INSTITUTE AND FACULTY OF ACTUARIES

Curriculum 2019

SPECIMEN SOLUTIONS

Subject SA7 – Investment and Finance
Specialist Advanced
1 (i) Callable bond = bond that can be redeemed (perhaps “recalled”) at the option of the issuer in line with predetermined conditions, e.g. price and outstanding term / at particular dates. [1]

(ii) (a) A residential (house) mortgage often includes a prepayment option. [1]

(b) Mortgage holders may seek to “redeem” early (i.e. repay their loan and replace it with a new one) once interest rates fall below a certain level compared to the rate currently being charged on their mortgage. [1]

Mortgage holders will also seek to “redeem” early if they sell their home. [1]

[Note to markers: students should adapt their answers to an individual and not a corporate or generic borrower.]

[Max 2]

(iii)

- The company will have asymmetric information about its current and future financial position. [0.5]

- By issuing callable bonds, the company gains a valuable option to modify its capital structure when circumstances make it advantageous to do so… [1]

- … without having to seek bondholder or market co-operation at the time [0.5]

- In effect the company has the option to anti-select against the bondholders of callable bonds [0.5]

- For example, if market rates have reduced … [0.5]

- … or there has been an improvement in credit rating… [0.5]

- … it could call the bond and replace it by issuing a new one at a lower coupon. [0.5]

- Current market structure may mean that investors (in general) are underpricing the call options they have effectively sold to the company meaning the company can capitalise on this mispricing by issuing more callable bonds at lower coupons than might otherwise be the case. [1]

- There may be excess demand for callable bonds at the time of issue, allowing the company to issue them at lower coupons than justified. [1]

- The company might want to issue callable bonds for matching reasons, for example because it is funding a portfolio or residential mortgages which may be subject to prepayment. [1]

[Max 4]
(iv)  

- All else being equal, the company will need to pay a higher coupon (or lower issue price) for a callable bond compared with an otherwise identical non-callable bond. [1]

- This is to compensate the holder for the option the company has to redeem the bond at a time to suit the company which probably will not suit the investor. [0.5]

- The callable bond will therefore increase the required return on debt. [0.5]

- WACC can be calculated as \((Debt / Debt + Equity) \cdot r_{debt} + (Equity / Debt + Equity) \cdot r_{equity}\) [0.5]

- For the same proportion of debt in the capital structure, this will increase the WACC which is a linear function of the required return on debt. [0.5]

- The average WACC cost including future debt could be lower if the calls were able to be made profitably in the future. [0.5]

(Max 2)

(v)  

(a)  

- The company could redeem the existing callable bond and issue a new callable bond with the same remaining maturity.

- It is likely this will attract a lower coupon than the in-service coupon, so the company’s coupon payments would be lower.

- The company could redeem the callable bond and replace it with one that is not callable, or otherwise modify the terms of the existing bond so as to remove the call feature.

- This is likely to attract a lower coupon still than an equivalent callable bond.

- The company could provide (or increase) security for the bond, resulting in a better credit rating.

- This will allow the company to pay a lower coupon (it will need to modify the bond terms to do so) [0.5 per point]

(b)  

- the reaction of bondholders to being selected against

- in particular their future willingness to reinvest into the company’s bonds
the legal ability to do this (especially as a replacement bond would likely be issued at the same time)
the practical ability to do this with regard to available cash resources (the redeemed bond will need to be paid out, so ready cash resources or a simultaneous new bond issue would have to take place)
the wider likely market demand for such bonds
the costs incurred
including any tax aspects of calling the bond and issuing a replacement bond

[1 per point]  
[Max 4]

(vi) A callable bond is equivalent to:
o an uncallable bond of the same remaining terms plus  
o a call option sold by the investor to the company permitting the early redemption of the bond by the company [1]
The investor could undo the effect of the sold call option by purchasing an equivalent call option… [0.5]
… in the market / from a bank / etc… [0.5]
… granting him the right to purchase a bond with terms identical to the uncallable bond. [0.5]
The investor could enter into a suitable derivatives contract that pays out if interest rates fall (e.g. an interest rate put option); in this way the investor would be hedging against a macroeconomic scenario that would cause the company to want to redeem early (and refinance) [0.5]
The investor could enter into a total return swap which effectively swaps the callable bond’s cashflows for an uncallable bond's cashflows, which retaining physical ownership of the callable bond. [0.5]
The investor could adjust his remaining portfolio so that the resulting callable-adjusted duration is closer to his requirements. [0.5]

[Max 2]

2 (i) investment trusts (including real estate investment trusts) [0.5]  
exchange-traded funds [0.5]  
unit trusts, open-ended investment companies (OEICs) [0.5]  
structured products [0.5]  
contracts for difference [0.5]  
life insurance savings policies [0.5]  
individual savings accounts (ISAs) [0.5]  

[Max 3]
(ii) As funds accumulate, life-style strategies typically try to reduce risk over time [1], by moving from growth to matching assets [0.5], avoiding high levels of risk close to retirement [0.5], when the savings are highest. [0.5]

Additionally, younger participants typically have a higher risk appetite [1], as they have a longer time horizon for investment [0.5] and higher human capital via future earnings. [0.5]

A constant allocation to risk over time would imply a higher risk strategy is required [0.5] in the early years when the asset value is low. [0.5]

Conventional unleveraged funds may not provide sufficient risk to meet the risk appetite for younger participants [1]

[Max 4, credit given for other relevant comments]

(iii) The two main linear equity derivative based approaches that could be used are:

- Total Return Swaps on equity indices. [1]
- Listed futures on equity indices. [1]

Given the leverage objective, physical replication plus financing would not be practically possible. [1]

The portfolio would most likely be constructed using cash collateral [0.5], invested in a cash fund to generate income [1] and an overlay of equity derivatives. [1]

[Max 4, credit given for a puts + calls approach]

(iv) Total Return Swaps on equity indices are traded OTC, introducing counterparty risk. [1]

Other risks are roll risk, liquidity risk and the risk of financing costs increasing. [0.5 \times 3]

Listed futures on equity indices will have higher margin requirements compared to OTC derivatives [0.5] and this increases the risk of not having sufficient collateral to maintain leverage. [1]

Futures also introduce basis risk to the underlying [0.5] and implicit roll costs. [0.5] Additionally futures only available on price indices [0.5] increasing basis risks due to dividends not being captured. [0.5]

[Max 4]

(v) Leverage management has the difficulty that due to variation margin and contract rolls, [1] the fund’s leverage ratio will fall in rising markets [0.5] and it will increase in falling markets. [0.5] This leads to a need to scale back exposure after a price fall [0.5] or scale up exposure after a price rise. [0.5] This may mean the fund ends up “buying high and selling low”. [1]

Additionally there will be increased rebalancing costs. [1]
There will also be “cash drag” due to the need to hold cash for margin calls. [1]

When investing during the calendar month, the exposure may not be in line with the 3 times objective as leverage will vary during the month. [1] [Max 5]

(vi) A less frequent leverage management process will mean that leverage ratios drift further away from the 3 times objective before rebalancing. [1]

Whilst there may be benefits in terms of reduced transaction costs, a further consequence is that it may not be possible to wait as long as 12 months [1] before there is in particular a need to reduce leverage. [0.5]

The manager would need to make a cash call or deleverage the fund by scaling back exposure [1], and this would need to happen as soon as relevant thresholds such as leverage limits are reached. [1]

In more volatile markets, rebalancing will be more frequent. [0.5] [Max 4]

3 (i)

- **The nature of the sponsor**, i.e. an oil company may feel more free to take investment risks within its pension scheme than a life insurance company or bank

- **Regulatory requirements**, including accounting disclosure and accounting treatment of surpluses and deficits

- Presence of any **government protection funds** (eg PBGC in USA, PPF in UK)

- Historical experience of risk events unfolding and **current volatility** of investment markets (equity, credit, property, bonds etc.)

- **Strength of sponsor**, for example size of balance sheet, current revenue and earnings and growth prospects. Having a strong Sponsor may increase risk appetite

- Existence of any **off-balance sheet protection**, for example escrow accounts or (third party) guarantees, increasing the ability to take risk

- **Term and nature of liabilities**. A Scheme with a longer time horizon may have a higher risk appetite

- **Cash flow position**, cash flow positive schemes may be able to take more risk
**Subject SA7** – Specimen Exam Solutions

- **Agreed schedule of contributions**, time horizon for fully funded and front-loading versus back-loading of schedule

- **Current funding level**, better funded Schemes may be able to take more risk, but worse funded schemes may need to take more risk to make up any deficit

- **Governance structure** in place, for example ability to diversify ability to react quickly would be better should the Scheme have a strong governance structure in place

  [1 mark per point, max 9]

(ii) Decisions will be needed on how to make use of the following data related aspects:

  - The length of time over which observations should be used [0.5]
  - The frequency of observations to be used, e.g. daily, weekly, monthly etc. data [0.5]
  - Data sources, selection of indices and geographical markets [0.5]

While carrying out the analysis, subjective decisions will be needed on the following:

- The way that outliers are treated [0.5]
- Relevance of the data period, including consideration of whether there has been a regime change during the data period [1]
- If the data period has seen regime changes, then some of the data will be less relevant to the current period [1]
- However if the data period is without regime changes, then volatility is likely to be underestimated [1]
- Correlations also change over time between different asset classes. [0.5]
- Survivorship bias for some asset classes [1]
- Some asset classes have seen changes to their risk levels, for example gearing levels can increase or decrease over time in equity markets [1]
- The fact that asset income can be affected by political interference, legal and tax changes which cannot be predicted with any accuracy [1]

[Max 7, credit given for other relevant comments]
(iii) By repo-ing some of the Scheme’s existing bonds, and using the cash generated to buy more long-dated government bonds, [1] the Scheme can increase exposure to interest rates and inflation within the asset portfolio. [0.5]

This means that the Scheme hedge a higher proportion of its liability interest rate and inflation risk, [1] without fully funding the hedge assets. [0.5]

A full duration match can sometimes be achieved by using only 30% of the Scheme’s funds, leaving the remainder available for other functions. [1]

The funding cost of repos is the repurchase rate, [0.5] and this is unknown beyond the term of the current repos. [1]

The Scheme will take on further credit exposure to the governments whose bonds it buys. [1]

At expiry of the repos any gains or losses will be cash-settled. [1] Therefore a liquid cash pool will be needed to cover such payments [0.5] although repos could be used to generate cash. [0.5]

A haircut of up to 5% may be required [0.5] and collateral will be required to be posted to cover any losses on the repo [0.5] and would be received as a result of any gains. [0.5] Therefore a pool of cash or government bonds will be required to cover these requirements. [1]

Counterparty exposure to repo counterparties will need to be managed appropriately. [1]

The requirement to roll repos on an ongoing basis should also be considered and managed. [1]

[Max 8]

4 (i) (a) **What are infrastructure projects?**

Infrastructure projects are basic facilities, services and installations needed for the functioning of a community. [1]

Examples include gas pipelines, toll roads, bridges, tunnels, airports, prisons or hospitals. [1. 3 valid examples]

Infrastructure projects are generally characterised by their long lives [1]. Some also have long development times. [1]

They are generally managed and financed on a long-term basis. [1]

Historically it was seen as the role of government to fund and manage these assets for the good of the population. [1]
Increasingly the assets are owned or managed by the private sector in ring-fenced structures, [1] with various forms of provision such as joint ventures, franchises or service agreements. [1/2]

[b] What are the investment characteristics of infrastructure projects?

The development period means that there is an initial period of low or negative cashflows, [1] followed by an extended period where they will deliver cashflows to their owners. [1] This is often referred to as a “j-curve”. [1/2]

The cashflows often have some degree of inflation linkage. [1/2]

Cashflows will often exhibit a high degree of stability. [1] This can lead to low correlations to traditional asset classes. [1]

Often infrastructure assets are natural monopolies. [1] or have other unique characteristics such as location. [1/2] This give the owners the opportunity to earn super-normal profits [1] due to low elasticity of demand. [1/2]

Therefore default risks are low during the operating phase, [1] however revenues may be subject to price caps by regulators [1]

During the construction or pre-construction phase of a project, default risks are higher [1] and cost overruns can be a significant risk [1/2] leading to the risk of additional financing being needed or dilution. [1]

Other risks include changing government policy, conflicts of interest within the government, reliance on government support, legal and regulatory risks, and wider business / macroeconomic factors that lead to changing demand. [1 per example, max 3 examples]

Due to the long-term nature of a project, investors normally expect to be rewarded by means of an illiquidity premium. [1] Similarly most infrastructure projects are single-purpose therefore this can result in a premium due to concentration risks. [1]

Typical IRRs can be 15-20% during the construction phase [1] (with higher rates for projects with high levels of risk or uncertainty), [1/2] and 5–10% for mature projects [1] with low or highly certain investment costs. [1/2]

[c] The case for sovereign wealth funds investing in infrastructure

Sovereign wealth funds will find the following aspects attractive
• Low default risks, stable long-term revenue streams, inflation linkage (some projects), tangible asset, ability to hold long-dated revenue streams to meet long-dated payments (i.e. low reinvestment risk), yield, diversification from other asset classes particularly equity and credit [1 per factor including description, max 3]

They may find the following factors unattractive:

• Regulatory uncertainty, illiquidity of investments, construction phase uncertainty, large investment size, management costs, complexity of financing structures, governance, specialist expertise required [1 per factor including description, max 3]

In general, larger sovereign wealth funds are likely to find infrastructure projects offer attractive investment opportunities, subject to pricing. [1]

(Max 4)

(ii) (a) **Infrastructure asset classes**

Infrastructure project can issue equity or debt. [1]

Equity offers greater influence over the underlying project, scope for higher returns due to capital growth, but higher risk/volatility. [1/2 × 3 for characteristics] Equity will be a real asset. [1/2]

Debt offers higher yields, lower risk/volatility, and less exposure to regulatory risks. [1/2 × 3 for characteristics] Unless the debt is inflation-linked, it will be a fixed asset. [1/2] Debt will generally be secured against the project. [1/2]

In addition, infrastructure exposure can be gained by investing in assets such as equities issued by infrastructure operators or builders, or listed funds. [1]

(Max 5)

(b) **Approaches to investing**

**Listed securities or funds** – these are listed equities or funds [1/2] that offer secondary market liquidity [1] with relatively low costs. [1/2] These will be managed in accordance with a published prospectus. [1]

**Direct** (in-house/segregated account) – this is a portfolio of directly held investments, either public or private. [1] The manager can have varying levels of discretion [1/2], depending on the investor’s needs and capabilities. [1/2]
**Unlisted funds** – many asset managers offer pooled funds that invest in a diversified portfolio of infrastructure assets. [1] These can be closed-ended or open-ended. [1/2] Divestments and investments may be subject to liquidity restrictions in open ended funds. [1] Funds of funds are also available. [1/2] The manager will be responsible for investment decisions, governance matters, and charge a fee. [1]

**Shared platform/club** – whilst these can be structured as segregated or pooled accounts [1/2], they offer delegation and pooling of governance [1] but also greater control and lower fees than would apply for a fund. [1/2]

**Challenges**

General issues – whilst there is increased demand for institutional funds due to falling bank appetite for holding these assets, [1] institutional investors often struggle to achieve sufficient scale to build diversified portfolios. [1] Investors may also struggle with governance issues and exerting influence on boards. [1] Asset manager fee scales may be prohibitively high, [1] particularly for infrastructure debt. [1/2] The long time horizon means that regulatory risk is potentially greater [1] eg due to a change in tax treatment. [1/2]

**Listed equities or funds** – issues include the following:

- May be difficult to construct a large portfolio using listed assets [1]
- Lack of control over underlying investments and transactions [1]
- Possible drift of style over time [1]

**Direct** – issues include the following:

- Requires sufficient scale to justify set up costs and governance [1]
- Without sufficient scale, it may not be possible to construct a diversified portfolio [1]
- Governance requirements may be time intensive [1]
- It will take time to build up a portfolio [1]

**Funds** – issues include the following:

- Manager fees can be high, particularly under a fund of funds approach [1]
- Even where funds are open ended, there can be restricted liquidity (e.g. gates or anti-dilution levies) [1]
- There may also be agency issues, e.g. the manager is incentivised to gather assets rather than be more selective [1]

**Clubs** – issues include the following:

- Need sufficient interest from committed investors [1]
Governance arrangements or decision making framework may be unwieldy depending on the extent of discretions [1]

[Max 12, credit given for other relevant comments]

END OF SOLUTIONS