ISMA CENTRE - THE BUSINESS SCHOOL
OF THE FINANCIAL MARKETS

UNIVERSITY OF READING
ENGLAND

IFID Certificate Programme

Structured Securities

OTC Structures

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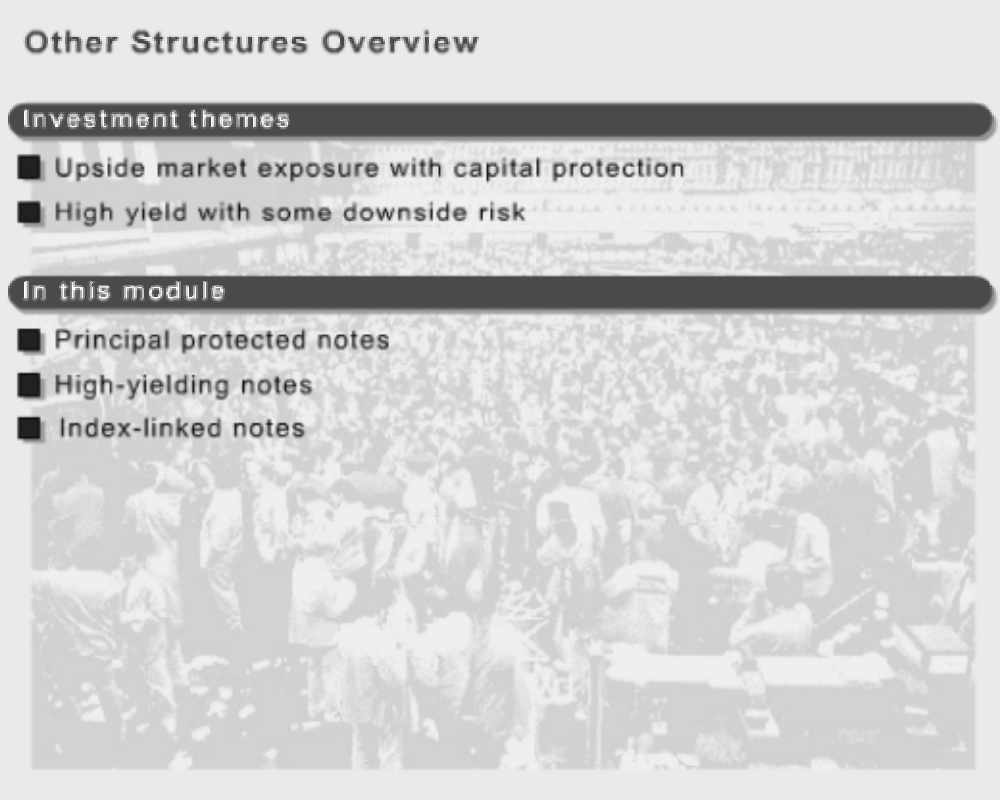
1. Overview



In this module we examine various structures not covered elsewhere which, in different ways, pursue much the same investment themes we find with structured securities in general:

- Upside market exposure with capital protection
- High yield with some downside risk

Most of the structures discussed here feature a fixed income security plus one or more embedded options (although there are some which use only forward-type contracts). Many of these structures contain exotic options, so you will find it useful to have covered *Exotic Options* before tackling this.

Learning Objectives

By the end of this module, you will be able to:

1. - Outline the generic structure of a principal protected note (PPN)
2. - Explain the rationale for issuing and investing in PPNs
3. - Outline the generic structure and investment rationale of a high yielding note
4. - Identify the types of option that have been embedded in a structured note by analysing the specification of the note's coupon structure and maturity payoff

2. Principal Protected Notes

Principal protected notes combine the features of a fixed income security, in terms of coupons and scheduled maturity, with upside exposure to one or more specified markets.

Also known as: **Capital protection bonds**, **Guaranteed return notes** (GRNs), **Guaranteed return structure** (GRS), **Index linked units** (IGLUs), **Equity participation notes** (EPNs), **Protected equity linked notes** (PENs), **Guaranteed return on investment** (GROIs).

Structure

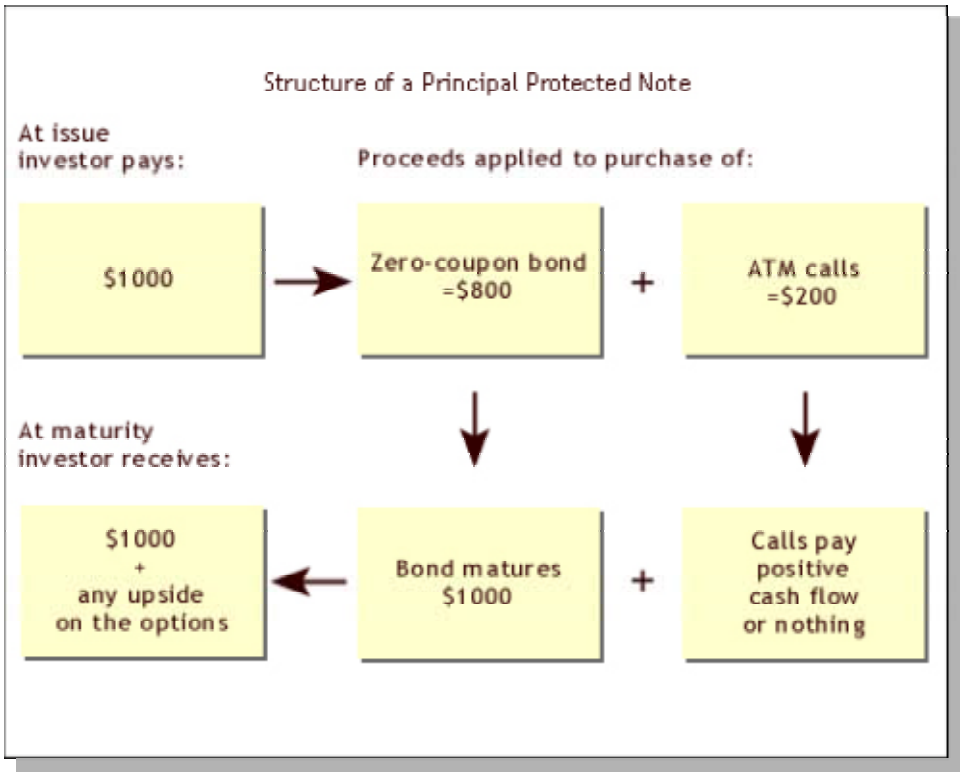
In their simplest form these structures are a package of:

- A low- or zero-coupon bond

  plus

- A call option on a given market or sector

The figure below shows the investor's cash flows at the issue and maturity of the note, and how the issuer applies the funds received.



How it Works

The bulk of the investor's capital is applied to the purchase of a low- or zero-coupon bond and the balance is used to buy as many call options as possible on the selected market, which is typically an equity market. The investor pays the premium on the calls from the interest that she should be earning on the bond.

At maturity of the structure, the principal on the bond guarantees the investor the full value of her principal, while any payoff on the options, if any, provides the potential windfall gain.

The issuer of this structure is short the call option. Unless the issuer is able to manage its risks, typically it will repurchase the option back from the bank which advised on the issue. This leaves the issuer with just a fixed income funding liability, at a known cost.

Example
Principal protected note.

Situation

The DAX-30 index of German stocks stands at 5,000 and a bank issues a Guaranteed Index Bond promising the following:

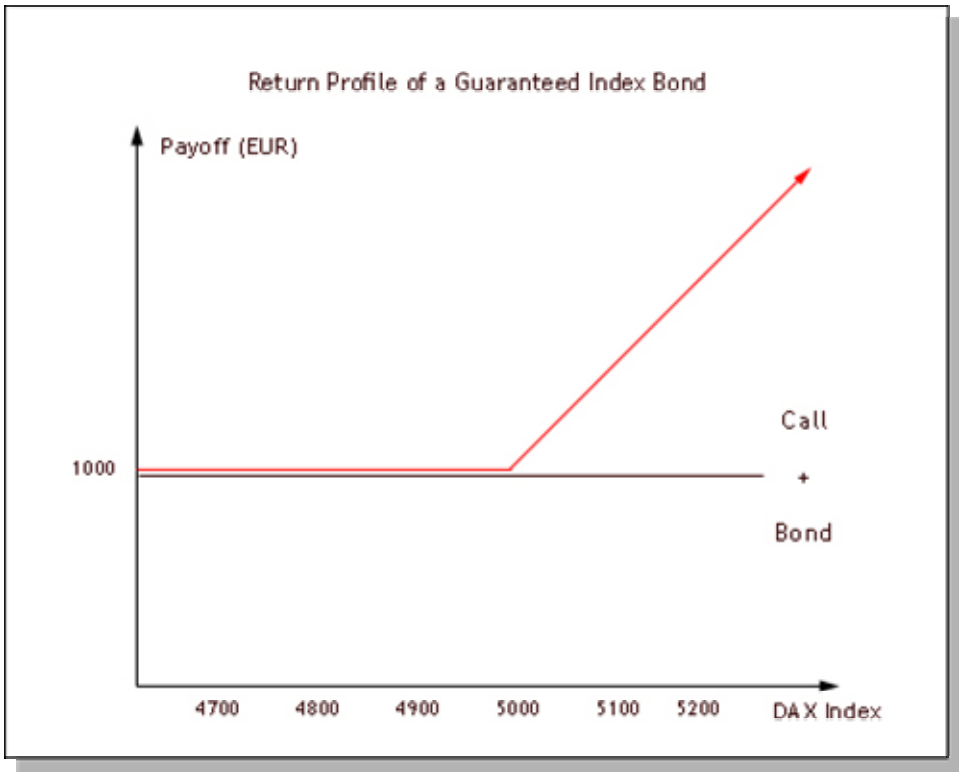
120% of the rise in the DAX-30 index of German equities over 5 years
or your money back - in full!

Analysis

This is simply a 5 year zero coupon bond plus a European-style ATM call on the DAX. The table below shows the payoff at maturity, under different equity market scenarios, for an investor placing EUR 1,000 into this structure:

DAX 30 Index	Payoff on zero	Payoff on call	Total
4800	1,000	0	1,000
4900	1,000	0	1,000
5000	1,000	0	1,000
5100	1,000	24	1,024
5200	1,000	48	1,048

- If the DAX is below 5,000 at the bond's maturity the investor receives her initial investment in full
- If the market rises 100 points to 5,100 (a 2% increase) the investor makes a return of EUR 24 (2.4%), *as if she had invested EUR 1,200*!
- If the market rises 200 points (4%) the investor gets EUR 48 (4.8%), and so on.



2.1. Gearing

In the example shown in the previous page, the structure achieves an effective gearing of 1.2 times (or 120%) the gain in the underlying equity market. The gearing that can be achieved depends on a number of factors:

- Cost of the underlying zero-coupon bond, therefore the amount of funds available to purchase the options. This is a function of the maturity of the structure, market yields and the issuer's credit rating.

- Volatility of the underlying market - the higher the volatility the more expensive are the options, so the lower is the gearing that can be achieved. In fact, all the factors that affect the pricing of options, which we saw in module Rates Trading and Hedging – Options Pricing and Risks, will affect the gearing that the issuer of the PPN can achieve.

- Strike of the embedded calls, which may be set above the current market to reduce premium cost and enhance gearing.

- The number of embedded options: some structures achieve higher gearing by capping the investor's upside (see the GROI example below).

- The nature of the embedded options. Some structures use exotic options to enhance their appeal to investors. For example:

    - To protect investors from any last-minute falls in the market at the maturity of the bond, the return is often based on the *average* of the equity index achieved during the last six months of the investment's life, rather than on its level at maturity - an average price or **Asian** option (see Asian Options - Applications)

    - To lock in any gains achieved on the index during the life of the investment, even if the index subsequently falls, the option is sometimes structured as a **ladder** (see Barrier Options - Applications) or as a **cliquet** (see Forward Options - Applications).

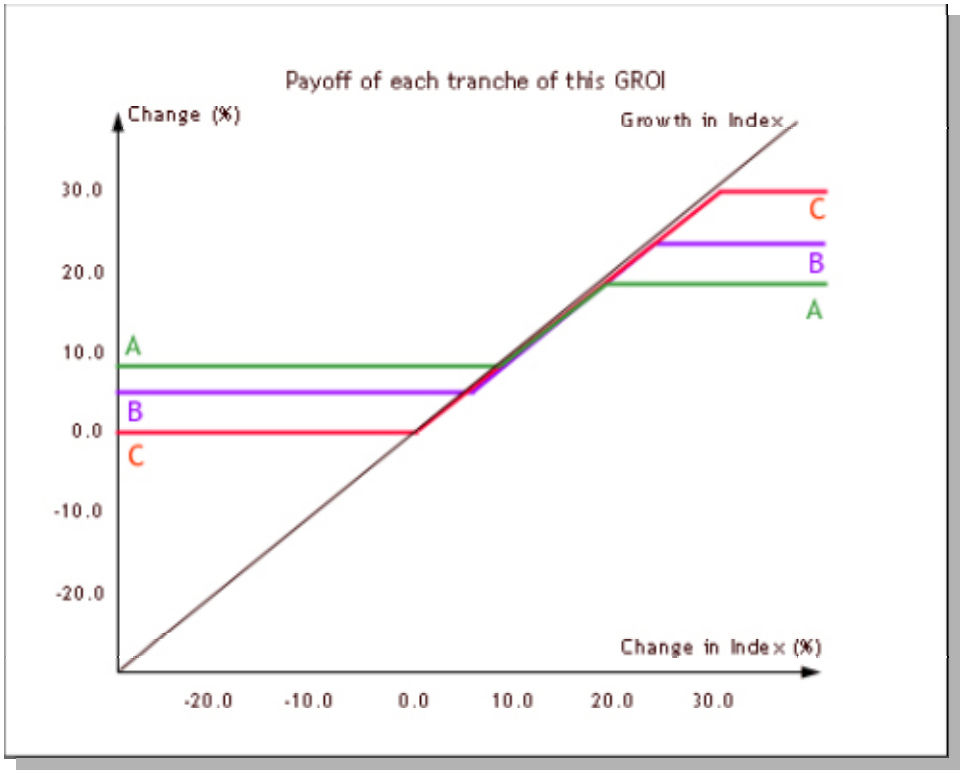
Example
Guaranteed Return on Investment (GROI).

GROI is SBC Warburg's proprietary name for a principal-protected equity-linked note consisting of a low- or zero-coupon bond plus a **vertical call spread** on the equity index (see *Options Strategies - Spread Trading*).

The cost of the call option on the underlying market is reduced by the sale of an OTM call. This enables the structure to pay a higher gearing but the investor's potential gain is capped. Below is an example of a 3-tranche GROI issue.

Maturity:	1 year
Coupon:	Zero
Underlying equity index:	FT-SE 100
Initial value of index:	6,500
Redemption value:	Investor can choose between 3 separate tranches with a minimum return at maturity, if the FT-SE is below 6,500, and a maximum return as follows: • Tranche A: min 8%, max 19% • Tranche B: min 5%, max 23% • Tranche C: min 0%, max 30%

The higher the minimum return guaranteed by each tranche, the lower is the cap level, as shown in the figure below.



3. High Yielders

When market yields are low, fixed income fund managers are under pressure to explore yield-enhancement strategies. These include:

- Buying paper with lower credit quality
- Earning fee income through securities lending
- Selling options

In many cases the security regulators (or the fund sponsors) limit the extent to which managers may pursue these strategies, in particular selling options. One way around this constraint is to embed the option(s) in a structured note, and in this section we explore some of the forms such structures have taken.

Example

Situation
The 12 month sterling LIBOR currently stands at 5.25% and the market expects UK rates to converge down to continental European levels. A top-name bank offers a sterling note on the following terms:

Currency:	GBP
Maturity:	12 months
Coupon:	5.75%
Issue price:	100.00

Principal repayment: Calculated according to the following formula:

$$\text{MIN}\left\{ 100.00 + 3 \times \frac{(5.75 - \text{Reference rate})}{100}, \; 0 \right\}$$

Reference rate: 12 month LIBOR at maturity of the note

Analysis
In essence, the investor is long a straight note and short a call option on the LIBOR, with a strike of 5.75%. At maturity, if LIBOR is higher than the strike the investor suffers a capital loss on the principal. The option premium is reflected in an above-market coupon and in this case amounts to 0.50% (= 5.75 - 5.25). The table below shows the net yield to maturity on the note under different LIBOR scenarios:

LIBOR	Coupon	Capital Gain	Net
5.25	5.75	0	5.75
5.50	5.75	0	5.75
5.75	5.75	0	5.75
6.00	5.75	-3 x 0.25 = -0.75	5.00
6.25	5.75	-3 x 0.50 = -1.50	4.25

3.1. Variations

- If her predictions are correct and UK rates do fall, then the investor earns an above-market yield but, if she gets it wrong, the downside is potentially unlimited. To limit their potential downside, notes of this type also typically set a floor price on the principal repayment at maturity; in effect the investor also buys an OTM call on the reference rate.

- As with principal protected notes, the gearing on these structures depends on a number of factors, including the nature of the embedded options (see section *Principal Protected Notes*). One popular variant is the **accrual note**.

  Interest on an accrual note stops accruing on any day when the market reference rate is above (or below) a certain pre-defined level.

  In a capped accrual note, the investor is long a fixed income security and short a strip of **digital options**, each with a payoff equal to one day of accrued interest; one of these options is set to expire on each day of the note's life! (See Digital Options).

- Another interesting variation on this theme is the **preferred equity redemption certificate** (PERC, see example below).

Example

Preferred Equity Redemption Certificates (PERCs).

PERCs are convertible preference shares with enhanced dividend yield, but capped upside on their market price.

Also known as: **Equity yield enhancement securities** (EYES), **Dividend enhanced convertible securities** (DECS), **Automatically converting equity securities** (ACES).

Both convertibles and bonds with warrants are appropriate funding vehicles when the issuer's share price has significant growth potential, enabling it to set the conversion price (or strike, if it is a warrant) at a premium to the underlying share price. However, there is a potential risk of equity dilution to existing shareholders, if the underlying shares perform well.

PERCs have been issued in situations where the issuer's share price is depressed and has low immediate growth prospects. It offers a higher dividend yield than ordinary shares or conventional prefs with limited risk of dilution. PERCs are convertible *at the issuer's option*:

- *Either* into the same number of ordinary shares, if the ordinaries are trading below a pre-determined **call price**

- *Or* into a smaller number of ordinary shares if the ordinaries are trading above the call price

Example

Issuer: ABC Corp
Issue price: $30.00 (same as the ordinary share at the time of issue)
Dividend: 6% fixed, payable quarterly (ordinaries yield 3.5%)
Maturity: 3 years
Conversion: Convertible before maturity *at the issuer's option* on the following terms:

Number of ordinary shares per PERC
= MIN { Call Price / Ordinary share price , 1 }

Conversion is mandatory on the same terms by the maturity date.

Call price: $35.00 (130% of the ordinary share price at the time)

Analysis
Consider the payoff to an investor holding 1,000 PERCs on the conversion date, under the following share price scenarios:

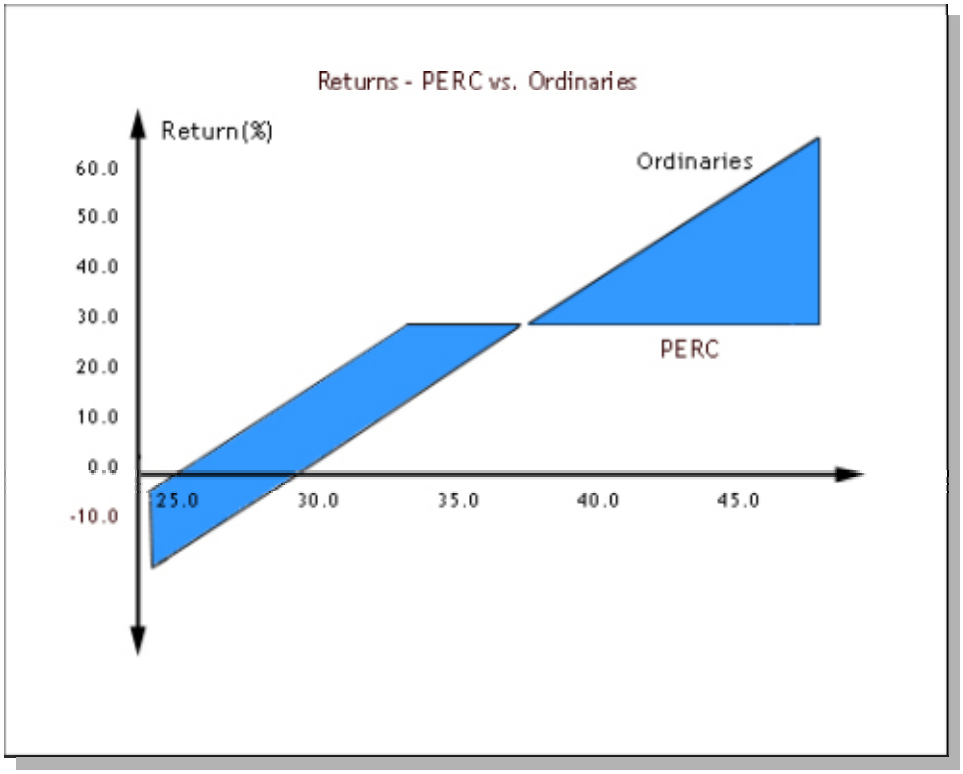
Ordinary Share	Number of Ordinaries Received	Market Value ($)	Return (%)
25.00	1,000	1,000 x 25.00 = 25,000	-16.7
30.00	1,000	1,000 x 30.00 = 30,000	0.0
35.00	1,000	1,000 x 35.00 = 35,000	16.7
40.00	35/40 x 1,000 = 875	875 x 40.00 = 35,000	16.7
45.00	35/45 x 1,000 = 777 (rounded)	777 x 45.00 = 34,965	16.7

If the ordinary shares perform well the investor receives correspondingly fewer ordinaries, thus limiting the market value of his holdings and hence the equity dilution to existing shareholders.

Now let's compare the *total* return of these PERCs (dividend plus capital gain) with the return from holding the equivalent number of ordinary shares over 3 years. (For simplicity we shall assume constant dividends on the ordinaries and we shall not compound the dividend income over the period).

Ordinary Share	PERCs			Ordinaries		
	Dividend (%)	Gain (%)	Net	Dividend (%)	Gain (%)	Net
25.00	18.0	-16.7	**1.3**	10.5	-16.7	**-6.2**
30.00	18.0	0.0	**18.0**	10.5	0.0	**10.5**
35.00	18.0	16.7	**34.7**	10.5	16.7	**27.2**
40.00	18.0	16.7	**34.7**	10.5	33.3	**43.8**
45.00	18.0	16.7	**34.7**	10.5	50.0	**60.5**

The figure below plots the return on the PERCs compared with that on the ordinaries.



The position is economically equivalent to the investor being long the ordinary shares and short out-of-the-money calls on these shares - a **covered call write** position (see *Options Strategies - Covered Sales*). The issuer effectively purchases call options on its shares and pays for them in the form of a higher dividend yield.

PERCs issues are popular at times of economic recession, because they provide a relatively high dividend yield to investors in poorly performing stocks, and they allow investors who are not normally permitted to trade in options effectively to write options in the underlying shares.

4. Exercise

4.1. Question 1

Question 1

An investment brochure published by a UK life assurance company reads as follows:

Are UK equities markets vulnerable?
Are you dissatisfied with the low yields available on fixed income investments?

The Guaranteed Index Bond (GIB) gives you an opportunity to participate in the rise of the FT-SE 100 index of UK stocks, but with 100% guarantee on your capital.

The GIB works like this:

- You purchase GIB certificates with a maturity of 5 years
- At maturity:
  - If the FT-SE rose you earn the rise in the index
  - If the FT-SE fell we return your capital in full

a) What are the main components embedded in this product?

- ☐ The investor is long a physically-settled call option on the FT-SE index
- ☐ The investor is long a zero-coupon bond
- ☐ The investor is long a par bond
- ☐ The investor is long a cash-settled call on the FT-SE index

b) If the 5 year yield (annually compounded) is 6.40%:

(i) For an investment of GBP 3,000.00, how much would be allocated to the purchase of the zero-coupon bond (to the nearest £5)?

GBP ☐

(ii) Therefore, how much would be left over to purchase the options?

GBP ☐

Type in your figures in each box and validate.

c) Using an option pricing model (spreadsheet), we shall now calculate the size of the option contract that could be purchased with the money calculated in (b)(ii).

In the pricing model, enter the following **Market data**:

Spot	6,342
Strike	6,342
Expiry (yrs)	5
Funding rate	6.40%
Yield	2.43%
Volatility	19%

What is the calculated option price?

(to the nearest index point)

Now close the option pricing model and calculate the contract size as follows:

Payoff in GBP per index point (to the nearest pence) = Answer to question (b)(ii) / Option price in index points

=

d) Next, we explore the payoff of this structure at maturity for different levels of the FT-SE. Using the results of part (c), complete the table below, which compares the maturity value of GBP 3,000 invested in the GIB with the value of an equivalent equity index portfolio. Enter your figures to the nearest pound.

FTSE Index	Value of GIB Investment			Value of FT-SE Portfolio
	Zero-coupon bond	Option	Net	
5342	3,000			
6342	3,000			
7342	3,000			
8342	3,000			

e) The GIB appears to outperform the equity portfolio under all market scenarios. Where's the catch? (One or more answers may be true.)

- ☐ There is no catch
- ☐ The GIB pays no interest
- ☐ The return on the equity portfolio should also include dividends!
- ☐ The options are too cheap!

f) What type of investor might be interested in this security?

- ☐ A very bullish investor who also perceived a lot of risk in the equity markets
- ☐ An investor who believed the equity market will remain subdued
- ☐ A very bearish investor
- ☐ A very bullish investor

g) The issuer is considering embedding one of the following call options to protect the gains on the index made during the life of the GIB, in case there was a last-minute drop in the equity market:

A: A ladder structure (see Barrier Options)
B: A cliquet structure (see Forward Options)
C: An up-and-out barrier call (see Barrier Options)
D: An average price (see Asian Options)

Which of these would *not* be relevant?

Which of these is likely to be cheapest? (in terms of premium cost)

h) The issuer of the GIB is exposed to movements in the FT-SE. Which (one or more) of the following strategies could they use to hedge that risk?

- ☐ Delta hedge using index futures
- ☐ Delta hedge with an index portfolio
- ☐ Buy an identical put option from an investment bank
- ☐ Buy an identical call option from an investment bank

4.2. Question 2

Question 2

A brochure from a top-name French bank reads as follows:

Are you dissatisfied with the current low yields on fixed income investments?
Do you find current equity valuations too high?

Cash-or-Shares is an investment that is linked to the performance of Groupe Bouygues, one of France's hottest stocks. It gives you an opportunity to earn above-average returns and at the same time acquire a blue-chip stock for your core equity portfolio at a 12% discount to the current market.

Cash-or-Shares works as follows:

- You purchase *Cash-or-Shares* certificates with a maturity of 12 months. During this time you earn EURIBOR + 150 basis points: much more than the current market!
- At maturity:
  - If the price of Bouygues common stock trades above EUR 181.82 you receive your principal in full
  - If the price of Bouygues trades below EUR 181.82 you receive 55 Bouygues shares for every EUR 10,000 you invested

a) If 12 month EURIBOR is 3.30% calculate below the yield to an investor under the following price scenarios for the underlying shares. Please enter answers to 2 decimal places.

Bouygues Share Price	Interest (%)	Capital Gain/loss on the Principal	Net Yield (%)
171.82	3.30 + 1.50 = 4.80		
176.82	4.80		
181.82	4.80		
186.82	4.80		
191.82	4.80		

b) What are the main components embedded in this product?

- ☐ The investor is short puts on the shares
- ☐ The investor is long a zero-coupon bond
- ☐ The investor is short calls on the shares
- ☐ The investor is long a par bond

c) What is the premium per share effectively received for the options sold?

EUR ☐