, depending on market prices at time of entry.

Disadvantages:

- The synthetic bond involves structuring, increasing complexity, and facilitation by an intermediary bank, increasing costs.
- The synthetic bond could be less liquid than actual bonds (it might be difficult to close out the position).
- The synthetic bond will require more expertise and delay due to legal documentation.
- Margin payments or other collateral may be required from the scheme.
- The synthetic bond will likely have more counterparty risk.
- It might not be possible to find a willing counterparty.

[Note: credit only awarded once if the same point highlighted as an advantage and a disadvantage]

iv.

- Matching considerations
    - The LDI fund will be managed for a specific profile of liabilities (probably a typical pension fund profile, or a subset of its liabilities).
    - The pension fund's overall liabilities may or may not fit this specific profile.
        - The fund may however be suitable for a subset of the pension fund's liabilities – if a significant subset, then the fund may be worth considering.
        - If the LDI fund is suitable for part of the liabilities, a suitable investment strategy will still be needed for the remaining liabilities.
    - The management of the LDI fund is not within the pension fund's control – investment choices by the fund may not always be the most suitable for this scheme's liabilities or within trustee's risk tolerance and objectives – hence there might be deviation from the pension fund´s objectives.

- Liquidity considerations
    - The ability, and conditions, of exiting the fund may make the fund unattractive relative to a more bespoke LDI solution.
    - The fund may be invested in instruments requiring margin payments which the pension fund may not be in a position to meet.

- LDI manager
    - Track record, experience and reputation in managing funds in general, and this specific type of fund in particular.
        - Whether this manager has any competitive advantages relative to the current manager, in terms of expertise or access to assets
    - Confirmation that the manager meets relevant authorisations, regulations, audit and independent custodial obligations.

- Costs
    - The fund may be able to offer a cost-effective LDI solution due to economies of scale.
    - However, if the pension fund is large this advantage is likely to be less important, and the benefits of a bespoke solution are likely to outweigh any cost benefit.

- LDI fund characteristics
    - The fund may make use of gearing, which may not be suitable for the pension fund.
    - The size of the fund in relation to the markets it invests in may hamper the ability of the fund to quickly invest/disinvest from certain positions.
    - The extent of counterparty risk within the fund, and the risk tolerance of the fund manager relating to this factor.
    - Whether disclosures by the fund manager are sufficient and adequate for an informed decision.

Examiner comments:

Overall disappointing performance by candidates who were not adequately prepared for the bookwork.

While part (i) was reasonably well attempted by most candidates, part (ii) was mostly bookwork and most candidates failed to clearly explain the difference between a real rate swap and a synthetic ILB. Consequently, most could not provide any sensible situations where the former may be more suitable.

Part (iii) was mostly poorly answered, due to most candidates not knowing what a synthetic ILB entails. Some referred only to the features of swaps ignoring the underlying FI bond that forms part of the strategy.

Part (iv) was reasonably well answered by those candidates who considered various factors.