ACCA PAPER P4

Advanced Financial Management

Module 9

Hedging Interest Rate Risk
Lecture Overview

- HEDGING INTEREST RATE RISK
  - Techniques/instruments
    - Forward rate agreements
    - Interest rate futures
    - Interest rate swaps
    - Options on FRAs
    - Options on futures
    - Swaptions
MONEY MARKET INSTRUMENTS

The financial markets can be divided into the following types:
- Capital markets: include stock-markets for shares and bond markets.
- Money markets: for short-term (< 1 year) debt financing and investment.
- Commodity markets: for trading of commodities such as oil, metals etc.
- Derivatives markets: trading of options and futures contracts.
- Insurance markets
- Foreign exchange markets

The types of instruments available in the money market include:
- Coupon bearing instruments
- Discount instruments

**Coupon bearing instruments**

Coupon bearing securities have a fixed maturity and a specified rate of interest. Coupon bearing securities include:

- **Certificates of deposit (CDs)**

- **Sale and repurchase agreements (‘repos’)**
  - In a repo transaction, X sells certain securities (treasury bills, bank bills etc) to Y and simultaneously agrees to buy them back at a later date at a higher price.
  - In effect, a repo is a secured short-term loan and the higher repurchase price reflects the interest on the loan.

**Example**
Reaper Co enters a repo agreement as follows:
1. Sell £4 million (nominal) UK Treasury Bills for £3.94 million.
2. Buy back 45 days later for £3.96 million.

Determine the effective interest rate.

**Solution**
Discount instruments

In the discount market, funds are raised by issuing bills at a discount to their eventual redemption or maturity value. Types of instruments include:

- **Treasury bills**
  - Issued mainly by governments via central banks.
  - Usually one or three month maturity.

- **Commercial paper**
  - Issued by corporations
  - Initial maturity usually between seven and forty-five days.
  - May be unsecured so credit ratings important.
  - High issue costs so only suitable for larger amounts.

- **Banker’s acceptances**
  - Mainly issued to facilitate international trade.

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**Example**

CP Co wishes to issue £10 million of commercial paper for 90 days at an implicit interest rate of 5% pa or 'at a discount of 5%'.

Determine the issue price.

**Solution**
INTEREST RATE RISK

For a company that is a net borrower, the interest rate risk is that interest rate will rise.

For a company that is a net depositor, the interest rate risk is that interest rate will fall.

Money market derivative can be used to manage interest rate risk. These include:
- Forward rate agreements (FRAs)
- Interest rate futures
- Options on FRAs (caps and floors)
- Options on interest rate futures
- Interest rate swaps
- Options on swaps (swaptions)

Forward rate agreements (FRAs)

An FRA is a forward contract to borrow or lend money in the future at an interest rate that is agreed today.

- Arranged on the OTC market so contracts can be tailor made
- FRAs are usually on amounts > $1m. A wide variety of maturities are available such as 3 months, 6 months and also beyond a year.
- Prices quoted as interest rates. The higher for borrowing and the lower for depositing. For example 7.40% - 7.25% (borrowing - depositing)
- Quotations are given in terms of beginning and ending dates i.e. 6v9 start in 6 months for a period of 3 months.
Example – FRA

Enfield Inc’s financial projections show an expected cash deficit in two months time of $8m, which will last for approximately three months.

It is now the 1st November 20X6. The treasurer is concerned that interest rates may rise before the 1st January 20X7. Protection is thus required for two months.

Now
1st Nov

Rate agreed
1st Jan

Risk of adverse movement
i.e. that interest rates will increase in this period

The treasurer can lock into an interest rate today for a future loan.

• The company takes out a loan as normal, i.e. the rate it pays is the going market rate at the date the loan is taken out.
• It will then receive or pay compensation under the separate forward rate agreement to return to the locked-in rate.

Suppose a 2 – 5 FRA at 5.00 – 4.70 is agreed.

• The agreement starts in 2 months time and ends in 5 months time.
• The FRA is quoted as interest rates for borrowing and lending — the borrowing rate is always the highest.

Calculate the interest payable if in two months’ time the market rate is:
(a) 7% or (b) 4%.
Solution

<table>
<thead>
<tr>
<th>Loan payments</th>
<th>7%</th>
<th>4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest payable on loan:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8m×0.07×3/12</td>
<td>(140,000)</td>
<td></td>
</tr>
<tr>
<td>8m×0.04×3/12</td>
<td>(80,000)</td>
<td></td>
</tr>
<tr>
<td>FRA payments Compensation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receivable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8m×(0.07-0.05)×3/12</td>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td>Payable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8m×(0.04-0.05)×3/12</td>
<td>(20,000)</td>
<td></td>
</tr>
<tr>
<td><strong>Combination gives an effective interest rate of 5%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(100,000)</td>
<td>(100,000)</td>
<td></td>
</tr>
</tbody>
</table>

- In this case the company is protected from a rise in interest rates but is not able to benefit from a fall in interest rates – a FRA hedges the company against both an adverse movement and a favourable movement.

- The FRA is a totally separate contractual agreement from the loan itself and could be arranged with a completely different bank.

- FRAs are usually on amounts > $1m and enable you to hedge for a period of one month up to two years. However, as an ‘over the counter’ instrument, they can be tailor-made to the company’s precise requirements.

- In the example above, the company is protected from a rise in interest rates but is not able to benefit from a fall in interest rates - a FRA hedges the company against both an adverse movement and a favourable movement.

- The FRA is a totally separate contractual agreement from the loan itself and could be arranged with a completely different bank.
Illustration 2

Stone Co's yield curve has been calculated as:

<table>
<thead>
<tr>
<th>Year</th>
<th>Individual yield curve (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.96</td>
</tr>
<tr>
<td>2</td>
<td>4.25</td>
</tr>
<tr>
<td>3</td>
<td>4.56</td>
</tr>
</tbody>
</table>

This means that Stone Co will have to pay interest of 3.96% if it wants to borrow money for 1 year, 4.25% if it wants to borrow for 2 years etc.

An alternative to borrowing for 2 years at 4.25% throughout is to borrow for 1 year initially at 3.96% and then to borrow for another year in 1 year's time at an unknown rate. The company could fix the interest rate in one year's time by asking the bank to quote a rate for a 12–24 FRA.

The rate quoted by the bank would be the rate \( r \), so that:

\[
1.0396 \times (1 + r) = 1.0425^2
\]

Rearranging this gives \( r = 4.54\% \).

Hence the 12 – 24 FRA rate for Stone Co would be 4.54%.

Test your understanding 1

Stone Co (the company in the previous Illustration) wants to borrow money in 2 years' time for a period of 1 year.

**Required:**

Using the company's spot yield information quoted above, calculate the rate of interest the bank would quote for a 24-36 FRA.

Test your understanding 1

A 24–36 FRA will fix the rate of interest in 2 years for a 1 year loan.

The FRA rate will be \( r \), such that:

\[
(1+r) \times 1.0425^2 = 1.0456^3
\]

because Stone Co could borrow for 3 years at 4.56% or alternatively the first 2 years at 4.25% followed by the FRA rate for 1 year.

Therefore, \( r = 5.18\% \).

The interest rate for a 24 – 36 FRA would be 5.18%.
Interest rate futures

An interest rate future is a traded FRA. Unlike FRA, an interest rate future has a standard maturity date (typically 3 months) and standard contract amount. Examples of interest rate futures traded are:

Short-term interest rate futures (STIRs)

<table>
<thead>
<tr>
<th>Reference rate</th>
<th>Futures exchange</th>
<th>Notional deposit</th>
<th>Tick size (%)</th>
<th>Tick value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-month sterling</td>
<td>LIFFE</td>
<td>£500,000</td>
<td>0.01</td>
<td>£12.50</td>
</tr>
<tr>
<td>3-month euribor</td>
<td>LIFFE/Eurex</td>
<td>€1 million</td>
<td>0.01</td>
<td>€25</td>
</tr>
<tr>
<td>3-month eurodollar</td>
<td>CME</td>
<td>$1 million</td>
<td>0.01</td>
<td>$25</td>
</tr>
<tr>
<td>3-month euroyen</td>
<td>TFE/LIFFE</td>
<td>¥100 million</td>
<td>0.005</td>
<td>¥12.50</td>
</tr>
</tbody>
</table>

Ticks and tick values

For STIRs, the minimum price movement is usually 0.01% or one basis point. The value of a tick is calculated as follows:

\[ \text{Tick value} = \text{contract amount} \times \text{one basis point} \times \frac{\text{fraction of year}}{\text{contract duration}} \]

For three-month sterling futures, value of one tick is

\[ £500,000 \times 0.0001 \times \frac{3}{12} = £12.50 \]

Futures prices

Prices are stated as (100 - the expected market reference rate), so a price of 95.5 would imply an interest rate of 4.5%.

If interest rate increases, futures price will fall.

If interest rate decreases, futures price will increase.

Calculating the number of contracts needed

\[ \text{Number of contracts} = \frac{\text{amount required}}{\text{Contract size}} \times \frac{\text{months required}}{\text{contract duration}} \]
Example – Global Inc

Global Inc wishes to borrow €9,000,000 for one month starting in 5 weeks’ time. Euribor is currently 3% and the treasurer of Global decides to fix the rate by selling IRFs at 96.90. The market rate subsequently rises by 25 basis points to 3.25%. As soon as the loan is agreed, the treasurer closes out Global’s position by buying a matching number of contracts at 96.65.

(a) Calculate the number of contracts required (Note: one 3-month contract is for €1,000,000)

(b) Demonstrate that, in this case, the gain on the futures contracts exactly matches the extra interest on the loan.

Solution

(a) Number of contracts = (9,000,000/1,000,000) × 1/3 = 3

(b) Extra interest cost on loan = 0.25% × 9,000,000 × 1/12 = €1,875

Gain on futures = 3 contracts × 25 ticks per contract × €25 per tick
(W) = €1,875

(W: value of tick = €1,000,000 × 3/12 × 0.0001 = €25)
Test your understanding 3

Assume that today is the 25th of January.

A company is going to borrow $2,000,000 in two months' time for a period of three months. It fears that the current interest rate will rise from its current level of 5%, so it wants to use $500,000 3-month interest rate futures to hedge the position.

Data from the futures market:

March futures price = 94.90
June futures price = 94.65

Required:

Calculate the result of the relevant futures hedge on the assumption that interest rates have risen to 7% and the futures price has moved to 92.90 in two months' time.

Test your understanding 3

- Buy or sell futures? Sell, since we are borrowing
- Number of contracts = (2,000,000/500,000) × 3/3 = 4
- Which expiry date? March, since it expires soonest after the transaction date of 25 March.

Contact the exchange: We need to sell 4 March contracts at a price of 94.90

Two months later:

Transaction: Interest will be $2m × 3/12 × 7% = $35,000

Futures market:

- Number of ticks movement per contract = (94.90 – 92.90) × 100 = 200
- Value of a tick = £500,000 × 3/12 × 0.0001 = £12.50
- Profit on futures = ticks per contract × tick value × no of contracts = 200 × 12.50 × 4 = £10,000

Hence, net cost = $35,000 – $10,000 = $25,000
Test your understanding 4

Sopoph Co is using June interest rate futures to cover the interest rate risk on a 3 month $1m borrowing starting on 31 May.

At the time the $500,000 futures contracts are set up on 1 January, the LIBOR rate is 5.00% and the futures price is 95.48. Sopoph Co can borrow at the LIBOR rate.

Assume that basis reduces in a linear manner.

Required:

(a) Calculate the financial result of the futures hedge on the assumption that the LIBOR rate on 31 May is 4.00%.

(b) Calculate the likely lock-in rate for this futures hedge, and hence the likely financial result of the hedge.

(c) Comment on your results to parts (a) and (b).
Test your understanding 4

(a) The hedge is set up by selling 2 June futures at a futures price of 95.48.

Likely result of the hedge:

Transaction – borrow $1m for 3 months at LIBOR on 31 May (4%)
Futures market: Sell at 95.48, buy at 96.08 (from basis workings below)
  Loss = 0.60%, multiplied by 2 × $500,000
  covered for 3 months

Total payment

(basis workings): $ (10,000) (1,500) (11,500)


1 January 31 May 30 June

LIBOR 5.00% 4.00%
Futures price 95.48 96.08 (W3)
  (i.e. 4.52%)
Basis 0.48% 0.08% (W2) 0 (W1)

(W1) Basis will reduce to zero by the expiry date of the contract, because on that date, the futures price will equal 100 – the (known) LIBOR rate.

(W2) Assuming basis reduces in a linear manner, the basis at 31 May should be 1/6 of the original 0.48% i.e. 0.08%.

(W3) Basis is the difference between LIBOR and the implied futures price interest rate, so implied interest rate is 4.00% – 0.08% = 3.92% and futures price is 96.08.

(b) The lock-in rate is

Implied interest rate (i.e. 100 – current futures price) + unexpired basis on the transaction date.

= (100 – 95.48) + 0.08% = 4.60%

Therefore, the likely financial result of the hedge is a total payment of

4.60% × $1m × 3/12 = $11,500

(c) The result is the same under both calculation methods. The lock-in rate method can be used as a shortcut, and it is particularly useful when the LIBOR rate on the transaction date is not known.
**Imperfect hedges**

The futures hedge is imperfect due to:

- Basis risk - the future rate (as defined by the future prices) moves approximately but not precisely in line with the cash market rate.

- If you are not dealing in whole contracts and have to round to whole contracts.

**Interest rate swaps**

- An interest rate swap is an agreement whereby the parties agree to swap a floating stream of interest payments for a fixed stream of interest payments and vice versa.

- There is no exchange of principal.

- Swaps can run for up to 30 years.

- Swaps can be used to hedge against an adverse movement in interest rates.

- A swap can be used to obtain cheaper finance.

**Example – Imperfect Hedge**

Company A wishes to raise $10m and to pay interest at a floating rate, as it would like to be able to take advantage of any fall in interest rates. It can borrow for one year at a fixed rate of 10% or at a floating rate of 1% above LIBOR.

Company B also wishes to raise $10m. They would prefer to issue fixed rate debt because they want certainty about their future interest payments, but can only borrow for one year at 13% fixed or LIBOR + 2% floating, as it has a lower credit rating than company A.

Calculate the effective swap rate for each company – assume savings are split equally.
Solution

Step 1: Identify the type of loan with the biggest difference in rates.

- Answer: Fixed

Step 2: Identify the party that can borrow this type of loan the cheapest.

- Answer: Company A
- Thus Company A should borrow fixed, company B variable, reflecting their comparative advantages.

Step 3:

- Company A has cheaper borrowing in both fixed and variable. Interest rate differentials are 3% for fixed and 1% for variable. The difference between these (2%) is the potential gain from the swap.
- Splitting this equally between the two counter parties, each should gain by 1%.

One way (there are many!) of achieving this is for A to pay B LIBOR (variable) and for B to pay A 10%.

Summary

<table>
<thead>
<tr>
<th>Actual borrowing</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A to B</td>
<td>(10%)</td>
<td>LIBOR</td>
</tr>
<tr>
<td>B to A</td>
<td>10%</td>
<td>(10%)</td>
</tr>
</tbody>
</table>

**Interest rates after swap**

<table>
<thead>
<tr>
<th>Open market cost – no swap</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(LIBOR + 1%)</td>
<td>(LIBOR + 2%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Saving</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>
Example – Interest rate swap via in intermediary

Co A currently has a 12-month loan at a fixed rate of 5% but would like to swap to variable. It can currently borrow at a variable rate of LIBOR + 12 basis points.

Co B has a 12-month loan at a variable rate of LIBOR + 15 basis points but, due to fears over interest rate rises, would like to swap to a fixed rate. It can currently borrow at 5.12% fixed.

The bank is currently quoting 12-month swap rates of 4.90 (bid) and 4.95 (ask).

Show how the swap via the intermediary would work.

Solution

- Co A already has a fixed outflow so must receive fixed from the bank and pay it variable to convert this to a net variable flow. It will thus receive the bid rate.
- Similarly Co B must pay the bank the fixed ask rate.

<table>
<thead>
<tr>
<th>Activity</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual borrowing</td>
<td>(5.00%)</td>
<td>(LIBOR + 0.15%)</td>
</tr>
<tr>
<td>Payment to bank</td>
<td>(LIBOR)</td>
<td>(4.95%)</td>
</tr>
<tr>
<td>Receipt from bank</td>
<td>4.90%</td>
<td>LIBOR</td>
</tr>
<tr>
<td><strong>Net interest rates after swap</strong></td>
<td><strong>(LIBOR + 0.10%)</strong></td>
<td><strong>(5.10%)</strong></td>
</tr>
</tbody>
</table>

Open market cost – no swap (LIBOR + 0.12%) (5.12%)

Saving 2 basis points 2 basis points

**Note:** Total potential saving = D differentials = 12 - 3 = 9 basis points.

Of this, 5 basis points have gone to the bank via the spread in quoted prices, leaving 4 to be shared between the two companies.
Interest rate options

An option provides the right but not the obligation to buy or sell a financial instrument on a date in the future at a price agreed today.

These can be both OTC options, in which case they are normally referred to as interest rate guarantees (IRG's) or exchange traded options.

(1) Interest Rate Guarantees (options on FRAs)

An interest rate guarantee (IRG) is an option on an FRA and, like all options, protects the company from adverse movements and allows it to take advantage of favourable movements.

IRGs are usually written by banks and other financial houses (i.e. the same institutions that may offer FRAs).

If there is an adverse movement

Exercise the option to protect

If there is a favourable movement

Allow the option to lapse

IRGs are more expensive than the FRAs as one has to pay for the flexibility to be able to take advantage of a favourable movement.

As with other OTC options, the buyer selects the maturity date, interest level, reference floating rate and the period and notional amount of capital involved.

• Caps and floors
  
o Buying a cap

  - The bank as writer of the option agrees to cap the interest rate charged on a loan.

  - If interest rates rise above the cap, then the bank pays the difference in rates to the holder.

  - If the interest rate stays below the cap, then there is no need to pay the bank.

  o Buying a floor

    - A minimum interest rate is set on a deposit.
Example – RGI

RGI Co wishes to invest $12 million in 5 months time for two months and considering the following hedging strategies.

(1) A 6–8 FRA quoted at 4%.
(2) An IRG at 4% for a premium of 0.1%.

Determine the costs if in six months time the market rate is: (a) 5% (b) 3% and comment.

Solution:

<table>
<thead>
<tr>
<th></th>
<th>IRG at 4%</th>
<th>FRA at 4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market rate</td>
<td>5% - lapse</td>
<td>3% - exercise</td>
</tr>
<tr>
<td>Interest</td>
<td>100,000</td>
<td>80,000</td>
</tr>
<tr>
<td>Premium</td>
<td>(12,000)</td>
<td>(12,000)</td>
</tr>
<tr>
<td>Net receipt</td>
<td>88,000</td>
<td>68,000</td>
</tr>
</tbody>
</table>

Comment: the choice between FRA and IRG will depend on expectations and the desired risk exposure of the firm.
(2) Options on interest rate futures

- These are options to buy or sell futures.
- A call option gives the holder the right to buy the futures contract.
- A put option gives the holder the right to sell the futures contract.

**Liffe short sterling options: £500,000; tick size 0.01%**

*Price on three-month Sterling December futures*

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Calls</th>
<th>Puts</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.50</td>
<td>2.20</td>
<td>1.25</td>
</tr>
<tr>
<td>94.00</td>
<td>1.74</td>
<td>1.84</td>
</tr>
<tr>
<td>94.50</td>
<td>1.32</td>
<td>2.90</td>
</tr>
<tr>
<td>95.00</td>
<td>0.87</td>
<td>3.46</td>
</tr>
</tbody>
</table>

Contract size = 

Tick size = 

Call settlement date = 

Strike price = 

Contract premium =
Choosing an exercise price

There are various ways of choosing an exercise price.

- **NB**: In a question, you may be told which exercise price to use, so check that first.
- One common way is to choose the exercise price closest to the current interest rate, so if the current interest rate were 6.00% then an exercise price of 94.00 would be chosen.
- Alternatively, choose the exercise price that will result in the highest net interest receipt or minimum total interest payment.

### CALL OPTIONS – deposit – highest net receipt.

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Deposit interest</th>
<th>Cost</th>
<th>Net Receipt</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.50</td>
<td>6.50</td>
<td>(2.20)</td>
<td>4.30</td>
</tr>
<tr>
<td>94.00</td>
<td>6.00</td>
<td>(1.74)</td>
<td>4.26</td>
</tr>
<tr>
<td>94.50</td>
<td>5.50</td>
<td>(1.32)</td>
<td>4.18</td>
</tr>
<tr>
<td>95.00</td>
<td>5.00</td>
<td>(0.87)</td>
<td>4.13</td>
</tr>
</tbody>
</table>

### PUT OPTIONS – loan – lowest total payment

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Loan interest</th>
<th>Cost</th>
<th>Total Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.50</td>
<td>6.50</td>
<td>1.25</td>
<td>7.75</td>
</tr>
<tr>
<td>94.00</td>
<td>6.00</td>
<td>1.84</td>
<td>7.84</td>
</tr>
<tr>
<td>94.50</td>
<td>5.50</td>
<td>2.90</td>
<td>8.40</td>
</tr>
<tr>
<td>95.00</td>
<td>5.00</td>
<td>3.46</td>
<td>8.46</td>
</tr>
</tbody>
</table>
Options hedging calculations

Step 1: Set up the hedge by addressing 4 key questions:

- Do we need call or put options?
- How many contracts?
- Which expiry date should be chosen?
- Which strike price / exercise price should be used?

Step 2: Contact the exchange. Pay the upfront premium. Then wait until the transaction / settlement date.

Step 3: On the transaction date, compare the option price with the prevailing market interest rate to determine whether the option should be exercised or allowed to lapse.

Step 4: Calculate the net cash flows – beware that if the number of contracts needed rounding, there will be some borrowing or deposit at the prevailing market interest rate even if the option is exercised.

Decision point – exercise the option or allow it to lapse

General rule:

If there is an adverse movement

Exercise the option to protect

If there is a favourable movement

Allow the option to lapse

Double check:

- Would you ever exercise an option that results in a loss?
- Therefore you must always have a profit on the futures when exercising and a potential loss if you allow the option to lapse.
Test your understanding 5: Interest rate options

It is now the 31st of July.

Tolhurst Co needs to borrow $10m in 1 month's time, for a 6 month period. The current market interest rate is 5%.

The following information is available regarding $500,000 3-month September interest rate options:

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Call</th>
<th>Put</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.50</td>
<td>1.39</td>
<td>-</td>
</tr>
<tr>
<td>94.75</td>
<td>1.02</td>
<td>0.18</td>
</tr>
<tr>
<td>95.00</td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td>95.25</td>
<td>0.21</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Premia are quoted in %.

**Required:**

Calculate the result of the options hedge if the interest rate has risen to 7.5% and if the September futures price has moved to 93.00 in one month's time.

Test your understanding 5: Interest rate options

**Set up hedge:**

- Call or put options? Put here, to cover a borrowing.
- How many contracts? ($10m/$500k) x (6/3) = 40
- Expiry date? September – expires soonest after the transaction date of 31 August.
- Which exercise price?

<table>
<thead>
<tr>
<th>Choice</th>
<th>Implied rate</th>
<th>Premium</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.75</td>
<td>5.25%</td>
<td>0.18%</td>
<td>5.43%</td>
</tr>
<tr>
<td>95.00</td>
<td>5.00%</td>
<td>0.65%</td>
<td>5.65%</td>
</tr>
<tr>
<td>95.25</td>
<td>4.75%</td>
<td>1.12%</td>
<td>5.87%</td>
</tr>
</tbody>
</table>

So we can see that the 94.75 option is the cheapest total cost.

**Contact exchange:** We need to buy 40 September put options with an exercise price of 94.75.

Premium payable upfront = 0.18% x 40 x $500,000 x 3/12 = $9,000

1 month later:

**Transaction:** Interest = 7.5% x $10m x 6/12 = $375,000

**Futures/options market:**

Exercise the put option i.e. sell at 94.75

Close out: Buy at futures price of 93.00

Gain is 1.75% (175 ticks) x 40 x $500,000 x 3/12 = $87,500

So, the net interest cost is $375,000 – $87,500 = $287,500 (plus the initial premium of $9,000)
Test your understanding 6: Futures and options

Chesterfield Co needs to borrow $5m for 6 months, starting in 4 months' time on 1st August.

The current LIBOR rate is 3.50% but there is a risk that interest rates will change over the next few months by up to 0.5% either way, so the company's treasurer is considering hedging the interest payments using futures contracts or options. Chesterfield Co can borrow at 25 basis points above the LIBOR rate.

Current futures/options information:

Futures ($500,000 3 month contracts)

<table>
<thead>
<tr>
<th>Month</th>
<th>Futures</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>96.40</td>
</tr>
<tr>
<td>September</td>
<td>96.10</td>
</tr>
<tr>
<td>December</td>
<td>95.86</td>
</tr>
</tbody>
</table>

Options on futures (premium quoted as an annual percentage)

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Jun</th>
<th>Sept</th>
<th>Dec</th>
<th>Jun</th>
<th>Sept</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>96.40</td>
<td>0.155</td>
<td>0.260</td>
<td>0.320</td>
<td>0.305</td>
<td>0.360</td>
<td>0.445</td>
</tr>
</tbody>
</table>

Required:

Estimate the likely financial position if Chesterfield Co hedges the interest rate risk using:

(a) futures contracts,
(b) options over futures contracts,

and recommend which method the company should use in this case.
Test your understanding 6: Futures and options

Futures hedge

To set up the hedge, Chesterfield Co needs to sell 20 September futures contracts, at a price of 96.10.

Basis workings:

<table>
<thead>
<tr>
<th></th>
<th>1 April</th>
<th>1 August</th>
<th>30 Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIBOR</td>
<td>3.50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Futures price</td>
<td>96.10</td>
<td>(i.e. 3.90%)</td>
<td></td>
</tr>
<tr>
<td>Basis</td>
<td>−0.40%</td>
<td>−0.13% (W2)</td>
<td>0 (W1)</td>
</tr>
</tbody>
</table>

(W1) Basis will reduce to zero by the expiry date of the contract, because on that date, the futures price will equal 100 - the (known) LIBOR rate.

(W2) Assuming basis reduces in a linear manner, the basis at 1 August should be 2/6 of the original −0.40% i.e. −0.13%.

From this information we can derive the lock-in rate as

Implied interest rate (i.e. 100 − current futures price) + unexpired basis on the transaction date.

=3.90% − 0.13% = 3.77%

However, since Chesterfield Co can borrow at 25 basis points above LIBOR, the rate applicable to Chesterfield Co is 3.77% + 0.25% = 4.02%.

Therefore, the likely financial result of this futures hedge is that 4.02% × $5m × 6/12 is payable, i.e. $100,500. This will be the case whatever the LIBOR rate moves to on the transaction date.

Tutorial note:

Although it wasn't necessary to calculate the closing futures price to find the financial result of the futures hedge, the workings below show how it would have been calculated in this case, using the example of a 0.50% increase and decrease in LIBOR for reference – a possibility which was trailed by the question. The closing rates can then be used to prove the financial result figure shown above, but also to use in the options hedges below.
### Basis workings (revisited):

<table>
<thead>
<tr>
<th></th>
<th>1 April</th>
<th>1 August</th>
<th>30 Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIBOR</td>
<td>3.50%</td>
<td>3.00% or 4.00%</td>
<td></td>
</tr>
<tr>
<td>Futures price</td>
<td>96.10</td>
<td>96.87 or 95.87</td>
<td></td>
</tr>
<tr>
<td>(i.e. 3.90%)</td>
<td></td>
<td>(i.e. 3.13% or 4.13%) (W3)</td>
<td></td>
</tr>
<tr>
<td>Basis</td>
<td>−0.40%</td>
<td>−0.13%</td>
<td>0</td>
</tr>
</tbody>
</table>

(W3) Basis is the difference between LIBOR and the implied futures price interest rate, so (for the 3.00% LIBOR rate) implied interest rate is 3.00% + 0.13% = 3.13% and futures price is 96.87.

Therefore, to confirm the financial result of the futures hedge calculated from the lock-in rate above:

<table>
<thead>
<tr>
<th>$</th>
<th>4.00% LIBOR</th>
<th>3.00% LIBOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest payable ($5m × 6/12 × (LIBOR + 0.25%))</td>
<td>(106,250)</td>
<td>(81,250)</td>
</tr>
<tr>
<td>Futures market: Sell at 96.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>−for 4% LIBOR buy at 95.87, so gain = 0.23%</td>
<td>5,750</td>
<td></td>
</tr>
<tr>
<td>−for 3% LIBOR buy at 96.87, so loss = 0.77%</td>
<td></td>
<td>(19,250)</td>
</tr>
<tr>
<td>(in both cases, apply the gain/loss % to the 20 × $500k × 3/12 contracts covered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net financial position</td>
<td>(100,500)</td>
<td>(100,500)</td>
</tr>
</tbody>
</table>

Effective interest rate (financial position/$5m) × (12/6) × 100

| | 4.02% | 4.02% |

Exactly as calculated earlier, by the much quicker lock-in rate method.

### Options hedge:

To set up the hedge, Chesterfield Co needs to buy 20 September put options, at an exercise price of 96.40. The upfront premium payable will be 0.360% of the amount covered i.e. 0.360% × 20 contracts × $500,000 × (3/12) = $9,000.
The above forecasts of closing futures prices will now be useful to help calculate the financial position under the options hedge:

<table>
<thead>
<tr>
<th></th>
<th>4.00% LIBOR</th>
<th>3.00% LIBOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Put options, so sell at (exercise price)</td>
<td>96.40</td>
<td>N/A</td>
</tr>
<tr>
<td>Buy at closing futures price</td>
<td>95.87</td>
<td>N/A</td>
</tr>
<tr>
<td>Therefore, gain on options</td>
<td>0.53%</td>
<td>N/A</td>
</tr>
<tr>
<td>Monetary gain on options (0.53% × 20 contracts × $500k × 3/12)</td>
<td>13,250</td>
<td>0</td>
</tr>
<tr>
<td>Interest payable ($5m × 6/12 × (LIBOR + 0.25%))</td>
<td>(106,250)</td>
<td>(81,250)</td>
</tr>
<tr>
<td>Cost of option premium</td>
<td>(9,000)</td>
<td>(9,000)</td>
</tr>
<tr>
<td>Net financial position</td>
<td>(102,000)</td>
<td>(90,250)</td>
</tr>
</tbody>
</table>

Effective interest rate (financial position / $5m) × (12/6) × 100

|                | 4.08% | 3.61% |

Hedging using the interest rate futures market fixes the rate at 4.02%, whereas with options on futures, the net cost changes.

If interest rates fall in the future then a hedge using options gives the more favourable rate. However, if interest rates increase then a hedge using futures gives the lower interest payment cost.

Before deciding which method is preferred, the company needs to consider what the more likely future interest rate movement will be.
- **Collars**

  - Options are expensive as the company needs to pay the premium on the options purchased. However, options provide the company with the flexibility to take advantage of favourable movement in interest rate while protecting the company from an adverse movement in rates.

  - A collar is a way of achieving some flexibility at a lower cost than a straight option.

    - **Loan interest**
      - **Deposit Interest**
      - Buy put options - sets max cost
      - Buy calls options - set min receipts
      - + Sell call options - limits min cost
      - + Sell put options - limits max receipts

    ![Diagram showing loan and deposit interest with options strategies.]

      - **Loan Interest**
        - Protect company
        - 10%
        - 8%
        - Benefits counterparty
        - Buy a put option - a cap
        - Sell a call option - a floor
        - Open market interest rate
        - Sets a higher limit - maximum cost.
        - Sets a lower limit - minimum cost.

      - **Deposit Interest**
        - Protect company
        - 9%
        - 7.5%
        - Benefits counterparty
        - Sell a put option - a cap
        - Buy a call option - a floor
        - Open market interest rate
        - Sets a higher limit - maximum receipts.
        - Sets a lower limit - minimum receipts.
Example: Option Prices

Liffe option price on three-month Sterling December futures

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calls</td>
</tr>
<tr>
<td>93.50</td>
<td>2.20</td>
</tr>
<tr>
<td>94.00</td>
<td>1.74</td>
</tr>
<tr>
<td>94.50</td>
<td>1.32</td>
</tr>
<tr>
<td>95.00</td>
<td>0.87</td>
</tr>
</tbody>
</table>

- If a company had a deposit of £500,000 and the treasurer wanted to hedge the position using traded options, he would buy a call option. If he purchased it at an exercise price of 95.00 he would be buying the right to interest receipts at 5% this would cost him a premium 0.87% (i.e. 0.87% × 100) 87 ticks (i.e. 87 × £12.50) = £1,088 per contract.

- If he purchased it at 93.50 he would be buying the right to interest receipts at 6.50% this would cost him a premium 2.20% (i.e. 2.20% × 100) 220 ticks (i.e. 220 × £12.50) = £2,750 per contract.

- The premium cost of the option will obviously depend on the exercise price chosen. Buying a call option at 93.50 should be more expensive than buying at 95.00, as the company has a greater chance of a profit when it comes to closing out its futures position.

**CALL OPTIONS – deposit – highest net receipt.**

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Deposit interest</th>
<th>Cost</th>
<th>Net Receipt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>93.50</td>
<td>6.50</td>
<td>(2.20)</td>
<td>4.30</td>
</tr>
<tr>
<td>94.00</td>
<td>6.00</td>
<td>(1.74)</td>
<td>4.26</td>
</tr>
<tr>
<td>94.50</td>
<td>5.50</td>
<td>(1.32)</td>
<td>4.18</td>
</tr>
<tr>
<td>95.00</td>
<td>5.00</td>
<td>(0.87)</td>
<td>4.13</td>
</tr>
</tbody>
</table>

**PUT OPTIONS – loan – lowest total payment**

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>Loan interest</th>
<th>Cost</th>
<th>Total Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>93.50</td>
<td>6.50</td>
<td>1.25</td>
<td>7.75</td>
</tr>
<tr>
<td>94.00</td>
<td>6.00</td>
<td>1.84</td>
<td>7.84</td>
</tr>
<tr>
<td>94.50</td>
<td>5.50</td>
<td>2.90</td>
<td>8.40</td>
</tr>
<tr>
<td>95.00</td>
<td>5.00</td>
<td>3.46</td>
<td>8.46</td>
</tr>
</tbody>
</table>
Example:

A company wishes to borrow £10m on the 1st of January for three months. The company does not wish to pay above its current rate of 10% the company borrows at LIBOR + a fixed margin of 2% (therefore they will buy a put at 92.00 to ensure a maximum company cost of 10%). LIBOR is currently 8%.

Having made initial enquiries it has been discouraged by the costs of the option. A member of its treasury team has suggested the use of a collar to reduce the premium cost of the purchased option. The company believes that LIBOR will not fall below 5.5% (therefore they will sell a call at 94.50 thus ensuring a minimum cost of 5.5%).

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>CALLS March</th>
<th>CALLS June</th>
<th>PUTS March</th>
<th>PUTS June</th>
</tr>
</thead>
<tbody>
<tr>
<td>90.50</td>
<td>2.20</td>
<td>2.10</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>91.00</td>
<td>1.80</td>
<td>1.70</td>
<td>0.05</td>
<td>0.07</td>
</tr>
<tr>
<td>91.50</td>
<td>0.95</td>
<td>0.91</td>
<td>0.18</td>
<td>0.20</td>
</tr>
<tr>
<td>92.00</td>
<td>0.80</td>
<td>0.77</td>
<td>0.20</td>
<td>0.22</td>
</tr>
<tr>
<td>92.50</td>
<td>0.70</td>
<td>0.68</td>
<td>0.25</td>
<td>0.28</td>
</tr>
<tr>
<td>93.00</td>
<td>0.66</td>
<td>0.60</td>
<td>0.28</td>
<td>0.30</td>
</tr>
<tr>
<td>93.50</td>
<td>0.50</td>
<td>0.48</td>
<td>0.30</td>
<td>0.32</td>
</tr>
<tr>
<td>94.00</td>
<td>0.40</td>
<td>0.36</td>
<td>0.35</td>
<td>0.40</td>
</tr>
<tr>
<td>94.50</td>
<td>0.15</td>
<td>0.12</td>
<td>0.60</td>
<td>0.70</td>
</tr>
<tr>
<td>95.00</td>
<td>0.07</td>
<td>0.05</td>
<td>1.20</td>
<td>1.40</td>
</tr>
<tr>
<td>95.50</td>
<td>0.02</td>
<td>0.01</td>
<td>2.10</td>
<td>2.50</td>
</tr>
</tbody>
</table>

Calculate the effective interest rate the company will pay using a collar if:

A LIBOR rise to 9.5% and future prices move to 90.20.
B LIBOR fall to 4.5% and future prices move to 96.10.
Solution:

A  Interest rates exceed the cap so the company will exercise its put option: \( (9.5\%) + (2\%) + (-0.20 + 0.15) + 92.00 - 90.20 = (9.75\%) \).

B  Interest rates have fallen below the floor so the bank will exercise its call option: \( (4.5\%) + (2\%) + (-0.20 + 0.15) - 96.10 + 94.50 = (8.15\%) \).
Swaption illustration

Shun Inc has a $10m loan, repayable in 5 years, at LIBOR + 2%. LIBOR is currently at 5.75%. The company is thus exposed to the risk of fluctuating interest rates.

The treasurer believes that LIBOR will stay low for the next two years, after which period, however, the outlook is at best uncertain. She would like to hedge this risk but is not sure if the current swap rate is the best available. The treasurer wants to lock in the swap rate in two years time for the following three years and have the flexibility to benefit from a lower swap rate should swap rates fall.

This is achieved by buying a 2-year option on a 3-year pay fixed 7% swap.

The decision that will have to be made in two years is illustrated below:

<table>
<thead>
<tr>
<th>Now</th>
<th>2 years</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buys swaption</td>
<td>Exercise date</td>
<td></td>
</tr>
<tr>
<td>Pays floating rate on loan</td>
<td>If 3-yr swap rate &gt;7%, then the swaption is exercised. Firm pays 7% fixed.</td>
<td></td>
</tr>
</tbody>
</table>
QUESTION

TRENTER INC
(ACCA 3.7 JUN 07)(CHAPTERS 11,15 AND 18)

Assume that it is now 1 June.

Trenter Inc has invested in the ordinary shares of each of five companies which it has identified as potential future take-over targets.

Trenter’s managers are concerned that the recent rise in the share price index might not last, and share prices could fall during the next three or four months.

Trenter does not want to sell any of the shares, but wishes to gain some protection against possible falls in share price. The company’s financial advisers have suggested three alternatives:

(i) stock index futures
(ii) options on stock index futures
(iii) a synthetic short position in the index, using both call and put options at the same exercise price.

Market data

<table>
<thead>
<tr>
<th>Investment</th>
<th>Shares held (000)</th>
<th>Share price (cents)</th>
<th>Equity beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fangle</td>
<td>250</td>
<td>740</td>
<td>1.35</td>
</tr>
<tr>
<td>Knoten</td>
<td>400</td>
<td>510</td>
<td>1.26</td>
</tr>
<tr>
<td>Dupple</td>
<td>120</td>
<td>1,140</td>
<td>1.15</td>
</tr>
<tr>
<td>Wraiter</td>
<td>310</td>
<td>365</td>
<td>0.82</td>
</tr>
<tr>
<td>Plesenn</td>
<td>1,435</td>
<td>98</td>
<td>1.65</td>
</tr>
</tbody>
</table>

The 100 share index of the relevant Stock Exchange is currently 5930, and the face value of an index contract is $10 per point.

Stock Exchange (SE) 100 Stock Index Futures

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>5936</td>
</tr>
<tr>
<td>September</td>
<td>5950</td>
</tr>
</tbody>
</table>

Options on SE 100 Stock Index Futures

<table>
<thead>
<tr>
<th>Exercise price</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Call</td>
</tr>
<tr>
<td>5625</td>
<td>331.0</td>
</tr>
<tr>
<td>5925</td>
<td>140.0</td>
</tr>
</tbody>
</table>

Required:

(a) Illustrate how each alternative might be used to hedge against falling share prices. The type of hedge, number of contracts and hedge cost should be shown wherever relevant. (9 marks)

(b) If, in September, the actual market prices had moved as shown below, calculate and comment upon the outcomes of each of the hedges.

<table>
<thead>
<tr>
<th>Investment</th>
<th>Share price (cents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fangle</td>
<td>680</td>
</tr>
<tr>
<td>Knoten</td>
<td>479</td>
</tr>
<tr>
<td>Dupple</td>
<td>1,026</td>
</tr>
<tr>
<td>Wraiter</td>
<td>370</td>
</tr>
<tr>
<td>Plesenn</td>
<td>78</td>
</tr>
</tbody>
</table>

SE 100 stock index futures price: 5585 (6 marks)

(c) The regulation of takeovers varies from country to country. Outline the typical factors that such regulation includes. (5 marks)

(Total: 20 marks)
Answer:

TRENTER INC

(a) Stock index futures

In order to protect against possible falling share prices September stock index futures should be sold. If actual share prices fall, the value of the futures contracts will also fall. The futures contracts may be closed out at a lower price than they were sold for, resulting in a futures market gain to offset the loss from actual share price movements. If the futures contract is held to maturity the hedge will lock into the futures price of 5950.

The number of contracts will depend upon the portfolio beta, estimated below.

<table>
<thead>
<tr>
<th>Investment</th>
<th>Shares held (000)</th>
<th>Share price (pence)</th>
<th>Market value($)</th>
<th>MV x Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fangle</td>
<td>250</td>
<td>740</td>
<td>1,850,000</td>
<td>2,497,500</td>
</tr>
<tr>
<td>Knoten</td>
<td>400</td>
<td>510</td>
<td>2,040,000</td>
<td>2,570,400</td>
</tr>
<tr>
<td>Dupple</td>
<td>120</td>
<td>1,140</td>
<td>1,368,000</td>
<td>1,573,200</td>
</tr>
<tr>
<td>Wrate</td>
<td>310</td>
<td>365</td>
<td>1,131,500</td>
<td>927,830</td>
</tr>
<tr>
<td>Plesen</td>
<td>1,435</td>
<td>98</td>
<td>1,406,300</td>
<td>2,320,395</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>7,795,800</strong></td>
<td><strong>9,889,325</strong></td>
</tr>
</tbody>
</table>

The portfolio beta is: \( \frac{9,889.325}{7,795.800} = 1.269 \)

The contract size is the current index value of 5930 x $10 = $59,300. (NB In some futures markets the contract size could be the futures price of 5,950 x $10 = $59,500. This is an acceptable answer.)

As the portfolio beta is higher than the index beta (assumed to be the market beta of 1), the hedge must be adjusted for the additional risk of the portfolio.

Hedge:

\[
\text{Sell } \frac{7,795,800}{59,300} \times 1.269 = 166.83 \text{ or 167 contracts}
\]

Options on stock index futures

Futures have the disadvantage of locking into an expected outcome, no matter how the associated cash market has performed. Options on futures allow the buyer of the option to either exercise the option and fix a worst case outcome, or, if market prices move in favour of the investor, to let the option lapse. In this case if the stock index was to rise above the relevant exercise price the option would not be exercised.

September put options should be purchased.

If Trenter wishes to protect current share prices, the closest option to the current index price of 5930 should be selected, which is 5925.

As with futures 167 contracts should be purchased. If the index value falls to below 5925 by the time of expiry of the option, the option would be exercised and futures sold at 5925 but immediately repurchased at a lower price to close out the deal and generate a profit. If the index value moved above 5925 the contract would not be exercised. The disadvantage of the option is that a premium of 108, or 108 x $10 = $1,080 per contract has to be paid to purchase the option. For 167 contracts this is $180,360, or approximately 2.3% of the portfolio value. This is a relatively expensive form of hedge.
Synthetic short position

The cost of an option hedge may be reduced by creating a synthetic short position. This would involve buying a put option with an exercise price of 5925 as above, but simultaneously selling a call option at the same exercise price. This would result in net premium paid of $(108.0 - 140.0) \times 10 \times 167 = (53,440)$, i.e. a net receipt.

This hedge protects against downside risk, but also takes away any potential benefit if market prices were to increase. It has created a synthetic short future.

(b) Outcomes of the hedges

Stock index futures

<table>
<thead>
<tr>
<th>Investment</th>
<th>Market value($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fangle</td>
<td>1,700,000</td>
</tr>
<tr>
<td>Knoten</td>
<td>1,916,000</td>
</tr>
<tr>
<td>Dupple</td>
<td>1,231,200</td>
</tr>
<tr>
<td>Wraier</td>
<td>1,147,000</td>
</tr>
<tr>
<td>Plesem</td>
<td>1,119,300</td>
</tr>
</tbody>
</table>

7,113,500

The market value of the shares has fallen by $682,300

The futures market gain is $167 \times (5950 - 5585) \times $10 = $609,550.

Overall there is a loss of $72,750, which would mean the hedge efficiency had been

89% \left( \frac{609,550}{682,300} \times 100\% \right)

Options on stock index futures

The option would be exercised to yield a futures gain of $167 \times (5925 - 5585) \times $10 = $567,800.

The net result including the cost of the option is $567,800 - $682,300 - $180,360 = $294,850, a much larger loss than the futures hedge.

However, it must be remembered that if the SE 100 futures price had moved to above 5925, the option would not have been exercised, and Trenter would have benefited from the increase in market prices.

Synthetic short position

The profit from the put option would be $567,800 as above.

The call option would expire worthless meaning that Trenter would retain the entire premium from selling the calls.

Overall the loss is $567,800 + $53,440 (net premium received) - $682,300, or $61,060.

The creation of the synthetic short future provides a better outcome than the actual futures contract.
(c) The regulation of takeovers usually includes the following factors:

- At the most important time in the company’s life – when it is subject to a takeover bid – its directors should act in the best interest of their shareholders, and should disregard their personal interests.
- All shareholders must be treated equally
- Shareholders must be given all the relevant information to make an informed judgement.
- The board must not take action without the approval of shareholders, which could result in the offer being defeated.
- All information supplied to shareholders must be prepared to the highest standards of care and accuracy.
- The assumptions on which profit forecasts are based and the accounting polices used should be examined and reported on by accountants.
- An independent valuer should support valuations of assets.
Raising Finance – Pilot paper Q4

You are the chief financial officer of a multinational company in the Do-it-Yourself (DIY) retail business based in the United States. Your company is considering a major expansion into the rapidly developing China market where one of your competitors has already established a presence with three stores, one in Beijing and two in Shanghai. After conducting local market research and a personal review, you are convinced that, although your competitor has successfully opened a new market in those cities, the demand is considerably greater than its ability to supply. Your overseas operations group report that they can open the appropriate supply chains and that, unlike the competition, you will be able to get a greater variety of goods onto the shelves and maintain supply at competitive prices.

Your assessment is that the company will need to raise the equivalent of $380 million of new finance over 10 years for this venture, of which $80 million could come from the company’s existing liquid reserves. You have completed your review of the financial merits of the case and the project offers a rate of return in excess of 80 per cent. The company’s current credit rating is assessed at AA-. Its total market capitalisation is $3.5bn, which includes a ten year syndicated loan of $0.5 billion due for retirement in three years. The balance of the firm’s capital is in the form of common stock (ordinary shares) trading on the New York and Hong Kong markets.

You wish to undertake a preliminary review of the options for financing this project. Your assessment is that borrowing the money is a possibility but that the increase in gearing would drop your credit rating to A+. You believe that the likelihood of that happening is 60 per cent, with a further 40 per cent chance that the company’s rating could fall to A. The company’s existing weighted average cost of capital (tax adjusted at the company’s average corporation tax rate of 50 per cent) is 6.8 per cent. The current nominal yield curve and credit spreads for the retail sector are shown below:

Exhibit 1: 30 year yield curve

Exhibit 2: Yield spreads for retail sector (in basis points)

<table>
<thead>
<tr>
<th>Rating</th>
<th>1yr</th>
<th>2yr</th>
<th>3yr</th>
<th>5yr</th>
<th>7yr</th>
<th>10yr</th>
<th>30yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa/AAA</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>18</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Aa1/AA+</td>
<td>8</td>
<td>12</td>
<td>20</td>
<td>30</td>
<td>32</td>
<td>35</td>
<td>60</td>
</tr>
<tr>
<td>Aa2/AA</td>
<td>15</td>
<td>24</td>
<td>30</td>
<td>34</td>
<td>40</td>
<td>50</td>
<td>65</td>
</tr>
<tr>
<td>Aa3/AA-</td>
<td>24</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>54</td>
<td>56</td>
<td>78</td>
</tr>
<tr>
<td>A1/A+</td>
<td>28</td>
<td>37</td>
<td>44</td>
<td>55</td>
<td>60</td>
<td>70</td>
<td>82</td>
</tr>
<tr>
<td>A2/A</td>
<td>55</td>
<td>65</td>
<td>75</td>
<td>85</td>
<td>95</td>
<td>107</td>
<td>120</td>
</tr>
</tbody>
</table>

Required:

(a) Estimate the expected cost of capital for this project on the assumption that the additional finance is raised through a bond issue in the US market. (10 marks)

(b) Draft a brief report for the board which outlines the alternative sources of finance that are potentially available for this project. Include, in your report, a brief discussion of the advantages and disadvantages and the likely impact of each alternative source upon the firm’s cost of capital. (10 marks)

(20 marks)
RAISING FINANCE (PILOT PAPER Q4) - Answer

(b) Paper on the alternative sources of capital

For a company in this position the following sources of finance suggest themselves:
- Sale and lease back of existing assets
- US debt financed through a further bond issue
- Debt raised on the Chinese market
- Equity finance by rights or new issue

The choice of financing is partly down to the cost and availability of the various sources and partly down to the method the company chooses to hedge its FOREX exposure.

If we ignore foreign exchange considerations for a moment, pecking order theory suggests that debt should be preferred to equity and the weighted average cost of capital calculation suggests that the firm should increase its gearing to capture further tax shield effects which are not currently being offset by increased default risk (static trade off theory). However, issue costs may be expensive and the company may seek to raise finance by sale and lease back of existing assets. There are implications for reporting under FASB 13 depending upon whether the leases are financing or operating leases. Raising $300 million of debt by a bond issue is at the low end of the scale for new debt issues of this type although it may be possible that a syndicated issue where a number of companies of similar credit rating are joined by a lead bank could be arranged. It is to be expected that the costs of the issue will be high in terms of commissions and underwriting fees.

Raising finance directly in China has been eased considerably with recent changes in the rules of the Chinese Securities Regulatory Commission opening better access of foreign firms to the Chinese bond and equity markets. However, the entry of China into the WTO in 2002 is still subject to the economy as tariff barriers and other constraints are removed. This process of liberalisation is likely to continue accelerating although, as with any emerging market, there are risks associated with inward investment and capital entry. These risks may be sufficient to raise the risk assessment against this company and as a result the benign implications of increased gearing outlined above may not be realised in practice.

The problem of hedging the foreign exchange exposure can be partly solved by borrowing directly in China and using the income flows from the new venture to finance the interest charges and capital repayments. Because the borrowing and the income flows are in the same currency transactions exposure is largely eliminated although any appreciation in the Chinese currency would increase the dollar value of the translated debt in the firm’s balance sheet. If the borrowing is used to purchase matching assets in China then the translation risk is mitigated along with the transaction risk. However, if the assets are not owned but leased or rented then translation effects will impact upon the balance sheet and may be misread by the market.

A second alternative would be to raise finance in the US and then engage in a currency swap for a ten year term. The effect of this would be to lock in the current exchange rate for the duration of the borrowing. However, finding a swap of this type would entail the services of a financial institution specialising in bringing appropriate counter-parties together. Such derivative arrangements have been mis-sold in the past with disastrous leveraging effects built into the contract.