INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2011 examinations

Subject ST5 — Finance and Investment
Specialist Technical A

General comments

Pleasingly, this diet continued the trend from last October and was a much better answered paper than in recent years resulting in a higher pass rate. Candidates typically answered Questions5, 6 and 7 much better than the others (albeit still foregoing 30-40% or more of marks available), with Question 4 attracting the worst responses, considerably so, with average scores of around a quarter of the available marks. Indeed question 1 was little better answered. Questions 1 and 4 go to the heart of modelling and understanding risk and a lack of understanding in these areas has been cited as a key factor in the "Credit Crisis" when risk management models failed. This is an area where actuaries could reasonably feel they could offer relevant skills and knowledge so it is important candidates demonstrate this. Likewise understanding of the theory and practicalities of portfolio diversification are core tenets of investment. Questions 5, 6 and 7 represented opportunities to demonstrate higher level skills in terms of non-standard/practical application of theory to current or unusual issues in investment – hence candidates who wish to progress to SA6 will need to improve their understanding of and approach to this type of question. The examiners were pleased to see progress in the scores being achieved as well as better data handling.

Most candidates seemed to identify and understand the key issues being examined and so appreciated the general content of solutions that the examiners were looking for – however those that were unsuccessful will find their solutions lacked sufficient (and often the most basic) detail or application of knowledge and scored lower accordingly. Many candidates still deviate from the topic and include irrelevant material or over emphasise minor points – although candidates will not be explicitly penalised for this, it gives an impression of a lack of understanding and, more importantly, wastes limited time. Time and priority management are key skills actuaries need to have. Where candidates made relevant points in other parts of their solutions, the examiners have used their discretion as to whether to recognise these answers or not. Likewise the examiners share and agree alternative possible solutions to questions alongside the approach outlined below.

Candidates are reminded of a bias in the paper towards recognising higher level skills and practical application – this is intentional and will continue. Likewise the examination system does properly allow for prior subject knowledge to be assumed. Investment is a necessarily practical subject and, at this level, the examiners expect candidates to demonstrate a breadth and depth of competency as would be expected from a senior student in a frequently evolving discipline. Hence simple regurgitation of bookwork will never be sufficient to ensure a Pass grade – and this was evident from the dispersion of candidates' responses in the more differentiating questions.

In order to succeed, candidates must ensure they familiarise themselves with the prevailing investment issues and the general market background facing institutional investors in the 12–18 months preceding a diet, more so the solutions (and sources of) being debated by the various stakeholders. Hence questions regarding banking and derivative approaches, as well as asset management and insurance solutions, to asset and liability risk management (including model risk) or modern financial theory and commercial applications should be considered likely scope for examination. Against a background of the credit crisis, new asset classes and ways of structuring investments will themselves generate new types of risk (such as operations, liquidity, credit and counterparty), so the need for new ways of regulation, monitoring and management. This paper also looked at the cost of capital, a major

consideration for clients since capital can no longer be assumed to be freely available or low cost. Finally the examiners encourage candidates to recognise there are different types of investor beyond purely pension funds and different taxation, time line and cost considerations will apply - it would seem that candidates have taken this on board.

Whilst the examiners will tolerate bullet point style responses, some candidates' handwriting was too poor to assess and they will have lost marks. Likewise "text speak" abbreviations will not be accepted.

1 The risks that are incurred by extreme market events can be identified and investigated by the process of *financial stress testing*. This involves subjecting a portfolio to extreme market moves by radically changing the underlying portfolio assumptions and characteristics, in order to gain insight into portfolio sensitivities to predefined risk factors. This pertains in particular to asset correlations and volatilities. There are two types of stress test:

- to identify "weak areas" in the portfolio and investigate the effects of localised stress situations by looking at the effect of different combinations of correlations and volatilities

- to gauge the impact of major market turmoil affecting all model parameters, while ensuring consistency between correlations while they are "stressed"

A major part of establishing a comprehensive stress testing framework should therefore focus on constructing stress test scenarios that apply to the specific portfolio (i.e. a *deterministic* approach). These scenarios should be tailored to reveal weaknesses in the portfolio structure in terms of risk exposure and sensitivity, and should thus focus on the risk factors that the portfolio is most exposed to. *(Candidates who suggest a stochastic approach needed to justify this to be given credit.)*

2 (i) A company can use swaps to reduce risk by matching its assets and liabilities. For example a company which has short term liabilities linked to floating interest rates but long term fixed rate assets can use interest rates swaps to achieve a more matched position. Currency swaps would be used by a company with liabilities in one currency and assets in another.

An inflation swap allows a receiver of inflation-linked payments to pay these to a counterparty in return for receiving a fixed payment. Typical payers of inflation under inflation swaps will include holders of loans with inflation-linked payments or leaseholders who receive inflation-linked rental income. Institutional investors such as pension funds, with inflation-linked liabilities, can use inflation swaps to receive inflation and thereby hedge the market risk from uncertain future inflation within their liabilities.

(Equivalent marks were awarded for any other example developed in equivalent detail.)

Swaps might be also used as a short-term transition management tool.

(ii) Flexibility. IRSs are OTC so can be made to measure for the company's portfolio.
Dealing costs. With the exception of the most liquid bonds, IRSs can have lower dealing costs.
Complexity. Assuming that the company has the appropriate expertise and systems, an IRS hedge can be less complex than putting together a portfolio of bonds and attempting immunisation.

A suitable swaps deal might be quicker to implement than transactions in physical assets.

(Other sensible comments were also awarded marks.)

3 (i) Infrastructure tends to be separated into two broad subsets — economic and social. Economic infrastructure includes highways, water and sewerage facilities, energy distribution and telecommunication networks whereas social infrastructure encompasses schools, universities, hospitals, public housing and prisons.

(ii) Infrastructure assets are generally characterised by high development costs (high barriers to entry) and long lives. They are generally managed and financed on a long-term basis. Other features include Large unit size, Illiquid and Inflation hedging properties.

Infrastructure assets display a number of characteristics that distinguish them from more traditional equity or debt investments. The assets themselves tend to be single purpose in nature, such as gas pipelines, toll roads or hospitals. The private investor's participation in the asset is often for a finite period. This is generally a function of the agreement the investor has made with the government authority, or a function of the natural useful life of the asset. In either case, infrastructure assets are characterised by their long lives. In fact the capital invested in these projects is often referred to as "patient" capital, in that the initial development involves high upfront capital costs with payback occurring over the asset's generally lengthy life.

One of the key characteristics of infrastructure assets, and what can make them particularly attractive as investments, is that they tend to be, or exhibit the characteristics of, natural monopolies. Under a natural monopoly, economies of scale are such that the unit cost of a product will only be minimised if a single firm produces the entire industry output. This environment has the potential to weaken market forces, so there may be a need for tighter regulation, particularly when there are few, if any, alternative suppliers of the infrastructure. In this case, firms operating in a natural monopoly, protected from new competitors by the high barriers to entry, may be able to earn abnormal profits by charging higher prices.

(iii) Infrastructure is generally specific events (i.e. building a new school), private equity is normal buying or supplying capital for private companies (i.e. buying a pizza restaurant chain).

Private equity tend to have shorter investment durations than infrastructure projects but this is not always the case and some private equity deals have a long lead time.

Private equity is only privately financed, whereas infrastructure projects can have an element of public finance. Infrastructure assets and companies can be listed.

Infrastructure tends to have bond like investment returns, although some infrastructure projects have equity like returns. Private Equity tends to be more equity like returns associated with higher levels of risk.

4 (i) Daily volatilities are: Asset X £3000)
Asset Y £1800)

$\sigma_{portfolio} = \sqrt{(3000^2 + 1800^2 + 2 \times 0.4 \times 3000 \times 1800)}$

$= \sqrt{(16{,}560{,}000)}$

$= 4069.398$

The 10-day 98% VaR is then

$\sqrt{10} \times 2.0537 \times 4069.398$ = £26428.17

(ii) The 10-day 98% VaR's for the individual assets are:

Asset X

$\sqrt{10} \times 2.0537 \times 3000$ = £19483.11

Asset Y

$\sqrt{10} \times 2.0537 \times 1800$ [½] = £11689.97

Total: £31172.98

Thus the benefit of diversification is £31172.98 – £26428.17 = £4744.81

(Marks were awarded for suggesting suitable approaches, even if the results were incorrectly evaluated).

(iii) There are significant costs associated with the process of diversification (dealing, administration, research and the loss of economies of scale).

The stability of the parameters ρ and σ may not survive periods of market stress. "In extreme conditions all correlations tend to 1".

Diversification only guards against specific risk. Systematic risk is still an issue.

There may not be suitable diversifying assets available at an acceptable cost. There may be statutory restrictions or mandate restrictions on the assets available.

The paramount need to match liabilities may restrict the assets available.

The need to apply diversification to intermediate cash flows (e.g. dividends) is a further practical problem.

5 (i)

- It depends what the investor wants to use the money for: on-going cash requirements or to fund an annuity in retirement.
- If the investor wants it for retirement funds he only has a short time to retirement so is probably concerned with capital preservation on his assets, so would probably favour Strong Growth as the asset class has lower volatility.
- However, the investor is risk seeking which means he might prefer the High Returns Company as equities have higher return.
- The assets are only a small portion of the investor's total assets. It depends what the investor's other assets are invested in. If the rest of the assets are in higher risk asset classes then he might prefer Strong Growth to dampen down volatility at the total portfolio level. If the rest of assets are in low returns then he might want a portion of assets in higher return asset classes so would be High Return manager.
- Overall the actual manager chosen will depend on the underlying motivations and other assets held.
- Other issues to consider include currency risk, the tax position of the investor and the level of management charges levied.

(ii)

- Market Risk
- Credit Risk
- Operational Risk
- Liquidity Risk
- Relative performance risk

(iii)

- Market risk – Market risk reflects the risk of changes in the value of portfolio due to market movements. Strong Growth is invested in Government bonds which tend to be low volatility. FBNX Investors are invested in futures and CDS which tend to exhibit more volatility and the market risk is likely to be higher with FBNX Investors.
- Credit risk – Risk that a counterparty will be unable to fulfil their obligations. Government bonds tend to be issued directly through the government (or government agency) or via market makers of large institutions. Credit risk tends to be relatively low. FBNX Investors are invested in futures which are exchange traded instruments and carry lower risk than OTC contracts. CDS are OTC instruments and can be issued by a

wide variety of counterparties with different levels of credit quality. Overall, would expect FBNX to have higher credit risk.

- Operational risk – fraud or mismanagement within the investment manager. Operational risk tends to be higher where there is not appropriate segregation of duties, enough staff or lack of technology which means more human intervention (and potential errors). In a large investment manager that has been established for a long time most operational issues should be addressed. FBNX only has 5 employees which means that employees will complete several different roles (poor segregation of duties). Also, likely that not have the IT budget to have the required infrastructure. FBNX is likely to have higher operational risk than Strong Growth.

- Liquidity risk – is the risk of not having cash needs due to liquidity of portfolio. Government bonds tend to be highly liquid even in times of market distress when there is often a flight to quality, so Strong Return should not suffer too many liquidity issues. Depending on the futures FBNX are invested in, they could be highly liquid or not. CDS tend to have good liquidity in normal market conditions but liquidity can dry up in terms of market distress (as seen following Lehmans collapse). FBNX is likely to suffer higher liquidity risk than Strong Growth.

- Relative performance risk – risk of underperforming relative to peer group. This depends on the quality of investment staff and the investment process. It is impossible to say how this will impact either manager. Past performance can be used but is not a good guide to the future.

6 (i) It is a vertical takeover as the restaurant is part of the overall supply chain the processing company is involved in. It is an upward vertical acquisition.

(ii)

- Diversify returns within the company

- Has money to invest and restaurant offers good rate of return relative to other investments

- The restaurant chain is being offered at a good price which makes it attractive

- Utilisation of unused tax benefits

- Protection against threat of takeover
- Enhance EPS – potentially higher margin business

- Low financing costs
- Improved co-ordination and administration of the supply chain
- Access to complementary resources

- Response to similar actions by competitors

(iii) Recession

Supplier – Likely that some sources of business, e.g. restaurants will reduce orders as people reduce discretionary spend. Its other sources of business (general public) is likely to be unaffected as people still need to eat and pork and beef are relative affordable meats. If they supply meats to other parties such as hotels these are likely to be impacted by the recession and supplies will be reduced. Overall, the supplier is likely to see business reduce.

Restaurants – During recession people reduce discretionary spend and restaurants are affected. There is likely to be reduced customers reducing the profits. In recession consumers look to restaurants to have special offers putting further pressure on profits.

Livestock costs

Supplier – It is uncertain what the impact is likely to be on the level of supply. As a supplier they are passing on the product after processing and as long as the purchasers can pass on the cost then profits are likely to be maintained. If the rise changes consumer behaviour and they substitute another product for pork and beef then demand is likely to decrease which will impact costs.

Restaurants – The cost will impact the prices it charges its customers. When prices rise rapidly over a short period of time, the restaurant is unlikely to pass on the total price rise immediately as people take time to adjust to the new cost. Over time as people accept the new price then price rises can be passed on. Therefore, profits will be affected in short term but unlikely to have an impact over a longer period of time.

(iv)

- Pull out of deal
- Look to reduce their offer to reflect market uncertainty
- Do nothing
- Delay the deal until market conditions become more certain
- Look to have the final price contingent on certain targets being hit
- Seek an alternative investment strategy

7

Calculations	*Rb*	*Portfolio returns*
Manager A	14.41%	20.3%
Manager B	9.47%	11.4%
Manager C	15.28%	21.1%
Manager D	11.94%	18.1%
		11.4%

(About half the available marks were awarded for the approach adopted, with the balance for the correct evaluations.)

(i)

	Outperformance	*Rank*
Manager A	8.8%	2
Manager B	0.0%	4
Manager C	9.6%	1
Manager D	6.6%	3

(ii)

	Risk Adjusted	
Manager A	5.9%	2
Manager B	2.0%	4
Manager C	5.8%	3
Manager D	6.1%	1

(iii) The investor is risk adverse so would prefer a lower risk manager. The manager with the lowest risk is manager B. However, the investor is looking to add returns from active manager, and manager B looks like it has very index like returns so might prefer one of the other managers, such as manager A. Other issues to consider would include the tax position of the investor, whether the figures quoted are net of management charges and the need to consider more than one year's results.

(Alternate conclusions reached were given equivalent credit if adequately argued.)

(iv) Standard deviation is appropriate where the whole of investor's wealth is being considered. If only a subset of assets then beta is the most appropriate method.

8 (i)

- Ownership – equity dilutes ownership interest, debt has no impact on ownership
- Cashflows – equity does not require cashflows but can pay optional dividends. Debt requires regular payments for coupon
- Voting rights – equity often carries voting rights, debt does not
- Priority of payout in default – Debt has higher priority than equity in the event of liquidation of a company
- Impact on financial ratios – Debt and equity have different impact on financial ratios
- Additional security or restrictive covenants may be required for debt financing.
- Tax treatment of the returns on the capital raised

- Debt securities are usually issued with a specified redemption date. Equities are usually irredeemable.

(ii) (a)

- Corporate Bonds – longer term debt, issued with various coupon rates and maturities
- Commercial paper – Short term issued directly by company
- Term Loans – A loan from a bank for a specific amount that has a specified repayment schedule and a floating interest rate.
- Evergreen Credit – Can borrow up to a specified limit with no fixed maturity
- Revolving Credit – Like evergreen but with fixed maturity, normally up to three years
- Bridging loans – advances to be repaid from specified income
- International bank loans

(b)

- Commitment
- Maturity
- Rate of interest
- Security

(iii)

- Commitment – This is where the borrower pays a fee to have advanced funds where required. It depends on the cashflow requirements of the two organisations so impossible to say how these are likely to differ.
- Maturity – It is likely that a large international chain will be given longer terms than Best Supermarket as the lenders are likely to have greater confidence the established supermarket can pay back loans over a period of time.
- Rate of interest – lenders charge higher rates of interest to higher risk borrowers. Therefore, Best Supermarket is likely to pay a higher rate of interest as it will be seen as higher risk.
- Security – Again as Best Supermarket will not be seen as good a credit risk as the established supermarket it is likely to be asked for greater security in return for the loan.

(Appropriate credit was given for discussion of alternative classification of the features in part (ii) (b).)

(iv)

- Short term cashflow issues and therefore loan will assist paying short term debts.
- Gross profits might not have been retained and therefore has no additional capital to expand. This might be due to the purchase of fixed assets or the level of dividends paid.
- Potentially high taxes meant net profits were low.
- The expansion plans cost more than the retained profits.
- Predicting lower gross profits in their core market due to recession which will reduce self finance.

(v) Best Supermarket sells essential goods and demand is relative inelastic. It is a non-cyclical (defensive) business. On the other hand luxury handbag market has elastic demand and in time of recession, people have less money, discretionary spend is reduced and therefore, a reduced number of handbags are being sold. It is a cyclical business.

As the country entered recession the luxury handbag share price would have reduced in value to a greater extent than Best Supermarket. Following the initial falls and during the recession the two share prices are likely to have performed similarly. As the country starts to leave recession and confidence return the luxury handbag share is likely to outperform Best Supermarket.

However, the actual performance of the handbag store will depend on the demand for their product relative to other handbag companies. Best Supermarket will probably lag the market as the country leaves the recession which is typical for a defensive stock.

END OF EXAMINERS' REPORT