

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2011 examinations

**Subject SA6 — Investment
Special Applications**

General comments

Disappointingly, this diet reversed the recent trend and was a very poorly answered paper compared with previous diets. The average marks still remain lower than the examiners feel ought to be achievable by candidates, who are likely to be working as advisers or asset managers in this most practical of fields.

Candidates typically answered Question 3 better than the others (albeit foregoing the majority of marks available) with Question 2 attracting the worst response. The anomalous pricing of swap markets relative to treasury bonds has persisted for a few years now and candidates ought to have been aware of this and the market response. Question 1 required the consideration of quantitative easing and whilst this was a popular response by many governments to the Credit Crisis, many candidates struggled to demonstrate an understanding of the reasons why and the practical issues and consequences despite the "real time" example. Given this question equated to half the overall marks available, a poor performance on this question was going to have a similar impact on overall returns.

Those candidates 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 during the marking process.

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 recently qualified actuary or 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. A recurring theme in recent years has been a move towards capital market as well as insurance and asset management solutions – hence questions regarding more direct approaches to asset and liability risk management or modern financial theory and commercial applications should be considered likely scope for examination. Against a background of the Credit Crisis and the ongoing concerns over sovereign creditworthiness, government intervention, new asset classes and ways of modelling and structuring investments will themselves generate new types of risk (such as operations, liquidity, credit, model and counterparty), so the need for new ways of regulation, monitoring and management. As actuaries move into wider fields, the examiners are likely to focus on the application of core skills in what may appear unfamiliar situations. However, better

candidates should be able to identify the key principles and considerations that a solution demands since this should be a feature of their "day job".

- 1** (i) Quantitative Easing (QE) is a monetary policy used by some central banks to increase the supply of money. It usually involves both a direct increase in the money supply and a knock-on effect from the fractional reserve system, increasing the money supply further. Although it can involve just making changes to the fractional reserve system, which increases the money supply.

QE is usually implemented by a central bank by first crediting its own account with money it creates ex nihilo (“out of nothing”). It then purchases financial assets, for example government bonds, agency debt, mortgage-backed securities and corporate bonds, from banks and other financial institutions in a process referred to as open market operations. It can also involve changing the reserve requirements which through the fractional reserve system would increase the money supply.

Sensible comments on examples of current and past QE by countries around the world were also awarded marks.

- (ii) Bond Market

QE will typically involve intervention in bond markets by the central bank – increasing bond prices and consequently lowering bond yields.

QE is typically used to impact the middle to longer end of the yield curve, which would not be directly impacted by more traditional monetary policy.

However, if the QE results in higher inflationary expectations, it may increase yields at the longer end of the yield curve.

Equity Market

If QE reduces bond yields, this will both improve the relative attractiveness of equities compared to bonds, and also reduce the discount rate at which future earnings are discounted, causing the equity to move higher.

Equities are a real asset and may also move higher on the prospect of higher inflation, or the removal of deflationary expectations.

The newly created excess reserves in the banking system and the higher money supply may further add to the demand for equities.

Lower bond yield should lead to lower interest rates which should stimulate economic activity, increase corporate profitability and future dividends, and thus raise equity prices.

The result of QE may have a disproportionate effect on the stock market in the short term, creating an imbalance in the economy and this can result in a stock market bubble unless the QE results in higher real economic output.

If QE results in investors being worried about inflationary expectations this would cause a stock market sell-off.

Exchange Rate

Initially the exchange rate should fall – unless similar or more severe QE is happening in other countries.

Lower interest rates reduce the demand for the domestic currency.

Lower exchange rates should increase the competitiveness of all exports. This is despite increasing the cost of imported raw materials used in production.

Lower exchange rates should increase the relative competitiveness and demand for domestically produced goods and services stimulating domestic growth in the next two years.

If QE results in stronger growth, this should lead the currency to appreciate eventually.

Economic Growth

Lowering short rates encourages investment spending by firms, and increases the level of consumer spending.

There can be a considerable lag between lowering interest rates and a pick-up in growth.

Capital investment spending by firms increases employment levels and therefore incomes, but it takes time for firms to plan and build new production facilities before they start producing goods.

To increase consumer spending you need to do one or more of:

- Increase disposable income by reducing the cost of servicing existing debt – the effect will be more immediate if borrowing is generally at floating rather than fixed rates.
- Discourage savings and / or encourage spending of savings – lower interest rates provide less reward for savings, however, consumers need confidence (e.g. job security or prospects) before savings are turned to spending.
- Encourage personal borrowing – lower interest rates make borrowing cheaper, however, consumers need confidence (e.g. job security or prospects) before borrowing to spend.

The return of consumer confidence will take time to emerge.

If QE results in other countries also conducting QE to engage in competitive devaluations, this is likely to hurt international trade, and hurt economic growth.

Inflation

Lower exchange rates will increase the cost of imported goods and services leading to supply side inflation. The impact on the inflation rate will depend on whether these higher costs can be passed on to consumers. Weak demand and the pressure of domestic alternatives are a limiting influence.

The use of forward currency contracts will create a longer lag.

Lower real interest rates mean an increased quantity of money is demanded which is met by an increase in the money supply. This can lead to inflation (demand side). Demand side inflation typically has a longer lag than economic growth.

(Other sensible answers are also acceptable, especially comment concerning the generation of imbalances in the economy and the impact that this has on markets. Likewise the examiners gave credit for points that apply to multiple areas)

- (iii) Explanations to be based on the following:

DB Pension Funds

Pension funds will be affected by changes in:

Bond yields

Equity markets

Inflation expectations

Salary inflation

Any currency effect

Level of matching of assets and liabilities and so sensitivity

Different Characteristics of Pension Funds

Mature – higher percentage invested in bonds.

Young – higher percentage invested in equities.

Effect of the initial QE

Bond Yields

Comments

Lower yields => higher bond prices => higher asset valuation

Lower yields => lower discount rate, higher liabilities valuation

Equity markets

Comments

Higher equity markets => higher asset valuation

Equities are a real asset, and higher inflationary expectations may mean higher asset prices.

Inflation expectations

Comments

QE should increase inflationary expectations/assumptions, if even from deflationary expectations to inflationary expectations.

Higher inflationary expectations => higher liability valuations

Salary inflation

Comments

Salary inflation assumptions will increase due to higher inflationary expectations. But they may decrease due to the poorer economic outlook

Currency effect

Comments

QE is likely to result in a lower exchange rate, resulting in a higher valuation of assets denominated in foreign currencies.

Overall effect

Comments explaining probable reduction in funding levels of different pension funds were expected.

Effect of the bursting of bond bubble

Bond Yields

Comments

Higher yields => lower bond prices => lower asset valuation

Higher yields => higher discount rate, lower liabilities valuation

Equity markets

Comments

Higher bond yields => future earnings discounted at higher rate => lower equity prices => lower asset valuations

Equities are a real asset, and higher inflationary expectations may mean higher asset prices. However, the associated need for tighter monetary policy to control inflation may result in lower equity prices.

Inflation expectations

Comments

QE should increase inflationary expectations/assumptions, if even from deflationary expectations to inflationary expectations.

Higher inflationary expectations => higher liability valuations

Salary inflation

Comments

Salary inflation assumptions will increase due to higher inflationary expectations. But they may decrease due to the poorer economic outlook

Currency effect

Comments

Higher yields are likely to result in a stronger currency which would result in a higher exchange rate, resulting in a lower valuation of assets denominated in foreign currencies.

Overall effect

Balanced comment explaining impact on funding levels of different pension funds

Further comments:

Possible bankruptcies of companies and consequent difficulties with covenants from employers

Difficulties in national finances may result in higher taxation on pension funds.

(Other sensible answers are also acceptable, especially comment concerning the generation of imbalances in the economy and the impact that this has on markets.)

- 2** (i) A repo is an agreement whereby one party sells stock to another with a simultaneous agreement to repurchase it at a later date at a pre-agreed price.
- The investor does not need any cash to purchase the gilt, as the repo will provide sufficient cash to pay for the gilt. In practice there is often a haircut of up to 5% so a small cash outlay is needed.
- The investor will then receive the total return on the gilt less the difference between the repurchase price and the sale price within the repo agreement. The difference between the two prices within the repo agreement can be considered as a financing cost to obtain a gilt on an unfunded basis.

- (ii) A profile of known or estimated future payments can be constructed for the liabilities. Provided the future payments do not change in amount or timing, a gilt portfolio can be constructed that generates coupon and principal payments that can be used to meet the obligation to make the payments.

Due to the limited number of gilt issues, gilts do not enable precise netting off of asset proceeds against liabilities payments. However a gilt-based hedge can be constructed that satisfies the liabilities' duration and convexity.

Repo allows this gilt portfolio to be created without requiring a cash outlay equal to the NPV of the liabilities (calculating using the gilt yield curve). Some cash outlay will be required to cover haircuts but it is possible to reduce the cash outlay to 30% or less of the NPV of the liabilities, if desired.

Under a gilt repo strategy, rather than additional gilts being purchased with cash, some of the existing gilts are placed on repo to generate cash to meet the cash requirement. Typically the gilts placed on repo would be those with the lowest financing cost (repo rate). It is important to use a number of counterparties and a range of roll dates and maturities to reduce market impact at the time of a roll.

(iii) **Hedge design**

If the latter payments are payable after the principal payment of the longest available gilt then it will not be possible to hedge these payments at present, creating reinvestment risk. Sterling interest rate swaps can be sourced at longer maturities than the longest available gilt.

A partial solution may be to hedge the interest rate sensitivity using shorter duration gilts, but this leads to some degree of curve risk compared to a hedge at the correct duration.

Due to "gaps" between bond maturities (particularly at longer durations), there may be a need to reinvest or disinvest bonds prior to maturity, and the hedge may therefore be imperfect. With a swap based hedge this issue does not arise as swaps can be written to any maturity up to 50 years, and with some availability up beyond 50 years.

Roll and settlement complexities

A repo based hedge requires frequent rolls of the repo position as the repos expire (e.g. every 3 months). This creates significant operational overhead compared to the collateral management process that would apply under a swap.

There is also a risk that repo financing may not be available at the time of a future roll, which would require the repo obligation to be settled in cash. If there is no cash in the portfolio then assets would need to be sold to meet the cash call.

If for liquidity reasons gilts from the hedge assets need to be sold then effectively the hedge is being scaled back, which is undesirable from a risk management perspective. With swaps, there would be a negative mark to market adjustment and cash or bonds would be posted, but bonds would not need to be realised.

Gilt repos are typically less efficient in terms of collateral usage than swaps due to issues such as lack of netting across trades and the need to maintain some level of cash to meet potential settlement payments. Overall this results in lower capital efficiency.

Credit risks

The use of gilt gives risk to a (small) degree of credit risk. Arguably this is of a lower likelihood than counterparty risks with banks under swaps, but the severity would be far greater as exposures to bank under swaps are collateralised whereas gilts are senior unsecured bonds issued by the UK government. Also under the cash/bond plus swap approach, the underlying cash and bond assets will also contain credit risks which in most cases will be equal to or larger than for gilts (albeit these only relates to the funded part of the hedge).

[No marks were available for stating the advantages of repo over swaps, or comments on inflation. Credit was given for other valid comments.]

- (iv) For an investor who measures its liabilities using the government bond curve, the gilt plus repo approach will lead to very low basis risk between the liability benchmark and the value of the hedge assets. Conversely a swaps based hedge will lead to significant basis risks due to fluctuations between the gilt and swap yield curves. The reverse would apply where the investor's liability benchmark is measured using a swaps curve.

When government bond yields are higher than swap yields, an unfunded hedge can be created at lower cost using gilts than swaps. This reflects two factors: The fixed yield (i.e. gilt yield or swap yield) is higher when using gilts

The floating rate (i.e. GC rate or LIBOR) has historically been lower for repo than swaps

- (v)

	Values £m					Return % p.a.				
	Gilts gross	Gilt repo	Gilt net	Non-gilts	Total	Gilts gross	Gilt repo	Gilt net	Non-gilts	Total
31/12/2006	1400	600	800	600	1400					
31/12/2007	1500	625	875	620	1495	7.1%	4.2%	9.4%	3.3%	6.8%
31/12/2008	1400	650	750	475	1225	-6.7%	4.0%	-14.3%	-23.4%	-18.1%
31/12/2009	1600	665	935	580	1515	14.3%	2.3%	24.7%	22.1%	23.7%
31/12/2010	1750	680	1070	600	1670	9.4%	2.3%	14.4%	3.4%	10.2%
Whole period	25.0%	13.3%	33.8%	0.0%	19.3%					

The return on the liabilities was 7.1%, –6.7%, 14.3%, 9.4% each year, or 25.0% over the period.

The return on assets was 6.8%, –18.1%, 23.7%, 10.2% each year, or 19.3% over the period.

- (vi) The asset/liability ratio has fallen, as can be seen by total assets of £1,670m relative to liabilities of £1,750m at the end of 2010. At the end of 2006, assets and liabilities were both equal to £1,400m.

The funding level was the lowest at end 2008 when assets were £1,225m and liabilities were £1,400m.

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- (i) If a large number of futures contracts are rolled on a single day, there could be significant volatility in prices for the two successive futures contracts (in each commodity) due to the large changes in demand.

The longer the roll period the less likely the rolling is to create market distortions, even if there is a large group of investors following the index.

There is limited benefit in extending the roll period from 5 working days to 16 working days, as futures in most commodities are very liquid, and the longer the roll period the more complex the index is to calculate and track.

- (ii) The ETF manager may not be able to mirror the exact timing of changes in the composition of the index, leading to some level of tracking error.

There will be transaction costs (dealing spreads), expenses, possibly some withholding taxes.

- (iii) The ETF needs to hold some cash for margin, and this would act as a drag on returns if the interest rate paid by the futures exchange is less than the return on the index. This will also create some tracking error.

If the ETF borrows cash for margin calls, this will allow the fund to be fully invested. When the index return is higher than the borrowing cost this will lead to a higher return for the investor.

- (iv) The key risks are:

- Underperformance of the ETF relative to the index due to the factors described above.
- ETF's ability to borrow restricted, forcing manager to reduce leverage, leading to investor losses (forced sales).
- Failure of one or more of the commodities futures exchanges, leading to a loss of margin and futures contracts needing to be replaced (or exposure lost).

- (v) The main way in which the index outperforms cash is due to the term premium on commodities futures, when the forward price curve is subject to backwardation, that is the commodity increases in value the closer it is to delivery, and that the rate of increase is higher than the cost of carry.

By being permitted to invest at longer maturities, the manager has a wide opportunity set to select the parts of the forward curve that are most attractive in terms of the expected rate of price increase.

The manager is also permitted to use different weights in each commodity which gives further scope to tilt the portfolio towards the commodity futures that are expected to increase in value the most.

There may also be some scope to add value by selectively hedging currency risks and by using different instruments to gain exposure to the underlying commodity futures.

The active manager could be given the following wider discretions, which if the manager is able to successfully deploy (net of transaction and other costs) could result in additional alpha:

Ability to borrow or create leverage using derivatives

Ability to invest in a wider range of commodity futures, and other commodity assets e.g. options

Ability to invest in asset classes outside the benchmark

Ability to keep interest rate and currency risks unhedged

END OF EXAMINERS' REPORT