Interest Rate Derivatives

Fixed Income Trading Strategies – Questions and Case Studies

eurex

Interest Rate Derivatives

Fixed Income Trading Strategies – Questions and Case Studies

eurex

Contents – Exercises

Case Studies

Contents – Solutions

Questions

Case Studies

Workbook Structure and Objectives

This workbook provides you with the opportunity to apply and review your knowledge of the fixed income derivatives traded on Eurex. You will be asked a variety of questions based on the brochure **"Interest Rate Derivatives – Fixed Income Trading Strategies"**. The answers should familiarize you with this particular market segment and enhance your understanding of the contracts traded on Eurex. Furthermore, the case studies on selected key topics will allow you to put your knowledge and experience into practice.

It is recommended that you refer to the brochure **"Interest Rate Derivatives – Fixed Income Trading Strategies"** to help solve the questions and case studies. The workbook also contains proposed solutions to the questions and case studies, which will aid your progress.

You will need a calculator to work out the tasks in this workbook, as well as the brochure **"Eurex Products"** and the **"Trading Calendar"**.

Exercises

Characteristics of Fixed Income Securities

Bonds – Definition

Question 1
What is the coupon of fixed income securities based upon?

Question 2
Name the securities the Swiss National Bank issues in order to raise capital.

Question 3
Complete the following table for the German Government securities relevant to the Eurex fixed income derivatives.

German Government issues	Maturity	Coupon payment
German Federal Treasury Notes (Bundesschatzanweisungen)		
German Federal Debt Obligations (Bundesobligationen)		
German Federal Government Bonds (Bundesanleihen)		

Lifetime and Remaining Lifetime

Question 4
What is meant by the "lifetime" of a fixed income security?

Question 5
What is meant by the "remaining lifetime" of a fixed income security?

Nominal and Actual Rate of Interest (Coupon and Yield)

Question 6
At what trade price plus accrued interest is the yield of a fixed income security equivalent to its nominal rate of interest?

Question 7
A bond that bears a coupon of 5.25 percent yields 4.85 percent. Is the bond traded above or below par?

Accrued Interest

Question 8
For which period does the buyer of a fixed income security pay accrued interest to the seller?

Question 9
How does the month of February influence the calculation of accrued interest on German Federal Government Bonds, German Federal Debt Obligations and German Federal Treasury Notes in a leap year?

The Yield Curve

Question 10
Which is the most common yield curve structure prevailing on the German bond market? Please describe it.

Question 11
Describe an "inverted" yield curve.

Question 12
What do you call a yield curve, which offers the same yield for all remaining lifetimes?

Bond Valuation

Question 13
Name the factors which determine the price of a bond.

Question 14
Describe the relation between the market yield and the present value of a fixed income security.

Question 15
How do you calculate the clean price of a bond?

Macaulay Duration

Question 16
Explain what the Macaulay duration describes.

Question 17
How does the Macaulay duration change? – The Macaulay duration is higher:
The ... the remaining lifetime.
The ... the capital market interest rate.
The ... the coupon.

Question 18
The Macaulay duration of a zero-coupon bond is equivalent to …

Modified Duration

Question 19
Describe the concept of modified duration.

Question 20
Is the following statement true or false? The percentage change calculated by the modified duration refers to the clean price of the bond.

Question 21
What is the relationship between the modified duration and the Macaulay duration?

Convexity – the Tracking Error of Duration

Question 22
Which error occurs when using modified duration to calculate price changes?

Question 23
Does the tracking error of the modified duration cause the rise in the bond price as a result of market interest rate changes to be overestimated or underestimated?

Eurex Fixed Income Derivatives

Characteristics of Exchange-Traded Derivatives

Question 24
Explain the term “derivatives”.

Question 25
Why are derivatives also called forward transactions?

Question 26
What is the advantage of trading standardized contracts?

Question 27
Which types of products are traded at Eurex?

Question 28
What is the difference between exchange-traded instruments and derivatives traded in the over-the-counter (OTC) market?

Question 29
Which characteristics of Eurex trading ensure high liquidity of the traded instruments?

Question 30
Describe the leverage effect of futures positions.

Introduction to Fixed Income Futures

What are Fixed Income Futures? – Definition

Question 31
Describe the financial instruments underlying the fixed income futures traded at Eurex.

Question 32
Describe the obligations arising from a future on bonds issued by the Swiss Confederation (CONF Future).

Futures Positions – Obligations

Question 33
Is the following statement true or false? A long position in a Euro Bobl Future automatically results in an obligation to buy deliverable bonds at maturity.

Question 34
Selling a future is also called "entering a … position".

Question 35
Describe the obligations arising from a short position in the Euro Schatz Future.

Settlement or Closeout

Question 36
Explain the term "physical delivery".

Question 37
Which alternative do market participants usually prefer: holding the position until the delivery date and making or taking physical delivery, or closing out the position before maturity?

Question 38
Describe how an investor can close out a long position of 40 contracts in the September 2002 CONF Future.

Contract Specifications

Question 39

Which maturity months are available for fixed income futures and what is the maximum remaining lifetime?

Question 40

Indicate the minimum price movement (tick) of Eurex fixed income futures. State its value in euros or Swiss francs.

Question 41

What is the nominal value of the bonds the seller of twelve Euro Schatz Futures has to deliver at maturity?

Question 42

Complete the following table:

Underlying: German Government issues	Contract value	Remaining lifetime of the deliverable bond at the delivery date	Product code
Euro Schatz Future			
Euro Bobl Future			
Euro Bund Future			
Euro Buxl Future			

Underlying: Swiss Government bonds	Contract value	Remaining lifetime of the deliverable bond at the delivery date	Product code
CONF Future			

Question 43

Is the following statement true or false? An obligation to deliver which arises from a short position in a Euro Schatz Futures contract, can only be fulfilled by German Federal Treasury Notes which have a remaining lifetime of 1¾ to 2¼ years at the delivery date. These Federal Treasury Notes must have a minimum issue size of EUR 2 billion.

Futures Spread Margin and Additional Margin

Question 44
Describe the concept of time spread positions with futures.

Question 45
Which open futures positions are subject to margin requirements?

Question 46
Which is usually the higher margin rate for instruments within the same margin class, the Futures Spread Margin or the Additional Margin?

Variation Margin

Question 47
Give the formula for the calculation of the Variation Margin (daily settlement of profits and losses) when entering into a new long futures position.

Question 48
What position does an investor hold if its margin account is debited in the case of rising prices for the underlying instrument?

The Futures Price – Fair Value

Question 49
Is the following statement true or false? If the market is in equilibrium, the theoretical price of a future has to be such that it should be possible to realize risk-free profits using counter transactions on the cash and forward markets.

Question 50
How do you calculate the theoretical price of a future?

Question 51
Does interest accrued until maturity reduce or increase the price of a future?

Question 52
Which interest rate is commonly used to calculate the financing costs of a future?

Cost of Carry and Basis

Question 53
Describe the concept of cost of carry.

Question 54
What is the relation between the futures price and the price of the underlying instrument in the case of a positive basis?

Question 55
What is the value of the basis at maturity of the futures contract?

The Conversion Factor (Price Factor)

Question 56
Describe the role of the conversion factor.

Question 57
Complete the following statement: The lower the coupon of a deliverable bond, the … the conversion factor and, consequently, the delivery price of this bond.

Question 58
Is the following statement true or false? The conversion factor of a deliverable bond is constant for a given delivery date.

The Cheapest-to-Deliver (CTD) Bond

Question 59
Which bond is the CTD?

Bond 1: Proceeds from a sale of the bond on the cash market: EUR 104,930; delivery price of the bond: EUR 105,117.

Bond 2: Proceeds from a sale of the bond on the cash market: EUR 105,090; delivery price of the bond: EUR 104,992.

Question 60
In which cases can the CTD change?

Question 61

What implications arise for the long position if it is the CTD that is delivered, as opposed to another deliverable bond?

Question 62

The conversion factor helps to make different bonds comparable. Why does a CTD exist nevertheless?

Question 63

Is the following statement true or false? If the market yield is below the notional coupon level, bonds with a shorter duration (higher coupon given similar maturities/ shorter maturity given similar coupons) will be preferred for delivery.

Applications of Fixed Income Futures

Trading Strategies

Question 64
What is the central function of derivatives markets?

Question 65
What are the reasons for trading in derivatives?

Question 66
Explain the role of arbitrage in the derivatives markets.

Question 67
Which futures position do you establish if you want to speculate on rising yields in the eight to 13 year segment in Swiss Government bonds?

Question 68
Define the term "trading".

Basic Futures Strategies

Question 69
Which risk positions in futures can you enter into?

Question 70
Indicate three essential advantages of trading fixed income futures in comparison to trading bonds.

Long Positions ("Bullish Strategies")

Question 71
Why is taking long positions in fixed income futures called a "bull strategy"?

Question 72
Describe the motives for taking a long position in the Euro Schatz Future.

Question 73
Which is the strategy an investor uses to speculate on declining yields at the long end of the Swiss yield curve?

Short Positions ("Bearish Strategies")

Question 74

Why is taking short positions in fixed income futures called a "bear strategy"?

Question 75

A trader holds an open short position of 15 Euro Bobl Futures. At the time of the valuation the settlement price has risen 48 ticks in comparison with the previous day's rate. What is the Variation Margin? Has the trader made a profit or a loss?

Question 76

An investor expects euro yields in the eight to ten year segment to rise in the next few days. Which futures contract will the investor decide to trade to reflect this view? Will the investor establish a long or a short position?

Spread Strategies

Question 77

Describe how a spread strategy is established.

Question 78

What is the purpose of establishing a spread position with fixed income futures?

Question 79

Is the following statement true or false? The risk potential of a spread position in fixed income futures is higher than that of an outright long or short position in the future because the risks of the single positions are cumulative.

Time Spread

Question 80

What does an investor speculate on if it opens a time spread position in fixed income futures and considers both contracts as correctly valued?

Question 81

An investor plans to enter into a long time spread position on the Euro Bund Future in May 2002. Give a detailed description of the three options it has.

Question 82

Which positions on the Euro Bund Future do you recommend to an investor who expects in mid-November that one-month interest rates (i.e. financing costs) will rise more strongly than four-month rates over the next few days?

Inter-Product Spread

Question 83

What kind of spread does an investor establish if it simultaneously opens a long position in the June Euro Bund Future and a short position in the June Euro Bobl Future?

Question 84

Construct an inter-product spread, which, on the basis of a normal yield curve, speculates on a steeper yield curve in the five- to ten-year segment.

Question 85

Why is it necessary to dynamically adjust the positions in inter-product spreads if investors want to completely exclude influences from market interest rate fluctuations?

Hedging Strategies Using Fixed Income Futures

Question 86

What risk are positions in German Government bonds subject to?

Question 87

In one month's time, you expect a cash inflow of EUR 200,000 from a life insurance policy that you want to invest in German Government bonds with a remaining lifetime of ten years. How can you hedge the current price level?

Choice of the Futures Contract

Question 88

How do you construct your portfolio in order to minimize the basis risk between the bonds to be hedged and the future used for doing so?

Question 89

On which grounds should an investor choose the contracts used for hedging purposes if there are no contracts with the same lifetime as the bonds to be hedged?

Determining the Hedge Ratio

Question 90

Describe what the hedge ratio is.

"Perfect Hedge" versus "Cross Hedge"

Question 91

Describe the potential profits and losses of a portfolio, which theoretically is completely hedged by fixed income futures (so-called "perfect hedge").

Question 92

Explain why it is hardly possible to implement a perfect hedge of a bond portfolio in practice.

Question 93

How can an investor reduce a portfolio's interest rate sensitivity by using fixed income futures, but still retain some profit potential?

Question 94

Describe the concept of a cross hedge.

Nominal Value Method

Question 95

In which case is the nominal value method sufficient to calculate the hedge ratio?

Modified Duration Method

Question 96

What is the advantage of using the modified duration method instead of the nominal value method to calculate the hedge ratio?

Question 97

How do you calculate the modified duration of a bond portfolio if you know the modified duration of the individual bonds?

Question 98

Is the following statement true or false? Due to the implicit projection error of the modified duration, this method for calculating the hedge ratio only yields satisfactory results for infinitesimal changes in yields.

Sensitivity Method

Question 99

Explain the term "basis point value".

Question 100

How do you calculate the basis point value of a cash market position?

Using Modified Duration for Partial Hedges

Question 101

How do you best use modified duration for partial hedges?

Static and Dynamic Hedging

Question 102

Why is it useful to regularly adjust the futures position of an existing hedge position (dynamic hedging)?

Question 103

What is the objective of static hedging?

Cash-and-Carry Arbitrage/Reverse Cash-and-Carry Arbitrage

Question 104

Describe the concept of arbitrage.

Question 105

Describe a cash-and-carry arbitrage with CONF Futures.

Question 106

Describe the components of a reverse cash-and-carry arbitrage transaction.

Question 107

When is a risk-free arbitrage transaction possible?

Introduction to Options on Fixed Income Futures

Options on Fixed Income Futures – Definition

Question 108
Name the options on Eurex fixed income futures currently available for trading.

Question 109
When does the settlement of the option premium for options on fixed income futures take place?

Question 110
Is the following statement true or false? The settlement of profits and losses of options on fixed income futures occurs only when the position is closed out or exercised, or when it expires.

Question 111
Are options on futures traded at Eurex European or American-style?

Options on Fixed Income Futures – Rights and Obligations

Question 112
Indicate the four basic option positions on fixed income futures.

Question 113
Describe the rights and obligations of a long put position in an option on a fixed income future.

Question 114
Is the following statement true or false? The seller of an option can only get free of its obligation by closing out the position.

Question 115
What are the alternatives for a holder of an option on fixed income futures, with respect to the position, during its lifetime?

Closeout

Question 116
How do you close out a short position of 400 put options, with an exercise price of 108.75 on the September 2002 Euro Schatz Future?

Exercising Options on Fixed Income Futures

Question 117

Complete the following table. What happens when options on fixed income futures are exercised or assigned?

Exercise of a …	Assignment of a …	Assignment of a …	Exercise of a …
long call option	short call option	short put option	long put option
results in the opening of a …			
… futures position	… futures position	… futures position	… futures position

Question 118

You are assigned an obligation to buy an August 2002 short put option on the Euro Schatz Future. Which futures position is opened for you?

Contract Specifications – Eurex Options on Fixed Income Futures

Question 119

What are the expiration months regularly available for options on fixed income futures on April 5 of a given year?

Question 120

Calculate the option premium (in euros) for a long position of 25 call options on the March 2002 Euro Bund Future, exercise price 110.00, which is trading at a price of 1.58 points.

Question 121

Indicate the Last Trading Day for the put option on the September 2002 Euro Schatz Future, exercise price 108.75, assuming that September 1 is a Sunday.

Premium Payment and Risk Based Margining

Question 122

Which margin component(s) does the margin requirement for options on fixed income futures usually comprise?

Question 123

Describe the concept of futures-style premium posting.

Question 124

Why are long positions in options on fixed income futures also subject to margin requirements?

Question 125

Indicate the Variation Margin for an open position of 40 short call options, exercise price 109.00, on the March 2002 Euro Bobl Future, which were sold at 0.26 points (26 basis points/ticks) today and are quoted at a Daily Settlement Price of 0.38 points (38 basis points/ticks). Indicate whether a profit or a loss was realized.

Question 126

You hold a short position in a call option on the June 2002 Euro Bund Future, exercise price 109.50, for four days. During this period moderate changes occur in both the option premium and the price of the underlying futures contract. You close out the position with a profit on the last day of the holding period. Did the Additional Margin remain constant over the whole period?

Option Price

Components

Question 127
What are the components of the theoretical price of an option?

Intrinsic Value

Question 128
What is the intrinsic value of an option with a price of 251 basis points if the time value is 180 basis points?

Question 129
Which components does the value of an option comprise of on its Last Trading Day?

Question 130
Complete the following table by indicating the relation between the exercise price and the market price of the future, and the intrinsic value (<,>,=).

	Out-of-the-money	At-the-money	In-the-money
Call	Exercise price … Futures price; intrinsic value … 0	Exercise price … Futures price; intrinsic value … 0	Exercise price … Futures price; intrinsic value … 0
Put	Exercise price … Futures price; intrinsic value … 0	Exercise price … Futures price; intrinsic value … 0	Exercise price … Futures price; intrinsic value … 0

Time Value

Question 131
In which case(s) is an option's premium equivalent to its time value?

Question 132
An out-of-the-money option's on the Euro Bund Future carries a premium of 1.05 points/EUR 1,050. What is the option's time value?

Question 133
Calculate the time value of a 103.50 put option on the June 2002 Euro Schatz Future with a premium of 0.08 points, assuming that the futures contract trades at 104.12 at the same time.

Determining Factors

Question 134
Is the following statement true or false? The lower the exercise price of an in-the-money call in comparison to the current price of the underlying instrument, the higher the intrinsic value of the option.

Volatility of the Underlying Instrument

Question 135

Which factors determine the time value of an option on a fixed income future?

Question 136

Describe the concept of historical volatility.

Question 137

Which type of volatility can serve as an indicator of market participants' expectations of yield fluctuations in liquid markets?

Remaining Lifetime of the Option

Question 138

In what way does the time value of an option depend on its remaining lifetime?

Question 139

Which option positions benefit from a decline in the remaining lifetime?

Question 140

Does it make sense to exercise options on fixed income futures before expiration?

Influencing Factors

Question 141

What happens to the premium of a put option on the Euro Bund Future if prices of German Government bonds with a maturity of 8½ to 10½ years increase?

Question 142

How are supply and demand reflected in the price of an option?

Important Risk Parameters ("Greeks")

Question 143
Name the variable influencing factors affecting an option's price and the corresponding risk parameter for options on fixed income futures.

Question 144
Generally speaking, what do the risk parameters describe?

Question 145
What is the purpose of calculating risk parameters?

Delta

Question 146
Complete the following table by indicating the possible values for delta.

Delta for long call positions	
Delta for long put positions	

Question 147
What does a delta of –0.45 mean for a position of one short call option on the Euro Bobl Future? Indicate the gain (or loss) in value of the short call position (in euros) for a change of 100 basis points in the price of the Euro Bobl Future.

Question 148
What is the position delta of an at-the-money short put position?

Gamma

Question 149
What does the gamma of an option position describe?

Question 150
Complete the following table by indicating the sign (positive/negative) of the position gamma.

	Long call	Short call	Long put	Short put
Position gamma				

Question 151
When does gamma reach its highest value relative to individual options?

Vega (Kappa)

Question 152
Explain what vega describes.

Question 153
Is the following statement true or false? The smaller the time value of an option, the larger its vega (kappa).

Question 154
Which positions benefit from declining volatility in the underlying instrument?

Theta

Question 155
Which sign does theta carry in the case of long positions in options on fixed income futures?

Question 156
For which options does theta tend to be highest?

Trading Strategies for Options on Fixed Income Futures

Long Call

Question 157
What is the market expectation of holders of a long call option on the Euro Bund Future?

Question 158
Describe the profit and loss potential of a long call option on the Euro Schatz Future.

Question 159
How can you determine the break-even of a long call position at the end of its lifetime?

Short Call

Question 160
How does the seller of a call on the Euro Bund Future expect long term yields to develop?

Question 161
Describe the profit and loss potential of a short call option on the Euro Bobl Future.

Question 162
Which transaction allows the seller of a call option on the Euro Bund Future to be released from the obligations arising from the sale?

Long Put

Question 163
How does the buyer of a put on the Euro Bobl Future expect five-year yields on the German capital market to develop?

Question 164
Describe the profit and loss potential of a long put option on the Euro Schatz Future.

Short Put

Question 165

What is the expectation of the seller of a put on the Euro Schatz Future regarding the price development of the Euro Schatz Future?

Question 166

Describe the profit and loss potential of a short put option on the Euro Schatz Future.

Question 167

How can you determine the break-even of a short put position at the end of its lifetime?

Bull Call Spread

Question 168

Construct a bull call spread on the Euro Bund Future using the options given below. The Euro Bund Future is currently trading at 108.27. You expect the futures price to rise towards 110.00 by the end of the options' lifetime.

Exercise price	Call premium on the March 2003 Euro Bund Future	Put premium on the March 2003 Euro Bund Future
108.00	1.18	1.18
110.00	0.47	2.47

Question 169

What is the formula for calculating the break-even of a bull call spread at the end of its lifetime?

Question 170

Is a bull call spread constructed with options on the Euro Bund Future subject to margin requirements (Additional Margin)?

Bear Put Spread

Question 171

Construct a bear put spread on the Euro Bobl Future using the options given below. The March 2003 Euro Bobl Future is currently trading at 106.87. You expect the futures price to fall towards 105.00 by the end of the options' lifetime.

Exercise price	Call premium on the March 2003 Euro Bobl Future	Put premium on the March 2003 Euro Bobl Future
107.00	0.70	1.02
105.00	2.03	0.27

Question 172

What is the formula for calculating the maximum profit of a bear put spread?

Question 173

Is a bear put spread with options on the Euro Schatz Future more sensitive to changes in the volatility of the Euro Schatz Future than a single at-the-money long put position on the Euro Schatz Future?

Long Straddle

Question 174

Construct a long straddle on the Euro Schatz Future using the options given below. The Euro Schatz Future is currently trading at 103.96. You expect the volatility of the Euro Schatz Future to increase in the short term.

Exercise price	Call premium on the March 2003 Euro Schatz Future	Put premium on the March 2003 Euro Schatz Future
105.00	0.06	2.05
104.00	0.33	0.34
103.00	1.02	0.06

Question 175

Generally speaking, will the holder of a long straddle be interested in holding the position until the expiration of the options?

Question 176

What does an investor speculate on if it holds an at-the-money long straddle in options on the Euro Bund Future?

Long Strangle

Question 177

Construct an out-of-the-money long strangle on the Euro Schatz Future using the options given below. The Euro Schatz Future is currently trading at 103.98. You expect the volatility of the Euro Schatz Future to increase in the medium term.

Exercise price	Call premium on the March 2003 Euro Schatz Future	Put premium on the March 2003 Euro Schatz Future
105.00	0.06	2.05
104.00	0.33	0.34
103.00	1.02	0.06

Question 178

Indicate which position is more sensitive to changes in the volatility of the Euro Bobl Future in absolute terms, given identical lifetime of the options:

A long strangle constructed with two out-of-the-money options on the Euro Bobl Future, or a long straddle constructed with two at-the-money options on the Euro Bobl Future.

Question 179

What are the formulas used to calculate the break-even points of a long strangle with out-of-the-money options at expiration?

Hedging Strategies Using Options

Hedging Strategies for a Fixed Time Horizon

Question 180
Describe the purpose of hedging strategies for a fixed time horizon (i.e. the option's expiration date) using options on fixed income futures.

Question 181
Which option positions on the Euro Bund Future can be used to hedge an existing German Government bond portfolio relative to the expiration date of the option against changes in long-term capital market yields?

Question 182
What is the overall position if a long futures position of 40 Euro Bobl Futures is hedged by 40 at-the-money put options?

Delta Hedging

Question 183
Why is delta hedging also called "dynamic hedging"?

Question 184
How many at-the-money put options on the Euro Bobl Future are necessary to hedge a position delta of +EUR 5,000/point on a cash-market position in German Federal Debt Obligations (Bundesobligationen)?

Gamma Hedging

Question 185
What is the objective of a gamma hedge?

Question 186
Use at-the-money options on the Euro Bund Future to construct a gamma hedge for a German Government bond portfolio with a position delta of +EUR 3,000/point.

Question 187
Which position in the Euro Schatz future is the equivalent of an option position comprising of an at-the-money long put and an at-the-money short call on the Euro Schatz Future?

Zero Cost Collar

Question 188

You hold a German Government bond portfolio with a delta that corresponds to a futures equivalent of ten Euro Bund Futures contracts. Construct a zero cost collar using the options on the Euro Bund Future given below.

Out-of-the-money call on the September 2002 Euro Bund Future	In-the-money put on the September 2002 Euro Bund Future
At-the-money call on the September 2002 Euro Bund Future	At-the-money put on the September 2002 Euro Bund Future
In-the-money call on the September 2002 Euro Bund Future	Out-of-the-money put on the September 2002 Euro Bund Future

Question 189

Which strategy has the same profit and loss profile at expiration as a zero cost collar?

Question 190

Why is this position called "zero cost collar"?

Futures/Options Relationships, Arbitrage Strategies

Synthetic Long Call

Question 191

Construct a synthetic long call on the Euro Schatz Future using the positions given below.

Short September 2002 Euro Schatz Future	Long September 2002 Euro Schatz Future
At-the-money long call on the September 2002 Euro Schatz Future	At-the-money short call on the September 2002 Euro Schatz Future
At-the-money long put on the September 2002 Euro Schatz Future	At-the-money short put on the September 2002 Euro Schatz Future

Question 192

Identify the delta (in EUR/point) of a synthetic long call position constructed by buying one contract of the Euro Bund Future and an out-of-the-money put option on the Euro Bund Future (delta: –0.35).

Question 193

In which market situation does it make sense to enter into a synthetic long call on the Euro Bund Future?

Synthetic Short Call

Question 194

Construct a synthetic short call on the Euro Bund Future using the positions given below.

Short September 2002 Euro Bund Future	Long September 2002 Euro Bund Future
At-the-money long call on the September 2002 Euro Bund Future	At-the-money short call on the September 2002 Euro Bund Future
At-the-money long put on the September 2002 Euro Bund Future	At-the-money short put on the September 2002 Euro Bund Future

Question 195

Describe the profit and loss potential of a synthetic short call.

Question 196

Does a synthetic short call on the Euro Bund Future, which consists of a short Euro Bund Future and an out-of-the-money short put on the same contract, represent an out-of-the-money, an at-the-money or an in-the-money option?

Synthetic Long Put

Question 197

Construct a synthetic long put on the Euro Bobl Future using the positions given below.

Short September 2002 Euro Bobl Future	Long September 2002 Euro Bobl Future
At-the-money long call on the September 2002 Euro Bobl Future	At-the-money short call on the September 2002 Euro Bobl Future
At-the-money long put on the September 2002 Euro Bobl Future	At-the-money short put on the September 2002 Euro Bobl Future

Question 198

What is the maximum profit of a synthetic long put?

Question 199

How do you construct a synthetic out-of-the-money long put on the Euro Schatz Future?

Synthetic Short Put

Question 200

Construct a synthetic short put on the Euro Schatz Future using the positions given below.

Short September 2002 Euro Schatz Future	Long September 2002 Euro Schatz Future
At-the-money long call on the September 2002 Euro Schatz Future	At-the-money short call on the September 2002 Euro Schatz Future
At-the-money long put on the September 2002 Euro Schatz Future	At-the-money short put on the September 2002 Euro Schatz Future

Question 201

In which market situation does it make sense to enter into a synthetic short put on the Euro Bobl Future?

Question 202

How do you construct a synthetic in-the-money short put on the Euro Schatz Future?

Reversal

Question 203

Construct a reversal on the Euro Bund Future using the positions given below.

Short September 2002 Euro Bund Future	Long September 2002 Euro Bund Future
At-the-money long call on the September 2002 Euro Bund Future	At-the-money short call on the September 2002 Euro Bund Future
At-the-money long put on the September 2002 Euro Bund Future	At-the-money short put on the September 2002 Euro Bund Future

Question 204

What is the main purpose of entering into synthetic long futures positions?

Question 205

When does it make sense to enter into a synthetic long future?

Conversion

Question 206

Is the following statement true or false? A combination of a synthetic long future and a "real" short future is called conversion.

Question 207

Construct a conversion on the Euro Bund Future using the positions given below.

Short September 2002 Euro Bund Future	Long September 2002 Euro Bund Future
At-the-money long call on the September 2002 Euro Bund Future	At-the-money short call on the September 2002 Euro Bund Future
At-the-money long put on the September 2002 Euro Bund Future	At-the-money short put on the September 2002 Euro Bund Future

Question 208

Is the following statement true or false? If the put option is cheap or the call option is expensive (both in relative terms), a risk-free profit can be achieved by creating a synthetic short futures position and combining it with a "real" long futures contract.

Accrued Interest

Question 209

In the market situation described below you want to buy the following Federal Debt Obligation to a nominal value of EUR 500,000 on July 23, 2002[1] (Tuesday). Please calculate the accrued interest and the invoice amount.

Federal Debt Obligation	
Nominal value	EUR 500,000
Coupon	3.25 %
Current price	98.89
Coupon payment date	05/19/2002

[1] For the purpose of simplification, all calculations are made on the following basis: Settlement date = Trade date + 2 days.

Bond Valuation

Question 210

Using the terms detailed below, calculate the price of the following bond for the settlement date of November 14, 2002 (Thursday), assuming a flat yield curve:

Capital market interest rate p.a.	3.55%
Bond	German Federal Debt Obligation, maturing on 15 February 2008
Nominal value	100
Coupon	4.00%
Settlement date	11/14/2002
First coupon date	02/15/2003
Remaining term for the first coupon	93 days

Indicate the present value (dirty price) first.

Calculate the bond price (clean price) for the settlement date (November 14, 2002).

Macaulay Duration

Question 211

You hold the following German Federal Debt Obligation in your portfolio. Using the terms indicated below, calculate the Macaulay duration of this bond for the settlement date of November 14, 2002 (Thursday), assuming a flat yield curve.

Capital market interest rate p.a.	3.55%
Bond	German Federal Debt Obligation, maturing on 15 February 2008
Nominal value	100
Coupon	4.00%
Settlement date	11/14/2002
First coupon date	02/15/2003
Remaining term for the first coupon	93 days
Present value (dirty price)	105.09

A few days later you open a new bond position which consists of the bonds indicated below. Indicate the Macaulay duration for the portfolio.

	Bond 1	**Bond 2**	**Bond 3**
Type of bond	Straight	Straight	Straight
Coupon	4.00%	4.20%	3.75%
Remaining lifetime	7 years	10 years	5 years
Nominal value	100,000	50,000	60,000
Present value (dirty price)	102.75	105.39	100.90
Market value	102,750	52,695	60,540
Share in the portfolio	47.60%	24.40%	28.00%
Macaulay duration	6.25 years	8.42 years	4.65 years

Modified Duration

Question 212

You hold a German Federal Debt Obligation with a nominal value of EUR 400,000, with has a remaining lifetime of about four years and a coupon of six percent. In order to assess the interest rate risk of this position, you want to know by how much the present value of the bond changes (in percentage terms) if market interest rates move by one unit (one percentage point). Calculate the modified duration of the bond described below, assuming a capital market interest rate of 4.14 percent, and indicate by how much the present value of the bond is expected to change if market yields rise by one percentage point.

Bond	
Type of bond	Straight
Coupon	6.00%
Remaining lifetime (years)	4 years and 22 days
Nominal value	EUR 400,000
Bond price (clean price)	106.81
Bond value (clean price)	EUR 427,240
Accrued interest	EUR 22,560
Macaulay duration	3.55 years

Convexity – the Tracking Error of Duration

Question 213

We have found out how the value of the bond position described above (see the case study for "Modified Duration") changes in relation to a one percentage point move in market yields. Calculate the actual percentage change in the value of the bond by determining the "error of duration": convexity. Also indicate the percentage change in the bond's present value, considering the impact of convexity.

Bond	
Type of bond	Straight
Coupon	6.00%
Market yield	4.14%
Remaining lifetime	4 years and 22 days
Nominal value	100
Present value	112.45
Accrued interest	5.64
Calendar days left until the next coupon payment date	22
Macaulay duration	3.55 years

Futures Spread Margin and Additional Margin

Question 214

On December 13, 2002, you open a long position of ten Euro Bobl Futures contracts expiring in March 2003. Eurex's margin parameter for the relevant margin class (FGBM) is 1.0 percentage point (EUR 1,000). Indicate the Additional Margin which must be pledged.

On December 17, 2002, you sell ten Euro Bobl Futures contracts expiring in June 2002 against your existing position. Indicate the Futures Spread Margin for your position in the case of a Spread Margin rate on the Euro Bobl Future of EUR 140 (back month) and EUR 350 (spot month).

Variation Margin

Question 215

You open a long position of twelve Euro Bund Future contracts at a price of 110.40, on November 25, 2002, at about 2:00 p.m. Please calculate the Variation Margin for the corresponding Daily Settlement Prices until the position is closed out on November 28, 2002, and state the total profit/loss on the position.

Date	Settlement price	Ticks	Tick (basis point) value (EUR)	Number of contracts	Variation Margin (EUR)
11/25/2002	110.15				
11/26/2002	109.45				
11/27/2002	109.90				
11/28/2002	109.60				
Total	–		–		

The Futures Price – Fair Value

Question 216

Using the terms shown below, calculate the futures price of a 5.25 percent Federal Republic of Germany Government bond, which matures on January 4, 2012. Note that a coupon payment date will occur during the lifetime of the futures contract.

Remaining lifetime of the future (T – t)	87 days
Price (clean price) of the bond (C_t)	101.76
Nominal interest rate of the bond (coupon) (c)	5.25 %
Accrued interest $c \frac{t - t_0}{365}$	4.93 %
Short-term refinancing rate ($_c r_t$)	3.42 %
Maturity date of the bond	01/04/2012
Settlement day for the future and the bond	12/13/2002

We assume that the bond is deliverable into the March 2003 Euro Bund Future. Calculate the theoretical futures price of the March 2003 Euro Bund Future (remaining lifetime: 87 days), assuming that the bond described above is the cheapest-to-deliver (CTD) for that contract and that the Eurex conversion factor for this bond is 0.949546.

The Cheapest-to-Deliver (CTD) Bond

Question 217

There are two bond issues eligible for delivery into the June 2002 Euro Bund Future. Please check which bond is the cheapest-to-deliver by comparing the prices at the settlement date in case of a physical delivery. The market yield is below the six percent notional coupon of the futures contract.

	5,25% Federal Republic of Germany – 01/04/2011	**5,00% Federal Republic of Germany – 07/04/2011**
Price of the bond	100.58	98.84
Nominal interest rate of the bond (coupon)	5.25%	5.00%
Accrued interest of the bond at futures maturity	2.26%	4.67%
Maturity date of the bond	01/04/2011	07/04/2011
Conversion factor	0.950591	0.934161
Final Settlement Price for the Euro Bund Future June 2002	106.20	106.20
Maturity date of the future	06/10/2002	06/10/2002

Time Spread

Question 218

A trader wishes to go long the June/September Euro Bund futures calendar spread. Based on the following information, what would be the theoretical break-even financing rate, on the assumption that the CTD bond in the front month contract will also be the same as in the far month contract?

If the financing rate falls, how might this affect the June/September spread?

What other factors will affect the profitability of this long calendar spread trade?

	June	September
Future	106.20	105.60
Conversion factor	0.931516	0.932838
Accrued Interest at delivery in EUR	2,151	3,411
Number of days between the June and September delivery dates		92

Inter-Product Spread

Question 219

In mid-November, you expect the currently normal but relatively steep yield curve to flatten in the two- to five-year maturity range. How will yields in this range develop?

The market situation is as follows:

Valuation date	11/14/2002 ("today")
December 2002 Euro Bund Future	109.59
December 2002 Euro Bobl Future	106.04
December 2002 Euro Schatz Future	103.30
Ratio Euro Bobl/Euro Bund (based on interest rate sensitivity)	8:5
Ratio Euro Schatz/Euro Bobl (based on interest rate sensitivity)	5:2

Please construct an inter-product spread that will help you to benefit from your market expectation described above. What is the smallest tradable unit of this spread, taking into account the interest rate sensitivities of the contracts used?

By the beginning of December your forecast has turned out to be correct, and the market situation is now as shown below. What is your profit/loss per unit?

Valuation date	12/03/2002
December 2002 Euro Bund Future	109.85
December 2002 Euro Bobl Future	108.80
December 2002 Euro Schatz Future	103.69

Choice of the Futures Contract

Question 220

In November 2002 you hold a German Government bond with a remaining lifetime of six years. The following futures can be used to hedge against interest rate risks:

Futures contract	Last traded price	Traded contracts
December 2002 Euro Bund Future	106.17	449,133
March 2003 Euro Bund Future	105.83	126,845
June 2003 Euro Bund Future	105.27	497
December 2002 Euro Bobl Future	105.05	221,723
March 2003 Euro Bobl Future	104.75	93,686
June 2003 Euro Bobl Future	104.15	355
December 2002 Euro Schatz Future	102.96	246,399
March 2003 Euro Schatz Future	102.66	80,994
June 2003 Euro Schatz Future	102.24	0

Which futures contract do you choose?

Determining the Hedge Ratio

Question 221

By mid-November 2002 you hold the following bonds, which are eligible for delivery into a futures contract:

	Bond 1	Bond 2
Issuer	Federal Republic of Germany	Federal Republic of Germany
Maturity date	07/04/2007	06/04/2008
Coupon	6.00 %	5.25 %
Nominal value	EUR 5,000,000	EUR 2,000,000
Price	107.21	104.52

Which futures contract do you choose if you want to hedge against changes in interest rates?

Which method do you use to calculate the hedge ratio? Please substantiate your answer.

Nominal Value Method

Question 222

On December 12, 2002, you hold the following bonds:

	Bond 1	Bond 2	Bond 3
Issuer	Swiss Confederation	Swiss Confederation	Swiss Confederation
Maturity date	01/06/2014	06/10/2012	02/11/2013
Coupon	4.25%	2.75%	4.00%
Nominal value	CHF 2,000,000	CHF 750,000	CHF 1,350,000
Price	108.91	95.41	106.21

Please calculate the hedge ratio, assuming that the bonds in your portfolio are eligible for delivery into the CONF Futures contract March 2003, which is trading at 120.75. Indicate whether you have to buy or sell the contracts.

Modified Duration Method

Question 223

On December 3, 2002, you hold the following German Government bonds in your portfolio:

	Bond 1	Bond 2	Bond 3
Type of bond	Straight	Straight	Straight
Coupon	5.00%	5.25%	4.50%
Maturity date	01/04/2011	07/04/2012	01/04/2008
Nominal value	EUR 1,000,000	EUR 500,000	EUR 600,000
Price	101.31	103.36	100.44
Market value	EUR 1,058,671.13	EUR 527,747.77	EUR 627,268.88
Share in the portfolio	47.82%	23.84%	28.34%
Modified duration	–6.26	–7.30	–4.29

You would like to hedge your bond portfolio by selling March 2003 Euro Bund Future contracts. Please calculate the hedge ratio and indicate how many contracts you have to sell. The market conditions are as follows:

Present value of the CTD bond	102.71
March 2003 Euro Bund Future	105.83
Modified duration (CTD)	–6.74
Conversion factor of the CTD	0.950491

Sensitivity Method

Question 224

You hold a portfolio of Swiss Confederation bonds with the following characteristics:

Clean price of the portfolio	CHF 12,005,639.78
Accrued interest	CHF 252,150.68
Modified duration of the portfolio	–7,56

Please calculate the hedge ratio required to fully hedge this portfolio, using the sensitivity method, and indicate how many futures contracts must be sold. The market situation is as follows:

March 2003 CONF Future	120.86
Modified duration of the CTD	–9.79
Market value of the CTD	105.21 × 100,000 = CHF 105,210
Conversion factor of the CTD	0.803191

Using Modified Duration for Partial Hedges

Question 225

You expect uncertainty in the Swiss bond market to increase during the next few days. However, you do not want to hedge your bond position completely against interest rate risks as you still see some potential for a rise in bond prices. You decide to reduce the interest rate risk of your bond position to one quarter of the current exposure.

Clean price of the portfolio	CHF 32,071,692.04
Accrued interest	CHF 1,200,182.91
Modified duration of the portfolio	–9.56

Please calculate the ratio for a partial (25 percent) hedge of this portfolio and indicate how many futures must be sold. The market situation is as follows:

March 2003 CONF Future	120.86
Modified duration of the CTD	–9.79
Market value of the CTD	105.21 × 100,000 = CHF 105,210
Conversion factor of the CTD	0.803191

Cash-and-Carry Arbitrage/ Reverse Cash-and-Carry Arbitrage

Question 226

Your analysis shows that the March 2003 Euro Bund Future is overvalued in the current market environment. You therefore decide to pursue a cash-and-carry strategy.[2]

Please calculate the profit per futures contract of the arbitrage strategy, assuming the Final Settlement Price stated below is calculated on the Last Trading Day:

Valuation date	**12/13/2002 ("today")**
Clean price of the CTD (C)	101.45
Nominal interest rate of the bond (coupon) (c)	5.25%
Accrued interest $(c \frac{t - t_0}{365})$	4.93%
Accrued interest until futures maturity $(c \frac{T - t}{365})$	0.93%
Maturity date of the bond (t_A)	January 4, 2011
Conversion factor	0.950491
Traded futures price when entering into the strategy	106.38
Remaining lifetime of the future (T – t)	87 days
Reinvestment period of the coupon	65 days
Short-term refinancing and reinvestment rate ($_c r_t$)	3.42%
Final Settlement Price of the future	106.55

[2] Note that transaction and financing costs as well as income from margin flows are not taken into account for the purposes of this case study.

Delta

Question 227

In mid-December 2002 you hold the position shown below. The March 2003 Euro Bobl Future is trading at 105.06.

Position	Price	Number of contracts	Option delta (points)	Position delta (EUR/point)
Long March 2003 Euro Bobl Future	105.06	30	1	
Long 104.50 put on the March 2003 Euro Bobl Future	0.34	20	–0.25	
Short 105.50 call on the March 2003 Euro Bobl Future	0.39	60	–0.43	
Total	–	–	–	

In order to manage your position you need to find out how strongly your position reacts to price changes in the Euro Bobl Future. Please calculate the impact of a 100 tick price rise in the Euro Bobl Future to 106.06.

Gamma

Question 228

In mid-December 2002 you hold a position in the March 2003 Euro Bobl Future, as well as various options based on the same contract.

Position	Price	Number of contracts	Option delta (points)	Option gamma (percent/point)	Position gamma (EUR/Punkt)
Long March 2003 Euro Bobl Future	105.06	30	1	0	
Long 104.50 put on the March 2003 Euro Bobl Future	0.34	20	–0.25	0.44	
Short 105.50 call on the March 2003 Euro Bobl Future	0.39	60	–0.43	–0.35	
Total	–	–	–	–	

In order to manage your position you need to know by how much (expressed in euros) the delta of your portfolio changes if the price of the Euro Bobl Future rises by one unit. (100 ticks)

Long Call

Question 229

It is the middle of December 2002. You expect five-year yields to decline. Although you want to benefit from the expected strong uptrend in the Euro Bobl Future, you also want to limit your losses in case your forecast turns out to be incorrect.

The market situation is as follows:

Position	Price	Delta (points)
March 2003 Euro Bobl Future	105.06	1
106.00 call on the March 2003 Euro Bobl Future	0.23	0.35
105.00 call on the March 2003 Euro Bobl Future	0.55	0.51
104.50 call on the March 2003 Euro Bobl Future	0.92	0.77

Please determine, on the basis of the data shown above, which position offers the greatest profit potential (in relation to the capital invested) if the March 2003 Euro Bobl Future rises strongly.

Complete the following profit and loss table for the selected option (at expiration) and indicate the break-even point on the Last Trading Day.

Euro Bobl Future at the end of the option's lifetime	Profit/loss on the option	Profit/loss per option contract (EUR)
107.00		
106.50		
106.00		
105.50		
105.00		
104.50		
104.00		

Short Call

Question 230

In December 2002 you expect two-year yields to either stagnate or rise slightly. Based on this forecast, you expect the price of the Euro Schatz Future to remain constant or fall slightly. The market situation is as follows:

Position	Price
March 2003 Euro Schatz Future	102.84
103.50 call on the March 2003 Euro Schatz Future	0.07
103.00 call on the March 2003 Euro Schatz Future	0.21
102.50 call on the March 2003 Euro Schatz Future	0.48

Which position do you choose from the options referred to? Please substantiate your choice.

Assuming that your market forecast is correct, how many contracts do you need to buy or sell in order to realize a profit of EUR 5,000 at the end of the option's lifetime?

Complete the following profit and loss table for the selected option (at expiration) and indicate the break-even point on the Last Trading Day.

Euro Schatz Future at the end of the option's lifetime	Profit/loss on the option	Profit/loss on the option position (EUR)
104.50		
104.00		
103.50		
103.00		
102.50		
102.00		

Long Put

Question 231

It is mid-December 2002 and you expect two-year yields to rise strongly. Although you want to benefit from the expected sharp move lower in the Euro Schatz Future, you also want to limit your losses in case your forecast should turn out to be incorrect.

The market situation is as follows:

Position	Price	Delta
March 2003 Euro Schatz Future	102.96	1
103.50 put on the March 2003 Euro Schatz Future	0.77	–0.62
103.00 put on the March 2003 Euro Schatz Future	0.39	–0.51
102.50 put on the March 2003 Euro Schatz Future	0.17	–0.28

Select the position, which offers the greatest leverage in the case of sharply lower prices for the Euro Schatz Future and give reasons for your choice.

Complete the following profit and loss table for the selected option (on the Last Trading Day) and indicate the break-even point.

Euro Schatz Future at the end of the option's lifetime	Profit/loss on the option	Profit/loss per option contract (EUR)
104.00		
103.50		
103.00		
102.50		
102.00		
101.50		

Short Put

Question 232

Towards the end of the year you expect ten-year yields to stagnate or decline slightly. Based on this forecast, you expect the price of the Euro Bund Future to remain constant or rise slightly.

The market situation is as follows:

Position	Price
March 2003 Euro Bund Future	106.06
107.00 put on the March 2003 Euro Bund Future	1.41
106.00 put on the March 2003 Euro Bund Future	0.82
105.00 put on the March 2003 Euro Bund Future	0.43

Which position do you choose, from the options referred to? Please substantiate your choice. Assuming that your forecast is correct, how many contracts do you have to buy/sell in order to realize a profit of EUR 10,000 at the end of the option's lifetime?

Complete the following profit and loss table for the selected option (on the Last Trading Day) and indicate the break-even point at expiration.

Euro Bund Future at the end of the option's lifetime	Profit/loss on the option	Profit/loss on the option position (EUR)
106.50		
106.00		
105.50		
105.00		
104.50		
104.00		

Bull Call Spread

Question 233

It is mid-December: you expect prices in the Euro Bobl Future to rise slightly towards the end of the year. You want to build up a position with limited risk and which entails lower upfront costs than those of a single (outright) option position.

The market situation is as follows:

Position	Price
March 2003 Euro Bobl Future	105.06
104.00 call on the March 2003 Euro Bobl Future	1.26
104.00 put on the March 2003 Euro Bobl Future	0.20
105.00 call on the March 2003 Euro Bobl Future	0.61
105.00 put on the March 2003 Euro Bobl Future	0.55
106.00 call on the March 2003 Euro Bobl Future	0.23
106.00 put on the March 2003 Euro Bobl Future	1.17

Which position do you choose from the options referred to? How many spreads do you have to buy in order to realize a gain of about EUR 2,500 if the Euro Bobl Futures rises to 106.00 until expiration?

Complete the following profit and loss table for the selected options (at the end of the options' lifetime) and indicate the break-even point on the Last Trading Day.

Euro Bobl Future at the end of the options' lifetime	Option position 1	Option position 2	Overall position	Overall position (EUR)
107.00				
106.50				
106.00				
105.50				
105.00				
104.50				
104.00				

Bear Put Spread

Question 234

On December 17, 2002, you expect slightly rising ten-year yields for German Government bonds. You want to build up a position with limited risk that involves lower costs than those of a single (outright) option position.

The market situation is as follows:

Position	Price
March 2003 Euro Bund Future	106.03
105.00 call on the March 2003 Euro Bund Future	1.49
105.00 put on the March 2003 Euro Bund Future	0.43
106.00 call on the March 2003 Euro Bund Future	0.88
106.00 put on the March 2003 Euro Bund Future	0.82
107.00 call on the March 2003 Euro Bund Future	0.47
107.00 put on the March 2003 Euro Bund Future	1.41

Which options do you trade to establish this strategy?

How many spreads do you have to buy if you want to limit the maximum loss exposure of the trade to about EUR 5,000?

Complete the following profit and loss table for the selected options (at expiration) and indicate the break-even point on the Last Trading Day.

Euro Bund Future at the end of the options' lifetime	Option position 1	Option position 2	Overall position	Overall position (EUR)
107.00				
106.50				
106.00				
105.50				
105.00				
104.50				
104.00				

Long Straddle

Question 235

Following a long period of relatively constant two-year yields, you expect increased uncertainty about price developments in this segment. You therefore expect the Euro Schatz Future to become more volatile.

The market situation is as follows:

Position	Price	Vega
March 2003 Euro Schatz Future	102.96	
102.50 call on the March 2003 Euro Schatz Future	0.54	0.10
102.50 put on the March 2003 Euro Schatz Future	0.14	0.10
103.00 call on the March 2003 Euro Schatz Future	0.21	0.18
103.00 put on the March 2003 Euro Schatz Future	0.37	0.18
104.50 call on the March 2003 Euro Schatz Future	0.07	0.11
104.50 put on the March 2003 Euro Schatz Future	0.73	0.11

Please construct a long straddle with options on the Euro Schatz Future.

Indicate the number of the long straddles necessary to realize a profit of at least EUR 5,000 if implied volatility increases by one percentage point immediately after having entered into the position.

Complete the following profit and loss table for the selected options (at expiration) and indicate the break-even points on the Last Trading Day.

Euro Schatz Future at the end of the options' lifetime	Option position 1	Option position 2	Overall position	Overall position (EUR)
104.50				
104.00				
103.50				
103.00				
102.50				
102.00				
101.50				

Long Strangle

Question 236

Following a long period of relatively constant ten-year yields, you expect increased uncertainty about yield developments in this segment. You therefore expect prices of the Euro Bund Future to become more volatile. Although you want to enter into a position which benefits from a rise in implied volatility, you are looking for a lower risk exposure compared to a long straddle.

The market situation is as follows:

Position	Price	Vega
March 2003 Euro Bund Future	106.08	
104.50 call on the March 2003 Euro Bund Future	1.85	0.14
104.50 put on the March 2003 Euro Bund Future	0.27	0.14
106.00 call on the March 2003 Euro Bund Future	0.86	0.19
106.00 put on the March 2003 Euro Bund Future	0.78	0.19
107.50 call on the March 2003 Euro Bund Future	0.31	0.14
107.50 put on the March 2003 Euro Bund Future	1.73	0.14

Please construct a long strangle with options on the Euro Bund Future.

Indicate the number of the long strangles necessary to realize a profit of at least EUR 5,000 if implied volatility increases by one percentage point immediately after having entered into the position.

Complete the following profit and loss table for the selected options and indicate the break-even points on the Last Trading Day, as well as the maximum loss.

Euro Bund Future at the end of the options' lifetime	Option position 1	Option position 2	Overall position	Overall position (EUR)
110.00				
109.00				
108.00				
107.00				
106.00				
105.00				
104.00				
103.00				
102.00				

Delta Hedging

Question 237

You want to hedge your bond position dynamically against interest rate risks by using options on the Euro Bund Future. Your bond portfolio has the following characteristics:

Present value of bond portfolio	EUR 2,213,687.78
Hedge ratio of the portfolio against the March 2003 Euro Bund Future[3]	–18.08

How many contracts of the March Option on the Euro Bund Future do you need to trade if you want to hedge the position through the sale of at-the-money calls (alternative 1) or the purchase of out-of-the-money puts (alternative 2)?

	Price	Delta
106.00 call on the March 2003 Euro Bund Future	0.86	0.46
105.00 put on the March 2003 Euro Bund Future	0.43	–0.29

Two days later, bond prices have already fallen – the new market data is as follows:

Present value of bond portfolio	EUR 2,193,132.16
Hedge ratio of the portfolio against the March 2003 Euro Bund Future	–17.96

	Price	Delta
106.00 call on the March 2003 Euro Bund Future	0.63	0.34
105.00 put on the March 2003 Euro Bund Future	0.58	–0.36

How do you have to adjust your option position/hedge (in both cases) in order to continue hedging the bond portfolio against interest rate risks?

[3] Calculated using the Modified Duration method (See case study "Modified Duration Method").

Zero Cost Collar

Question 238

You hold EUR 10,000,000 (nominal value) of the CTD for the Euro Bobl Future and you want to hedge this position against price volatility using options. The Euro Bobl Future is currently trading at 105.05. You want to hedge a futures-equivalent price level of 104.00 at the end of the options' lifetime. You are willing to give up part of your profit opportunity provided you can reduce the hedging cost to close to zero.

Please construct a hedge which protects a futures-equivalent price of 104.00 at expiration of the options and whose costs are as close to zero as possible.

You can use the following options:

Position	Price
104.00 call on the March 2003 Euro Bobl Future	1.26
104.00 put on the March 2003 Euro Bobl Future	0.22
105.00 call on the March 2003 Euro Bobl Future	0.61
105.00 put on the March 2003 Euro Bobl Future	0.55
106.00 call on the March 2003 Euro Bobl Future	0.21
106.00 put on the March 2003 Euro Bobl Future	1.17

Complete the following profit and loss table for the selected options (at expiration) and indicate the maximum profit and loss on the Last Trading Day.

Euro Bobl Future at the end of the options' lifetime	Futures-equivalent cash market position	Option position 1	Option position 2	Overall position	Overall position (EUR)
107.00					
106.50					
106.00					
105.50					
105.00					
104.50					
104.00					
103.50					
103.00					

Synthetic Long Call

Question 239

You expect two-year yields to decline. You want to benefit from the expected rise in prices in this segment and simultaneously limit your risk exposure. You therefore decide on a long call.

The market situation is as follows:

Position	Price
March 2003 Euro Schatz Future	102.84
103.00 call on the March 2003 Euro Schatz Future	0.21
103.00 put on the March 2003 Euro Schatz Future	0.34

Please complete the profit and loss table for both the synthetic and the "real" long call, and check which alternative offers the more advantageous profits/loss profile on the Last Trading Day. Please state the price advantage.

Euro Bobl Future at the end of the options' lifetime	Future	Option	Synthetic long call	"Real" long Call
105.00				
104.50				
104.00				
103.50				
103.00				
102.50				
102.00				
101.50				
101.00				

Synthetic Short Call

Question 240

You expect prices in the Euro Bobl Future to stagnate or fall and are willing to accept the significant risk exposure associated with a short option position. You therefore decide to sell calls on the Euro Bobl future.

The market situation is as follows:

Position	Price
March 2003 Euro Bobl Future	105.08
105.00 call on the March 2003 Euro Bobl Future	0.56
105.00 put on the March 2003 Euro Bobl Future	0.53

Please complete the profit and loss table for both the synthetic and the "real" short call, and check which alternative offers the more advantageous profits/loss profile on the Last Trading Day. Please state the price advantage.

Euro Bobl Future at the end of the options' lifetime	Future	Option	Synthetic short call	"Real" short call
107.00				
106.50				
106.00				
105.50				
105.00				
104.50				
104.00				
103.50				
103.00				

Synthetic Long Put

Question 241

You expect yields at the long end of the curve to rise. You want to benefit from the anticipated price decline in this segment, while entering into a position with limited exposure to risk. You therefore decide to enter into a long put on the Euro Bund Future.

The market situation is as follows:

Position	Price
March 2003 Euro Bund Future	106.08
106.00 call on the March 2003 Euro Bund Future	0.84
106.00 put on the March 2003 Euro Bund Future	0.78

Please complete the profit and loss table for both the synthetic and the "real" long put, and check which alternative offers the more advantageous profits/loss profile on the Last Trading Day. Please state the price advantage.

Euro Bund Future at the end of the options' lifetime	Future	Option	Synthetic long put	"Real" long put
108.00				
107.50				
107.00				
106.50				
106.00				
105.50				
105.00				
104.50				
104.00				

Synthetic Short Put

Question 242

You expect prices in the Euro Schatz Future to stagnate or rise slightly and are willing to accept the significant risk exposure associated with a short option position. You therefore decide to sell puts on the Euro Schatz Future.

The market situation is as follows:

Position	Price
March 2003 Euro Schatz Future	102.49
102.50 call on the March 2003 Euro Schatz Future	0.26
102.50 put on the March 2003 Euro Schatz Future	0.24

Please complete the profit and loss table for both the synthetic and the "real" short put, and check which alternative offers the more advantageous profits/loss profile on the Last Trading Day. Please state the price advantage.

Euro Schatz Future at the end of the options' lifetime	Future	Option	Synthetic short put	"Real" short put
105.00				
104.50				
104.00				
103.50				
103.00				
102.50				
102.00				
101.50				
101.00				

Reversal

Question 243

You are an arbitrageur who observes the price structure for options on the Euro Schatz Future. You find that the 103.00 put option on the March 2003 contract is overpriced in comparison to the corresponding call. A synthetic Euro Schatz Future therefore offers a price advantage over the actual contract.

Please create an arbitrate strategy exploiting the existing price imbalance.

The market situation is as follows:

Position	Price
March 2003 Euro Schatz Future	102.78
103.00 call on the March 2003 Euro Schatz Future	0.14
103.00 put on the March 2003 Euro Schatz Future	0.39

Please complete the profit/loss table for both the synthetic and "real" Euro Schatz Future, stating the profit per contract in EUR made on the strategy.

Euro Schatz Future at the end of the options' lifetime	Option position 1	Option position 2	Synthetic future	"Real" future	Reversal
105.00					
104.50					
104.00					
103.50					
103.00					
102.50					
102.00					
101.50					
101.00					

Conversion

Question 244

In mid-December 2002, you observe that the 106.50 call option on the March 2003 Euro Bobl Future is overpriced in comparison to the corresponding put option. Therefore, the actual Euro Bobl Future is cheaper than the synthetic contract.

Please create an arbitrate strategy exploiting the existing price imbalance.

The market situation is as follows:

Position	Price
March 2003 Euro Bobl Future	105.12
106.50 call on the March 2003 Euro Bobl Future	0.20
106.50 put on the March 2003 Euro Bobl Future	1.49

Please complete the profit/loss table for both the synthetic and "real" Euro Bobl Future, stating the profit per contract in EUR made on the strategy.

Euro Bobl Future at the end of the options' lifetime	Option position 1	Option position 2	Synthetic future	"Real" future	Conversion
108.00					
107.50					
107.00					
106.50					
106.00					
105.50					
105.00					
104.50					
104.00					
103.50					
103.00					

Solutions

Characteristics of Fixed Income Securities

Bonds – Definition

Answer 1

The coupon of fixed income securities is based upon the nominal value.

Answer 2

Money market book-entry claims, Treasury Notes and Confederation Bonds.

Answer 3

German Government issues	Maturity	Coupon payment
German Federal Treasury Notes (Bundesschatzanweisungen)	2 years	Annual
German Federal Debt Obligations (Bundesobligationen)	5 years	Annual
German Federal Government Bonds (Bundesanleihen)	10 years, 30 years	Annual

Lifetime and Remaining Lifetime

Answer 4

The period between its issuance and its maturity.

Answer 5

The period between the value date of the purchase or sale of an already issued bond (or the date of the delivery of a fixed income future) and the bond's maturity.

Nominal and Actual Rate of Interest (Coupon and Yield)

Answer 6

Trade price = Nominal value

Answer 7

The bond is traded above par.

Accrued Interest

Answer 8
The buyer pays accrued interest to the seller for the period between the last coupon date and the value date of the purchase/sale.

Answer 9
February 29 is taken into account when calculating the number of interest days: actual/actual = 366/366.

The Yield Curve

Answer 10
The "normal" yield curve: bonds with a long remaining lifetime yield more than bonds with a shorter remaining lifetime.

Answer 11
Bonds with a long remaining lifetime yield less than bonds with a shorter remaining lifetime.

Answer 12
A "flat" yield curve.

Bond Valuation

Answer 13
Capital market interest rate, nominal interest rate, nominal value, remaining lifetime, accrued interest.

Answer 14
The present value and the market yield have an inverted relationship.

Answer 15
Clean price = Present value (dirty price) – Accrued interest

Macaulay Duration

Answer 16
Macaulay duration is a measure of how the coupon and the remaining lifetime of a bond influence its interest rate sensitivity. It is defined as the weighted average of the periods of time until the individual yield and redemption payments fall due, with the present value of the payments being used as weighting factor.

Answer 17
... the longer the remaining lifetime.
... the lower the capital market interest rate.
... the lower the nominal yield.

Answer 18
... its remaining lifetime.

Modified Duration

Answer 19
Modified duration is calculated as the percentage change in the present value of bonds if the level of capital market interest rates changes by one unit (one percentage point).

Answer 20
The statement is false. The modified duration refers to the present value (Clean price + Accrued interest).

Answer 21
The modified duration is equivalent to the negative value of the Macaulay duration, discounted over a period of time.

Convexity – the Tracking Error of Duration

Answer 22
The modified duration assumes a linear relationship between the bond's present value and the market interest rate. In fact, the relationship between the present value and the market interest rate is convex.

Answer 23
The price increase is underestimated.

Eurex Fixed Income Derivatives

Characteristics of Exchange-Traded Derivatives

Answer 24
Derivatives are contracts whose prices are derived from underlying cash market instruments (also referred to as "underlying instruments" or simply "underlyings"). These cash or spot market instruments include equities, bonds, indexes and commodities such as oil, electricity, metals, or agricultural products.

Answer 25
In contrast to cash market transactions, which are usually settled by delivery versus payment within a period of two or three days after the trade date, derivatives provide for transaction settlement in the future, on fixed settlement dates. Apart from the exercising of options, delivery or cash settlement of derivative contracts takes place only on specific dates during the year.

Answer 26
Trading standardized contracts results in a concentration of order flow, which ensures market liquidity.

Answer 27
The Eurex product range comprises of futures on equity indexes, money market instruments, government bonds and exchange-traded funds as well as options on individual equities, equity indexes, money market futures and fixed income futures.

Answer 28
In contrast to OTC derivatives, exchange-traded products feature standardized contract specifications.

Answer 29
Order flows are concentrated thanks to standardization of the traded products. In addition, the high number of admitted exchange members and the use of designated market markers for certain products further guarantees high liquidity.

Answer 30
When entering into a futures trade it is not necessary to invest the total value of the contract. Only the maximum potential loss expected on one exchange trading day has to be provided as collateral (margin). This is lodged in, the form of securities or cash. In terms of the capital invested, the profit or loss potential is much greater for derivative contracts than for cash market transactions.

Introduction to Fixed Income Futures

What are Fixed Income Futures? – Definition

Answer 31
Eurex fixed income futures are based on German Government and Swiss Confederation with a fixed-rate coupon. However, they are not based on a specific security, but on a notional bond with a fixed coupon of six percent and a remaining lifetime at the date of delivery set out in the specifications of the contract. Several securities are available for fulfilling the delivery obligation.

Answer 32
The CONF Future obliges its seller or buyer to deliver or accept delivery at the set maturity date and at a price determined in advance, one of the Swiss Confederation issues defined as deliverable by Eurex. This issues have a remaining lifetime of eight to 13 years and a nominal value of CHF 100,000.

Futures Positions – Obligations

Answer 33
The statement is true.

Answer 34
Selling a future is also called "entering into a short position".

Answer 35
Being short in the Euro Schatz Futures contract results in the obligation to deliver, on the experation date and at a price determined in advance, one of the German Government issues defined as deliverable by Eurex with a remaining lifetime of 1¾ to 2¼ years and to a nominal value of EUR 100,000.

Settlement or Closeout

Answer 36
At futures maturity, the underlying instruments of a contract – in this case, bonds – must be delivered (short position), or delivery must be accepted (long position).

Answer 37
Market participants usually prefer closing out their positions to making or taking physical delivery.

Answer 38
The investor can close out the long position in the September 2002 by contract 40 CONF Future contracts with the same maturity.

Contract Specifications

Answer 39

The three following quarterly months within the March, June, September and December cycle are available for delivery. Therefore fixed income futures have a maximum remaining lifetime of nine months.

Answer 40

The price of Eurex fixed income futures is quoted in percent of the nominal value of the notional bond to two decimal places. The minimum price movement is 0.01 percent (tick, in this case one basis point). The corresponding value of a basis point is EUR 10 for fixed income futures on German instruments and CHF 10 for the CONF Future.

Answer 41

The seller of twelve Euro Schatz Futures has to deliver bonds to a nominal value of EUR 1,200,000 at maturity.

Answer 42

Underlying: German Government issues	Contract value	Remaining lifetime of the deliverable bond at the delivery date	Product code
Euro Schatz Future	EUR 100,000	1¾ to 2¼ years	FGBS
Euro Bobl Future	EUR 100,000	4½ to 5½ years	FGBM
Euro Bund Future	EUR 100,000	8½ to 10½ years	FGBL
Euro Buxl Future	EUR 100,000	20 to 30½ years	FGBX

Underlying: Swiss Government bonds	Contract value	Remaining lifetime of the deliverable bond at the delivery date	Product code
CONF Future	CHF 100,000	8 to 13 years	CONF

Answer 43

The statement is false. German Federal Debt Obligations and German Government bonds are deliverable as well if their remaining lifetime matches, the Euro Schatz Future contract specifications and if they fulfill the required minimum issuance volume.

Futures Spread Margin and Additional Margin

Answer 44
Holding opposite long and short positions in different maturity months of the same futures contract is referred to as holding a time spread position.

Answer 45
Long positions, short positions and futures spread positions.

Answer 46
The Additional Margin rate is higher.

Variation Margin

Answer 47
Daily Settlement Price of the future on the opening day – Purchase price of the future = Variation Margin.

Answer 48
If the margin account is debited when prices in the underlying instrument are rising, the investor must hold a short position.

The Futures Price – Fair Value

Answer 49
The statement is false. Risk-free profits (arbitrage) are impossible if the markets are in equilibrium.

Answer 50
Theoretical futures price = Cash market price + Financing costs – Income on the cash market position

Answer 51
Accrued interest reduces the price of a future.

Answer 52
Short-term refinancing rates, which are usually paid in interbank transactions for deposits with a term equivalent to the lifetime of the future (so-called repo rates).

Cost of Carry and Basis

Answer 53
Cost of carry is equivalent to the negative value of the net financing costs of the cash market position. Cost of carry is defined as income from the cash market position less financing costs.

Answer 54
The futures price is below the price of the underlying.

Answer 55
The value of the basis equals zero at maturity.

The Conversion Factor (Price Factor)

Answer 56
The conversion factor makes possible a comparison of the value of the different deliverable bonds in case of a physical delivery. It is used to calculate the delivery price of any bond delivered into the futures contract.

Answer 57
The lower the coupon of a deliverable bond, the lower the conversion factor and, consequently, the delivery price of this bond.

Answer 58
The statement is true.

The Cheapest-to-Deliver (CTD) Bond

Answer 59
Bond 1 is the CTD. It offers a price profit of EUR 187 (105,117 – 104,930) in case of physical delivery. Bond 2 implies a loss of EUR 98 (104,992 – 105,090) compared to its market value in case of physical delivery. Therefore Bond 1 has an overall price advantage of EUR 285 (187 + 98) over Bond 2.

Answer 60
The CTD can change if the level of interest rates changes, or if "cheaper" bonds are issued that fulfill the criteria for eligibility to the basket of deliverable bonds.

Answer 61

The delivery of the CTD is equivalent to the delivery of the least favorable bond for the long position.

Answer 62

The conversion factor is calculated assuming a flat yield curve at the level of the nominal yield of the notional bond on which the futures contract is based. However, this is rarely the case in reality; as a result, particular bonds are usually cheaper to deliver than others.

Answer 63

The statement is true.

Applications of Fixed Income Futures

Trading Strategies

Answer 64
The main function of derivatives markets is to transfer risks between market participants.

Answer 65
Trading in derivatives occurs for three reasons: hedging, trading and arbitrage.

Answer 66
Arbitrage ensures that the market prices of derivative contracts diverge only marginally and for a short period of time from their theoretical values. This ensures that the market equilibrium is restored.

Answer 67
You open a short position in the CONF Future.

Answer 68
Trading means entering into risk positions for the purpose of making a profit, assuming that market developments are forecast correctly.

Basic Futures Strategies

Answer 69
Long positions, short positions and spread positions.

Answer 70
Trading fixed income futures instead of bonds offers the following advantages:
- High market liquidity and transparency;
- Simple handling of short positions;
- Low cash liquidity requirements because only Additional Margin must be deposited.

Long Positions ("Bullish Strategies")

Answer 71
An investor who holds a long position in fixed income futures is bullish about the price development of the underlying market. Going long of fixed income futures implies speculating on rising prices in the underlying bonds.

Answer 72
The investor expects yields in the 1¾ to 2¼ year segment of the curve to fall and wants to tie up less liquidity than would be necessary to enter into a cash OTC position.

Answer 73
The investor establishes a long position in the CONF Future in order to speculate on falling rates at the long end of the Swiss yield curve.

Short Positions ("Bearish Strategies")

Answer 74

An investor who holds a short position in fixed income futures is bearish about the price development of the underlying market. Going short means that the investor is speculating that the prices of the underlying bonds will decline.

Answer 75

The Variation Margin is:

Number of contracts × Number of ticks (basis points) × Value of ticks (value of basis points) = –15 × 48 × EUR 10 = EUR –7,200

The trader has made a loss.

Answer 76

The investor will decide to initiate a short position in the Euro Bund Future.

Spread Strategies

Answer 77

A spread is the simultaneous purchase and sale of futures contracts with either different maturity dates or different underlying instruments.

Answer 78

The purpose of entering into a spread position is to achieve profits on expected changes in the price difference between the long and short position legs.

Answer 79

The statement is false. The risk of a spread position is smaller because it is partly offset by the inverse development of the single positions.

Time Spread

Answer 80

Holders of a time spread position in fixed income futures expect a non-parallel shift in the yield curve in the money market segment. Accordingly, they expect any change in financing costs for the futures contract with the shorter maturity to differ from any change for the longer futures contract.

Answer 81

Option 1: Simultaneous purchase of the June 2002 Euro Bund Future/sale September 2002
Option 2: Simultaneous purchase of the June 2002 Euro Bund Future/sale December 2002
Option 3: Simultaneous purchase of the September 2002 Euro Bund Future/sale December 2002

Answer 82

Other things being equal, the rise in funding rates will push up the price of fixed income futures. The investor should buy December contracts because financing costs are rising more strongly in this segment, and simultaneously sell March Euro Bund Future contracts.

Inter-Product Spread

Answer 83

This spread is called an inter-product spread.

Answer 84

Purchase of Euro Bobl Futures and simultaneous sale of Euro Bund Futures, with a ratio that takes into account the different interest rate sensitivities of the two contracts.

Answer 85

When opening the position, the ratio between purchased and sold fixed income futures is determined on the basis of the different interest rate sensitivities (modified duration). The modified duration assumes a linear relationship between market yields and the price of the bond. In fact, this relationship is convex. This is why the ratio has to be adjusted if market yields change.

Hedging Strategies Using Fixed Income Futures

Answer 86

Holdings in German Government bonds are subject to the risk of interest rate changes.

Answer 87

A long position of two Euro Bund Futures contracts lets you hedge at the current price level; this will avoid the need to make additional investments in the case of falling yields.

Choice of the Futures Contract

Answer 88

The bonds in the portfolio should belong to the basket of bonds deliverable into the fixed income futures contract used for the hedge.

Answer 89

The investor should choose contracts with a high correlation to the portfolio.

Determining the Hedge Ratio

Answer 90

The hedge ratio indicates how many futures contracts are necessary to hedge a portfolio.

"Perfect Hedge" versus "Cross Hedge"

Answer 91

In theory, and in an ideal scenario, a perfect hedge using fixed income futures results in the complete elimination of risk exposure. However, it also removes any profit potential.

Answer 92

A perfect hedge of a portfolio may be impossible for the following reasons:

- Only integer numbers of futures contracts can be traded.
- The portfolio may not consist completely of deliverable bonds.
- The period to be hedged is not in line with the remaining lifetime of the future.

Answer 93

The investor can choose to only partially hedge the portfolio.

Answer 94

In the case of a cross hedge the hedge, position does not precisely offset the performance of the cash portfolio.

Nominal Value Method

Answer 95

If the bond portfolio to be hedged consists exclusively of the CTD of the futures contract used for the hedge.

Modified Duration Method

Answer 96

The modified duration method takes account of possible differences in the interest rate sensitivity of the futures contract and of the cash bonds in a portfolio.

Answer 97

The modified duration of the overall bond portfolio is equivalent to the aggregate modified duration of the individual bonds it contains, weighted by the present value.

Answer 98

The statement is false. Since the modified duration occurs in both the numerator and the denominator when calculating the hedge ratio, the error of the modified duration is offset to some extent.

Sensitivity Method

Answer 99

The basis point value indicates the interest rate sensitivity of fixed income securities. Interest rate sensitivity is expressed as the absolute change in value of a security in case of a one tick/basis point (0.01 percent) interest rate change.

Answer 100

Present value (dirty price) of the bond portfolio × Modified duration of the bond portfolio / 10,000.

Using Modified Duration for Partial Hedges

Answer 101

When using modified duration for partial hedges the investor sets a new target for the modified duration of the overall position. The aim is to calculate the hedge ratio to meet that target.

Static and Dynamic Hedging

Answer 102

As the interest rate structure upon which the hedging models are based is simplified, inaccuracies in the hedge ratio may occur over time. Therefore, it is necessary to adjust the futures position to ensure the desired total or partial hedge effect.

Answer 103

Static hedging refers only to a certain point in time, namely the futures maturity. By using static hedging the investor protects a minimum value of the bond portfolio at that point in time.

Cash-and-Carry Arbitrage/Reverse Cash-and-Carry Arbitrage

Answer 104

Arbitrage means that an investor enters into risk-free (closed) positions, taking advantage of market mispricing of derivatives or securities.

Answer 105

The investor buys the current CONF CTD on the cash market and simultaneously opens a corresponding short position with the same nominal value in the CONF Future. The bonds are delivered at maturity of the future. If the future is overvalued, the arbitrageur may achieve a risk-free profit from this transaction.

Answer 106

A reverse cash-and-carry arbitrage consists of short bond positions and long futures positions. This strategy requires borrowing the cash bonds.

Answer 107

Risk-free arbitrage is possible if the price differential between the theoretical and the actual futures price exceeds transaction costs.

Introduction to Options on Fixed Income Futures

Options on Fixed Income Futures – Definition

Answer 108
There are options on the Euro Schatz Future, the Euro Bobl Future and on the Euro Bund Future.

Answer 109
The full premium is settled when the option expires or is exercised ("futures-style" premium posting).

Answer 110
The statement is false. The settlement of profits and losses occurs daily by way of Variation Margin flows, just as with futures.

Answer 111
Eurex options on futures are American-style. This means they can be exercised on any exchange trading day throughout the lifetime of the option.

Options on Fixed Income Futures – Rights and Obligations

Answer 112
The four basic option positions are: long call, short call, long put and short put.

Answer 113
The buyer of a put has the right, but not the obligation, to sell the futures contract at an exercise price specified in advance. To obtain this right, the investor pays the seller of the put an option premium, which is settled by futures-style premium posting.

Answer 114
The statement is true.

Answer 115
The holder of an option position can exercise it, hold it or close it.

Closeout

Answer 116
By buying 400 put options of exactly the same series.

Exercising Options on Fixed Income Futures

Answer 117

Exercise of a …	Assignment of a …	Assignment of a …	Exercise of a …
long call option	short call option	short put option	long put option
results in the opening of a …			
long futures position	short futures position	long futures position	short futures position

Answer 118

You enter into a long position in the September 2002 Euro Schatz Future.

Contract Specifications – Eurex Options on Fixed Income Futures

Answer 119

On that day of the year the following expiration months are traded: May, June, July and September. Generally speaking, the three following calendar months and the next quarterly month from the March, June, September and December cycle are available.

Answer 120

158 ticks/basis points × EUR 10 per tick/basis point × 25 contracts
= Option premium EUR 39,500.

Answer 121

The Last Trading Day of all options on fixed income futures is the sixth exchange trading day before the first calendar day of the expiration month. In the case described above this is August 23, 2002.

Premium Payment and Risk Based Margining

Answer 122

Options on fixed income futures are subject to Additional Margin.

Answer 123

The buyer of options on fixed income futures pays the premium at exercise or at the expiration of the option. Contract price changes during the lifetime are accounted for by Variation Margin. When the option is exercised, the buyer pays the (remaining) premium, which is equivalent to the value of the Daily Settlement Price on this day.

Answer 124

The premium is not paid until the option expires or is exercised. The margin is used to cover the risk of default until the premium is paid in full, or the position is closed.

Answer 125

Variation Margin = (Selling price – Daily Settlement Price) × Point value × Number of contracts = (26-38 ticks) × EUR 10 per tick × 40 contracts = EUR –4,800.

The investor has made a loss.

Answer 126

Yes, because the Additional Margin is used to cover the maximum losses expected during any exchange trading day. The maximum risk of losses remains constant in the case of moderate price changes, so the Additional Margin does not change.

Option Price

Components

Answer 127

Theoretical price of an option = Intrinsic value + Time value

Intrinsic Value

Answer 128

The intrinsic value of the option is 71 basis points.

Answer 129

There is no time value left on the Last Trading Day of an option. Therefore the option's price is equivalent entirely to its intrinsic value.

Answer 130

	Out-of-the-money	At-the-money	In-the-money
Call	Exercise price > Futures price; intrinsic value = 0	Exercise price = Futures price; intrinsic value = 0	Exercise price < Futures price; intrinsic value > 0
Put	Exercise price < Futures price; intrinsic value = 0	Exercise price = Futures price; intrinsic value = 0	Exercise price > Futures price; intrinsic value > 0

Time Value

Answer 131

The option's premium is equivalent to its time value if the option is at-the-money or out-of-the-money.

Answer 132

The time value is 1.05 points/EUR 1,050.

Answer 133

The option is out-of-the-money. The time value is therefore 0.08 points.

Determining Factors

Answer 134

The statement is true.

Volatility of the Underlying Instrument

Answer 135

The time value of an option is determined by the volatility and price of the underlying fixed income future, as well as the remaining lifetime and the exercise price of the option.

Answer 136

Volatility measures the intensity of price fluctuations of the underlying instrument. Historical volatility is based on past data and represents the standard deviation of the daily returns of the underlying.

Answer 137

Implied volatility.

Remaining Lifetime of the Option

Answer 138

The closer an option moves towards expiration, the lower its time value becomes until it eventually reaches zero at expiration on the Last Trading Day. The time decay accelerates as the expiration date comes closer.

Answer 139

Short call and short put positions.

Answer 140

No. Usually, the holder of the option loses the time value upon exercise and therefore does not achieve the best result possible. Closing out a position usually leads to a better result.

Influencing Factors

Answer 141

The put premium is going to fall.

Answer 142

Through implied volatility, since all other factors are given.

Important Risk Parameters ("Greeks")

Answer 143
Price of the underlying instrument: delta/gamma; volatility of the underlying instrument: vega (kappa); remaining lifetime of the option: theta.

Answer 144
The risk parameters describe the absolute change in the option price (or in a value derived from the option price), which occurs if the examined influencing factor is changed by one unit. All other influencing factors are kept constant for the purpose of this analysis.

Answer 145
Risk parameters help to describe the behavior of complex option positions. Knowing and understanding risk parameters is therefore indispensable for the risk management of portfolios which include options.

Delta

Answer 146

Delta for long call positions	$0 \leq \text{delta} \leq 1$
Delta for long put positions	$-1 \leq \text{delta} \leq 0$

Answer 147
If the price of the Euro Bobl Future rises by 100 basis points, the value of the short call position declines by approximately EUR 450, and conversely, if the price of the Euro Bobl Future falls, the value of the short call position increases by approximately EUR 450.

Answer 148
The position delta of an at-the-money short put is about +0.5.

Gamma

Answer 149
The gamma of an option position describes the change in the delta if the price of the underlying instrument changes by one unit.

Answer 150

	Long call	Short call	Long put	Short put
Position gamma	Positive	Negative	Positive	Negative

Answer 151
The gamma is highest for at-the-money options shortly before expiration.

Vega (Kappa)

Answer 152
Vega indicates by how many units the option price will change given a one-percentage point change in the volatility of the underlying instrument.

Answer 153
The statement is false.

Answer 154
Short option positions benefit from declining volatility in the underlying instrument.

Theta

Answer 155
It is negative.

Answer 156
Theta is usually highest for at-the-money options immediately before expiration.

Trading Strategies for Options on Fixed Income Futures

Long Call

Answer 157
Holders of a long call option on the Euro Bund Future expect a major increase in the price of the Euro Bund Future.

Answer 158
The profit potential of a long call on the Euro Schatz Future is very high if the prices of the underlying instrument rise. The potential loss is limited to the option premium.

Answer 159
Break-even = Exercise price + Option premium

Short Call

Answer 160
The seller of a call expects long-term yields to rise slightly or remain unchanged.

Answer 161
The profit potential of a short call on the Euro Bobl Future is limited to the option premium received. The loss potential is unlimited and can be very high in the event of a sharp rise in the price of the underlying instrument.

Answer 162
The investor can close out the position by buying a call option on the Euro Bund Future with the same expiration and exercise price.

Long Put

Answer 163
The buyer of a put on the Euro Bobl Future expects five-year yields on the German capital market to rise strongly.

Answer 164
The theoretical profit of a long put on the Euro Schatz Future is limited only by how far the underlying can move lower. The profit will be the exercise price of the option minus the option premium minus the level of the underlying (provided prices have declined) at expiration. The loss potential is limited to the option premium paid.

Short Put

Answer 165

The seller of a put on the Euro Schatz Future expects the price of the underlying to rise slightly or to remain constant.

Answer 166

The profit potential of a short put on the Euro Schatz Future is limited to the option premium received. The loss potential is equivalent to the exercise price of the option minus the option premium.

Answer 167

Break-even = Exercise price – Option premium

Bull Call Spread

Answer 168

A bull call spread can be constructed by buying the 108.00 call option on the March 2003 Euro Bund Future and simultaneously selling the 110.00 call option on the same underlying contract.

Answer 169

Exercise price of the long call + Net premium = Break-even

Answer 170

Because the option premium is paid only when the options expire or are exercised, the bull call spread requires collateral (Additional Margin).

Bear Put Spread

Answer 171

A bear put spread can be constructed by selling the 105.00 put option on the March 2003 Euro Bobl Future and simultaneously purchasing the 107.00 put option on the same contract.

Answer 172

Exercise price long put – Exercise price short put – Net premium

Answer 173
No, the vega of the bear put spread is smaller than that of the at-the-money long put because the vegas of the two options which are bought and sold to from the strategy partially offset each other.

Long Straddle

Answer 174
A long straddle can be constructed by buying the 104.00 call option on the March 2003 Euro Schatz Future and simultaneously purchasing the 104.00 put option on the same contract.

Answer 175
No. A long straddle is particularly vulnerable to time decay. For the strategy to be profitable at expiration, the price of the underlying instrument must differ from the exercise price by at least the aggregate option premium.

Answer 176
The investor expects the volatility of the Euro Bund Future to increase in the short term.

Long Strangle

Answer 177
An out-of-the-money long strangle can be constructed by buying a 105.00 call and simultaneously purchasing a 105.00 put option on the March 2003 Euro Schatz Future.

Answer 178
The long straddle is more sensitive to changes in volatility because the vega of the purchased options is larger.

Answer 179
Lower break-even point = Exercise price long put – Aggregate premium;
Upper break-even point = Exercise price long call + Aggregate premium

Hedging Strategies Using Options

Hedging Strategies for a Fixed Time Horizon

Answer 180
The purpose of hedging strategies for a fixed time horizon using options on fixed income futures is to safeguard a portfolio against changes in short, medium or long-term capital market yields with respect to a specific date, i.e. the expiration date of the option.

Answer 181
Long puts on the Euro Bund Future can be used to hedge an existing bond portfolio for a fixed time horizon.

Answer 182
This is a synthetic at-the-money long call position over 40 contracts.

Delta Hedging

Answer 183
Delta hedging is used to hedge the value of a portfolio for part of the lifetime of an option. With the help of options, the investor tries to reduce the delta of the overall position to zero. However, the delta of the options used also changes with movements in the price of the underlying, so the option position has to be adjusted dynamically.

Answer 184

$$\text{Delta bond position} / (-\text{Delta long put} \times \text{Point value option}) = \text{Number of contracts}$$

Using the delta of –0.5 of at-the-money put options, the formula looks as follows:

$$\text{EUR } 5{,}000/\text{point} \,/\, (0.5 \times 1{,}000 \text{ EUR}/\text{point}) = 10 \text{ contracts}$$

Gamma Hedging

Answer 185
The aim of a gamma hedge is to ensure that the investor does not to have to adjust the hedge ratio throughout the hedge period. For this purpose, the investor uses options in such a way that the gamma value of the overall bond portfolio equals zero.

Answer 186

You have to use an identical number of short calls and long puts with the same exercise price because this combination has a constant delta of –1 and therefore a gamma of zero. Since the aggregate delta of the two options is –1, the hedge ratio is equivalent to the quotient of the position delta of the cash position and the point value of the options.

Delta cash position/Point value option = Number of short calls and long puts

$$\frac{\frac{\text{EUR 3,000}}{\text{Point}}}{\frac{\text{EUR 1,000}}{\text{Point}}} \Rightarrow \text{3 short calls and 3 long puts}$$

The option position consists of three long puts and three short calls.

Answer 187

This option position corresponds to a short position in the Euro Schatz Future.

Zero Cost Collar

Answer 188

The zero cost collar is established by selling ten out-of-the-money calls on the September 2002 Euro Bund Future and simultaneously purchasing ten out-of-the-money puts on the September 2002 Euro Bund Future.

Answer 189

The profile is equivalent to that of a bull spread.

Answer 190

The exercise prices of the two options can be chosen in such a way that the premium paid for the long put is offset by the premium received for the short call. "Collar" means that the position offers a limited profit and loss potential in case of falling or rising prices of the underlying instrument.

Futures/Options Relationships, Arbitrage Strategies

Synthetic Long Call

Answer 191
Purchase of the September 2002 Euro Schatz Future and simultaneous purchase of the at-the-money put on the same contract.

Answer 192
Delta synthetic long call = Delta futures position + Delta option position =
EUR 1,000/point – EUR 350/point = EUR 650/point.

Answer 193
This transaction makes sense if the investor expects the price of the Euro Bund Future to rise and if the synthetic long call has an advantage – at expiration – that is at least equivalent to the difference in transaction costs over the "real" long call.

Synthetic Short Call

Answer 194
Sale of the September 2002 Euro Bund Future and simultaneous sale of the at-the-money put on the same contract.

Answer 195
In line with the profit potential of a "real" short call, the profit potential of a synthetic short call is limited to the premium. If prices rise, the loss is theoretically unlimited.

Answer 196
The synthetic short call represents an in-the-money option.

Synthetic Long Put

Answer 197
Sale of the September 2002 Euro Bobl Future and simultaneous purchase of the at-the-money call on the same contract.

Answer 198
In theory, the maximum profit of a synthetic long put is only limited by how far the price of the underlying can move lower. The final profit is equivalent to the exercise price minus the traded futures price less the premium paid.

Answer 199
An out-of-the-money long put on the Euro Schatz Future is constructed by combining a short Euro Schatz Future with an in-the-money long call on the Euro Schatz Future.

Synthetic Short Put

Answer 200
Purchase of the September 2002 Euro Schatz Future and the simultaneous sale of the at-the-money call on the same contrance.

Answer 201
Constructing a synthetic short put makes sense if the investor expects the price of the Euro Bobl Future to remain constant or rise slightly, and if the synthetic short put offers an advantage – at option expiration – that is at least equivalent to the difference in transaction costs over the "real" short put.

Answer 202
An in-the-money synthetic short put on the Euro Schatz Future is constructed by combining a long Euro Schatz Future with an out-of-the-money short call on the Euro Schatz Future.

Reversal

Answer 203
Simultaneous sale of the September 2002 Euro Bund Future, purchase of the at-the-money call and sale of the at-the-money put on the same contrance.

Answer 204
Synthetic futures positions are exclusively used for arbitrage purposes, due to the wider bid/offer spreads on the options used.

Answer 205
Constructing a synthetic long future makes sense if the price advantage of the synthetic over the "real" long futures position exceeds the difference in transaction costs.

Conversion

Answer 206

The statement is false. A conversion consists of a synthetic short future and a real long future. The combination described above is called a reversal.

Answer 207

Simultaneous purchase of the September 2002 Euro Bund Future with the sale of the at-the-money call and purchase of the at-the-money put on the same contrance.

Answer 208

The statement is true.

Accrued Interest

Answer 209

Settlement date:	July 25, 2002 (Thursday)
Value date for accrued interest:	July 24, 2002 (one day before the settlement date)
Number of interest days:	67

The trade date is July 23, 2002 (Tuesday). As the value date for accrued interest is exactly one calendar day before the settlement date (July 25, 2002 (Thursday)), accrued interest is calculated for the period from the coupon payment date up to and including July 24, 2002 (Wednesday).

Formula for calculating accrued interest:

$500{,}000 \times 0.0325 \times 67/365 = \text{EUR } 2{,}982.88$

Invoice amount as per the settlement date (July 25, 2002):

Nominal value × Current price of the bond + Accrued interest =
$500{,}000 \times 0.9889 + 2{,}982.88 = \text{EUR } 497{,}432.88$

Bond Valuation

Answer 210

Remaining term for the first coupon:

$$\frac{93}{365} = 0.255$$

Calculating present value:

$$\text{Present value} = \frac{4.00}{(1 + 0.0355)^{0.255}} + \frac{4.00}{(1 + 0.0355)^{1.255}} + \ldots + \frac{4.00 + 100}{(1 + 0.0355)^{5.255}} = 105.09$$

Interest days (from February 15, 2002): 272

Formula for calculating accrued interest:

$$100 \times 0.04 \times 272/365 = 2.98$$

Bond price (clean price) on the value (November 14, 2002):

Present value (dirty price) – Accrued interest = 105.09 – 2.98 = 102.11

Macaulay Duration

Answer 211

Macaulay duration of the bond:

$$\frac{\frac{4.00}{(1+0.0355)^{0.255}} \times 0.255 + \frac{4.00}{(1+0.0355)^{1.255}} \times 1.255 + \ldots + \frac{4.00+100}{(1+0.0355)^{5.255}} \times 5.255}{105.09} = 4{,}71 \text{ years}$$

The details of the calculation can also be presented in a table format:

Coupon	Yield	Period	Present value of payment	Present value of payment × Period
4.00	0.0355	0.255	3.9646	1.0110
4.00	0.0355	1.255	3.8287	4.8050
4.00	0.0355	2.255	3.6974	8.3376
4.00	0.0355	3.255	3.5706	11.6224
4.00	0.0355	4.255	3.4482	14.6722
104.00	0.0355	5.255	86.5804	454.9800
			105.0899	**495.4282**

Macaulay-Duration = 495,4282 / 105,0898 = 4,71 years

Macaulay duration of the bond portfolio:

$6.25 \times 0.476 + 8.42 \times 0.244 + 4.65 \times 0.28 = 6.33$ years

Modified Duration

Answer 212

$$\text{Modified Duration} = -\frac{\text{Macaulay Duration}}{1 + \text{Market yield}} = -\frac{3.55}{1 + 0.0414} = -3.41\,\%$$

$$\text{Change in bond value} = \text{Dirty price of the bond} \times \text{Modified duration}$$

If market interest rates rise by one percentage point, the bond should lose EUR 15,338.18 in value.

Convexity – the Tracking Error of Duration

Answer 213

Calculating modified duration:

$$\text{Modified Duration} = -\frac{\text{Macaulay Duration}}{1 + \text{Market yield}} = -\frac{3.55}{1 + 0.0414} = -3.41\,\%$$

Calculating convexity:

$$\frac{\frac{6.00}{1.0414^{0.060}} \times 0.060 \times 1.060 + \frac{6.00}{1.0414^{1.060}} \times 1.060 \times 2.060 + \ldots + \frac{106.00}{1.0414^{4.060}} \times 4.060 \times 5.060}{112.45 \times 1.0414^{2}} = 16.08$$

Calculating the percentage change in the bond's present value:

$$\text{Modified Duration} \times \text{Change in market yields} + 0.5 \times \text{Convexity} \times (\text{Change in market yields})^2$$
$$= -3.41 \times 0.01 + 0.5 \times 16.08 \times 0.01^2 = -3.33\,\%$$

Taking convexity into account, the value of the bond is likely to change by –3.33 percent if yields move up by one percentage point.

Futures Spread Margin and Additional Margin

Answer 214

Calculating Additional Margin:

Additional Margin = Number of spreads × Margin parameter (EUR)
= 10 × 1,000 = EUR 10,000

The collateral to be pledged amounts to EUR 10,000.

Calculating Futures Spread Margin:
The calculation of the Futures Spread Margin on fixed income futures takes into account the extent to which the risks of long and short positions in contracts of the same margin class offset each other in value when approaching the next delivery date. If one of the two futures contracts concerned matures in the month during which the margin is calculated, the calculation must be based on the higher "spot month" margin rate. However, this is not the case for the spread mentioned above, seeing that the first contract will be due in three months' time. The back month rate is therefore used to calculate the Futures Spread Margin.

Futures Spread Margin = Number of spreads × Margin parameter (back month (EUR))
= 10 × EUR 140 = EUR 1,400

The Futures Spread Margin required is EUR 1,400.

Variation Margin

Answer 215

Date	Settlement price	Ticks	Tick (basis point) value (EUR)	Number of contracts	Variation Margin (EUR)
11/25/2002	110.15	–25	10	12	–3,000
11/26/2002	109.45	–70	10	12	–8,400
11/27/2002	109.90	+45	10	12	+5,400
11/28/2002	109.60	–30	10	12	–3,600
Total	**–**	**–80**	**–**		**–9,600**

The total loss incurred on the position is EUR 9,600.

The Futures Price – Fair Value

Answer 216

Calculating the futures price:

Futures price = Present value of the bond + Financing costs – Income on the bond during the future's lifetime

Calculating the financing costs:

$$\text{Financing costs} = (C_t + c\,\frac{t - t_0}{365}) \times {}_c r_t \times \frac{T - t}{365}$$

$$= (101.76 + 4.93) \times 0.0342 \times \frac{87}{365} = 0.87$$

Calculating income:

The reinvestment of the coupon payments has to be taken into account when determining income on the bond. The reinvestment period is the period between the coupon payment date and futures maturity (January 4, 2003 to March 10, 2003 = 65 days).

Income = Accrued interest until futures maturity + Income from reinvestment of coupon payments

$$= 5.25 \times \frac{87}{365} + 5.25 \times 0.0342 \times \frac{65}{365} = 1.28$$

Calculating the equivalent futures price of the CTD:

Futures price CTD = 101.76 + 0.87 – 1.28 = 101.35

Calculating the theoretical price of the Euro Bund Future:

$$\text{Futures price} = \frac{\text{Futures price CTD}}{\text{Conversion factor}} = \frac{101.35}{0.949546} = 106.74$$

The theoretical price of the Euro Bund Future is 106.74.

The Cheapest-to-Deliver (CTD) Bond

Answer 217

Proceeds of a cash market sale	**5.25% Federal Republic of Germany – 01/04/2011**	**5.00% Federal Republic of Germany – 07/04/2011**
Value of the bond + Accrued interest	EUR 100,580 + EUR 2,260	EUR 98,840 + EUR 4,670
= Total	EUR 102,840	EUR 103,510

Calculation of the delivery price	**5.25% Federal Republic of Germany – 01/04/2011**	**5.00% Federal Republic of Germany – 07/04/2011**
Euro Bund Future Final Settlement Price × Conversion factor + Accrued interest	EUR 100,952.76 + EUR 2,260	EUR 99,207.90 + EUR 4,670
= Total	EUR 103,212.76	EUR 103,877.90

Comparison	**5.25% Federal Republic of Germany – 01/04/2011**	**5.00% Federal Republic of Germany – 07/04/2011**
Delivery price	EUR 103,212.76	EUR 103,877.90
– Proceeds of a cash market sale	EUR 102,840	EUR 103,510
= Advantage/Disadvantage in case of physical delivery	EUR 372.76	EUR 367.90

The 5.25 percent Federal Republic of Germany – 4 Jan 2011 is currently the cheapest-to-deliver bond because it offers the holder of a short futures position the higher advantage in case of a physical delivery.

Answer 218

A long calendar spread involves the simultaneous purchase of the near date and the sale of the far date future. The expected profit or loss will be a consequence of a number of factors, including a change in short term interest rates during the holding period of the spread.

A starting point is to use the above information and the premise that the CTD bond could be taken delivery of in the near date future, at a total price of

$$(106.20 \times 0.931516) + 2.151 = 101.07799 \text{ (per 100 nominal)}$$

plus it could also be sold back in September at

$$(105.60 \times 0.932838) + 3.411 = 101.91869 \text{ (per 100 nominal)}$$

The expected net profit/loss would be the difference between the cost of buying the bond in June and its sale in September, including the financing of the position over time, less the income earned on the bond for the carry period of 92 days.

The break-even finance rate can be calculated as follows. It is based on a derivation of the implied repo rate formula:

	June	September
Invoice amount (per 100 nominal)	101.07799	101.91869
(Futures price × Conversion Factor + Accrued Interest)		

Net expected profit (loss):

$$101.91869 - 101.07799 = 0.84070$$

Break-even financing rate:

$$\frac{0.84070 \times 365 \times 100}{101.07799 \times 92} = 3.2998$$

Therefore the theoretical break-even financing rate on the calendar spread if held to full maturity would be 3.3 percent.

In reality spread traders are unlikely to actually hold the position throughout the full June to September period. What is more likely is that the trader who expects short term financing rates to fall (and we will assume the CTD will still remain constant) will buy the calendar spread. If rates fall, and other factors remain equal, in simple terms more traders will be attracted to buying the June contract and selling the September contract.

Therefore, for example, the original spread was put on for a financing rate of 3.3 percent, and market rates fell almost immediately by 0.5 percentage points, this would signal an arbitrage opportunity to other traders at the current futures prices. Arbitrageurs and spread traders would soon move in to buy June futures and sell September futures, which would benefit the original spread trader. This may cause the spread to widen, perhaps therefore encouraging the original spread trader to close out his position by selling back the June future at a higher price than originally paid and buying the September future at a lower price than it was originally sold at.

Clearly the level of short term financing rates and how they change across the maturity spectrum will ultimately affect bond futures prices. Significant changes in the yield curve can cause the CTD bond to vary also from one month to the other. If, in our example, there was an actual change or even an increase in the likelihood of a change in the CTD, then the June/September spread would be affected.

Inter-Product Spread

Answer 219

A flattening yield curve in the two-to-five-year range means that yields in the two-year segment will experience a stronger rise (or a less pronounced decline) than those in the five-year segment of the curve. If the spread changes in line with the investor's expectations, the price of the Euro Schatz Future will fall more (or rise less strongly) than that of the Euro Bobl Future.

In order to act on your market expectation you will have to sell Euro Schatz Futures and buy Euro Bobl Futures. The smallest tradable unit of this spread, based on interest rate sensitivity, is five short Euro Schatz Futures and two long Euro Bobl Futures.

Calculating the profit/loss of the spread position:

Result of the Euro Schatz Future position	**Points**	**EUR**
Futures sale on 11/14/2002	103.30	+103,300
Futures purchase on 12/03/2002	103.69	–103,690
Loss per contract		–390
Position loss on 5 contracts		–1,950

Result of the Euro Bobl Future position	**Points**	**EUR**
Futures purchase on 11/14/2002	106.04	–106,040
Futures sale on 12/03/2002	108.80	+108,800
Profit per contract		+2,760
Position profit on 2 contracts		+5,520

Result of the spread position (EUR)	**–1,950 + 5,520 = + 3,570**

The total profit on your position is EUR 3,570.

Choice of the Futures Contract

Answer 220

None of the available futures contracts is based on bonds with a remaining lifetime of six years, such as the one in your portfolio. You choose the December 2002 Euro Bobl Futures contract. The remaining lifetime of the bonds deliverable into this Euro Bobl Futures contract is 4½ to 5½ years, which is why this contract offers the highest correlation to the price of your bond. The December contract is preferable over the other maturities due to its higher liquidity.

Determining the Hedge Ratio

Answer 221

You choose the December 2002 Euro Bobl Future because this contract reflects the development in five-year yields. Furthermore, the bonds in your portfolio are deliverable into this contract.

Since the bonds of the portfolio are deliverable into the December 2002 Euro Bobl Future, the contract tracks the behavior of the bond prices relatively well. In this case, the nominal value method gives a sufficiently accurate result to determine the hedge ratio.

Nominal Value Method

Answer 222

Since the bonds are included in the basket of deliverable bonds, you can use the nominal value method to calculate the hedge ratio:

$$\text{Hedge ratio} = \frac{\text{Nominal value bond portfolio}}{\text{Nominal value CONF Future}} = \frac{\text{CHF } 4{,}100{,}000}{\text{CHF } 100{,}000} = 41 \text{ contracts}$$

In order to hedge the current position you have to sell 41 March 2003 Euro Bund Future contracts.

Modified Duration Method

Answer 223

Calculating the modified duration of the bond portfolio:

$$\text{Modified duration} = (-6.26) \times 0.4782 + (-7.30) \times 0.2384 + (-4.29) \times 0.2834 = -5.95$$

Calculating the market value of the bond portfolio:

$$\text{Market value}_{BP} = 1{,}058{,}671.13 + 527{,}747.77 + 627{,}268.88 = 2{,}213{,}687.78$$

Calculating the hedge ratio:

$$\text{Hedge ratio} = \frac{\text{Market value}_{BP}}{\text{Present value}_{CTD} \times 1{,}000} \times \frac{\text{Modified duration}_{BP}}{\text{Modified duration}_{CTD}} \times \text{Conversion factor}$$

$$= \frac{2{,}213{,}687.78}{102{,}710} \times \frac{-5.95}{-6.74} \times 0.950491 = 18.08$$

In order to hedge the bond portfolio you will have to sell 18 March 2003 Euro Bund Future contracts.

Sensitivity Method

Answer 224

Calculating the basis point value of the bond portfolio:

$$\text{Basis point value}_{BP} = \frac{\text{Market value}_{BP} \times \text{Modified Duration}_{BP}}{10{,}000}$$

$$= \frac{(12{,}005{,}639.78 + 252{,}150.68) \times -7.56}{10{,}000} = -9{,}266.89$$

Calculating the basis point value of the CTD:

$$\text{Basis point value}_{CTD} = \frac{\text{Market value}_{CTD} \times \text{Modified Duration}_{CTD}}{10{,}000}$$

$$= \frac{105{,}210 \times -9.79}{10{,}000} = -103.00$$

Calculating the hedge ratio:

$$\text{Hedge ratio} = \frac{\text{Basis point value}_{BP}}{\text{Basis point value}_{CTD}} \times \text{Conversion factor}$$

$$= \frac{-9{,}266.89}{-103.00} \times 0.803191 = 72.26$$

For a complete hedge of the bond position you will have to sell 72 contracts of the March 2003 CONF Future.

Using Modified Duration for Partial Hedges

Answer 225

The objective of the hedge is to reduce the modified duration of the portfolio to one quarter of its original exposure.

$$\text{Target}_{\text{Modified duration}} = \frac{-9.56}{4} = -2.39$$

Calculating the hedge ratio:

$$\text{Hedge ratio} = \frac{\text{Market value}_{BP}}{\text{Market value}_{CTD}} \times \frac{\text{Target}_{\text{Modified duration}} - \text{Modified duration}_{BP}}{\text{Modied duration}_{CTD}}$$

$$\times \text{ Conversion factor}$$

$$= \frac{32{,}071{,}692.04 + 1{,}200{,}182.91}{105{,}210} \times \frac{(-2.39) - (-9.56)}{-9.79} \times 0.803191 = -186.03$$

In order to partially hedge the portfolio described above, you will have to sell 186 March 2003 CONF Future contracts.

Cash-and-Carry Arbitrage/ Reverse Cash-and-Carry Arbitrage

Answer 226

A simultaneous sale of the March 2003 Euro Bund Future and purchase of the cheapest-to-deliver bond, with the cash bond position being financed in the money market at the short-term financing rate. The current cheapest-to-deliver is the 5.25 percent Federal Republic of Germany January 4, 2011. Note that a coupon payment on the CTD will occur during the lifetime of the future (on January 4, 2003).

Transaction	Amount	Remarks
Purchase of the CTD (present value)	101,450 + 4,930 = EUR 106,380	Price of the bond + Accrued interest
Financing costs until the futures delivery date	106,380 × 0.0342 × 87/365 = EUR 867.19	Present value × Short-term financing rate × Number of days/365
Income during the lifetime of the future (credit and reinvestment of the coupon)	5,250 + (5,250 × 0.0342 × 65/365) = EUR 5,281.97	Value of the coupon + (Value of the coupon × Short-term rate number of days/365)
Overall costs of the bond position	106,380 + 867.19 – 5,281.97 = EUR 101,965.22	Present value of the investment + Financing costs – Income

Variation Margin		Remarks
Delivery price of the bond at maturity of the Euro Bund Future	(106.38 – 106.55) × 100 × 10 = EUR –170	(Traded price – Final Settlement Price) × 100 × Tick (basis point) value

Delivery price for value date 12/13/2002		Remarks
Delivery price of the bond at maturity of the Euro Bund Future	(106,550 × 0.950491) + 930 = EUR 102,204.82	Euro Bund Future at Final Settlement Price × Conversion factor + Accrued interest

Comparison			Remarks
Delivery price of the bond	EUR	102,204.82	
Variation Margin	EUR	–170	
Overall cost of the bond position	EUR	–101,965.22	
Profit	EUR	69.60	

The total profit of the arbitrage strategy is EUR 69.60.

The example shown in this case study is for illustration purposes. In practice, additional influencing factors, such as supplementary income from lending the securities held, must be taken into account. Arbitrage opportunities generally exist for a number of seconds only. This is why arbitrage trading is usually the preserve of professional market participants.

Delta

Answer 227

Calculating the position delta (EUR/point):

Position delta = Number of contracts × Option delta × Value of one percentage point

Position	Price	Number of contracts	Option delta (points)	Position delta (EUR/point)
Long March 2003 Euro Bobl Future	105.06	30	1	+30,000
Long 104.50 put on the March 2003 Euro Bobl Future	0.34	20	−0.25	−5,000
Short 105.50 call on the March 2003 Euro Bobl Future	0.39	60	−0.43	−25,800
Total	–	–	–	**−800**

If the Euro Bobl Future price rises from 105.06 to 106.06 the overall position, which has a delta of −800, will incur an estimated loss of EUR 800.

Gamma

Answer 228

Calculating the position gamma (EUR/point):

Position delta = Number of contracts × Delta amount × Gamma × Value of 1% point

Position	Price	Number of contracts	Option delta (points)	Option gamma (% / points)	Position gamma (EUR/point)
Long March 2003 Euro Bobl Future	105.06	30	1	0	0
Long 104.50 put on the March 2003 Euro Bobl Future	0.34	20	−0.25	0.44	+2,200
Short 105.50 call on the March 2003 Euro Bobl Future	0.39	60	−0.43	−0.35	−9,030
Total	–	–	–	–	**−6,830**

The delta of the portfolio will decline by an estimated EUR 6,830 if the future's price rises by one unit.

Long Call

Answer 229

A long call on the March 2003 Euro Bobl Future with an exercise price of 106.00 offers the highest profit potential, in terms of the capital invested, if prices rise strongly. Although the option has the smallest delta, it offers the largest leverage: this is evident if you relate the delta to the invested capital.

Euro Bobl Future at the end of the option's lifetime	Profit/loss Long call 106.00	Profit/loss per option contract (EUR)
107.00	+0.77	+770
106.50	+0.27	+270
106.00	–0.23	–230
105.50	–0.23	–230
105.00	–0.23	–230
104.50	–0.23	–230
104.00	–0.23	–230

The break-even point of the out-of-the-money long call on the Euro Bobl Future (106 March 2003), on its Last Trading Day is 106.23.

Short Call

Answer 230

You decide to sell 24 March 2003 Euro Schatz at-the-money calls. Selling the at-the-money calls means you receive the highest time value. Although the risk of being exercised is smaller with the out-of-the-money 103.50 calls. Exercise price 103.00 you sell less time value the fact that the exercise price is further away from the underlying means you will receive a smaller premium. The in-the-money call 102.50 is not in line with your market view.

Euro Schatz Future at the end of the option's lifetime	Profit/loss Short call 103.00	Profit/loss on the option position (EUR)
104.50	–1.29	–30,960
104.00	–0.79	–18,960
103.50	–0.29	– 6,960
103.00	+0.21	+ 5,040
102.50	+0.21	+ 5,040
102.00	+0.21	+ 5,040

The break-even point of the short 103.00 call on the March 2003 Euro Schatz Future, on its Last Trading Day is 103.21.

Long Put

Answer 231

You decide on buying out-of-the-money puts on the March 2003 Euro Schatz Future with an exercise price of 102.50. The premium on this option will increase the most if prices in the underlying future decline as expected. Although the option has the smallest delta, it offers the largest leverage: this is evident if you relate the delta to the invested capital.

Euro Schatz Future at the end of the option's lifetime	Profit/loss Long put 102.50	Profit/loss per option contract (EUR)
104.00	–0.17	–170
103.50	–0.17	–170
103.00	–0.17	–170
102.50	–0.17	–170
102.00	+0.33	+330
101.50	+0.83	+830

The break-even point of the long 102.50 put on the March 2003 Euro Schatz Future, on its Last Trading Day is 102.33.

Short Put

Answer 232

You decide to sell twelve at-the-money (106.00) March 2003 Euro Bund Future put.

Although you receive the greatest premium if you choose at-the-money puts, the risk of the option being exercised at the end of the lifetime is higher. Selling the out-of-the-money put reduces the threat of being exercised. However, you are selling less time value and hence reducing the maximum profit on the strategy. The in-the-money put does not meet your market expectation.

Euro Bund Future at the end of the option's lifetime	Profit/loss on the option	Profit/loss on the options position (EUR)
106.50	+0.82	+ 9,840
106.00	+0.82	+ 9,840
105.50	+0.32	+ 3,840
105.00	–0.18	– 2,160
104.50	–0.68	– 8,160
104.00	–1.18	–14,160

The break-even point of the short 106.00 put on the March 2003 Euro Bund Future, on its Last Trading Day is 105.18.

Bull Call Spread

Answer 233

You decide to buy four 105.00 at-the-money calls and to sell four 106.00 out-of-the-money calls on the March 2003 on the Euro Bobl Future.

Euro Bobl Future at the end of the options' lifetime	Long call 105	Short call 106	Overall position	Overall position (EUR)
107.00	+1.39	−0.77	+0.62	+2,480
106.50	+0.89	−0.27	+0.62	+2,480
106.00	+0.39	+0.23	+0.62	+2,480
105.50	−0.11	+0.23	+0.12	+480
105.00	−0.61	+0.23	−0.38	−1,520
104.50	−0.61	+0.23	−0.38	−1,520
104.00	−0.61	+0.23	−0.38	−1,520

The break-even point on this bull call spread on the Euro Bobl Future on its Last Trading Day, is 105.38 (Lower exercise price + Net premium).

Bear Put Spread

Answer 234

You decide to buy 13 106.00 at-the-money puts and to sell 13 105.00 out-of-the-money puts on the March 2003 Euro Bund Future. The maximum loss per spread is the net premium; this arises if both options expire worthless.

Euro Bund Future at the end of the options' lifetime	Short put 105	Long put 106	Overall position	Overall position (EUR)
107.00	+0.43	−0.82	−0.39	−5,070
106.50	+0.43	−0.82	−0.39	−5,070
106.00	+0.43	−0.82	−0.39	−5,070
105.50	+0.43	−0.32	+0.11	+1,430
105.00	+0.43	+0.18	+0.61	+7,930
104.50	−0.07	+0.68	+0.61	+7,930
104.00	−0.57	+1.18	+0.61	+7,930

The break-even point of the bear put spread on the Euro Bund Future on its Last Trading Day, is 105.61 (Upper exercise price – Net premium).

Long Straddle

Answer 235

In order to establish the trade you buy 14 at-the-money calls on the March 2003 Euro Schatz Future with an exercise price of 103.00, plus 14 at-the-money puts on the March 2003 Euro Schatz Future with the same exercise price.

An immediate increase in implied volatility by one percentage point will result in a gain of 0.18 points for each of these options. The profit per contract is therefore EUR 360, which is equivalent to an overall profit of EUR 5,040.

Euro Schatz Future at the end of the options' lifetime	Long call 103	Long put 103	Overall position	Overall position (EUR)
104.50	+1.29	−0.37	+0.92	+12,880
104.00	+0.79	−0.37	+0.42	+5,580
103.50	+0.29	−0.37	−0.08	−1,120
103.00	−0.21	−0.37	−0.58	−8,120
102.50	−0.21	+0.13	−0.08	−1,120
102.00	−0.21	+0.63	+0.42	+5,580
101.50	−0.21	+1.13	+0.92	+12,880

The break-even points of the long straddle on its Last Trading Day are 103.58 (Exercise price + Total premium) and 102.42 (Exercise price – Total premium), respectively.

Long Strangle

Answer 236

Purchase 18 107.50 calls and simultaneously buy 18 104.50 puts on the March 2003 Euro Bund Future.

An immediate increase in implied volatility by one percentage point will result in a gain of 0.14 points for each of these options, equivalent to EUR 280 per contract. A position of 18 long strangles will therefore result in a profit of EUR 5,040 if implied volatility rises immediately by one percentage point.

Euro Bund Future at the end of the options' lifetime	Long call 107.50	Long put 104.50	Overall position	Overall position (EUR)
110.00	+2.19	−0.27	+1.92	+34,560
109.00	+1.19	−0.27	+0.92	+16,560
108.00	+0.19	−0.27	−0.08	−1,440
107.00	−0.31	−0.27	−0.58	−10,440
106.00	−0.31	−0.27	−0.58	−10,440
105.00	−0.31	−0.27	−0.58	−10,440
104.00	−0.31	+0.23	−0.08	−1,440
103.00	−0.31	+1.23	+0.92	+16,560
102.00	−0.31	+2.23	+1.92	+34,560

The break-even points of the long strangle on its Last Trading Day are 108.08 (Upper exercise price + Total premium) and 103.92 (Lower exercise price – Total premium), respectively. The maximum loss of EUR 10,440 is incurred with prices between the two exercise prices.

Delta Hedging

Answer 237

Alternative 1: Calculation of the hedge ratio for a delta hedge using short calls:

$$\text{Hedge ratio}_{\text{Call}} = \frac{\text{Hedge ratio}_{\text{Future}}}{\text{Delta}_{\text{Call}}} = \frac{-18.08}{0.46} = -39.30$$

In order to hedge the bond portfolio against interest rate risks you will have to sell 39 106.00 calls on the March 2003 Euro Bund Future.

Alternative 2: Calculation of the hedge ratio for a delta hedge using long puts:

$$\text{Hedge ratio}_{\text{Put}} = \frac{\text{Hedge ratio}_{\text{Future}}}{\text{Delta}_{\text{Put}}} = \frac{-18.08}{-0.29} = 62.34$$

In order to hedge the bond portfolio against interest rate risks you have to buy 62 105.00 puts on the March 2003 Euro Bund Future.

Alternative 1: Adjusting the delta hedge using short calls to the changed market data:

$$\text{Hedge ratio}_{\text{Call}} = \frac{\text{Hedge ratio}_{\text{Future}}}{\text{Delta}_{\text{Call}}} = \frac{-17.96}{0.34} = -52.82$$

In order to maintain the hedge against interest rate risks you have to sell another 14 (53-39) 106.00 calls on the March 2003 Euro Bund Future.

Alternative 2: Adjusting the delta hedge using long puts to the changed market data:

$$\text{Hedge ratio}_{\text{Put}} = \frac{\text{Hedge ratio}_{\text{Future}}}{\text{Delta}_{\text{Put}}} = \frac{-17.96}{-0.36} = 49.89$$

In order to maintain the hedge against interest rate risks you have to close out twelve (62-50) 105.00 puts on the March 2003 Euro Bund Future.

Zero Cost Collar

Answer 238

Purchase 100 104.00 puts and simultaneously sell 100 106.00 calls on the March 2003 Euro Bobl Future. The price of the trade is 0.01 per spread, or EUR 1,000 for the overall trade.

Profit/loss of the position at expiration of the options:

Euro Bobl Future at the end of the options' lifetime	Futures-equivalent cash market position	Long put 104.00	Short call 106.00	Overall position	Overall position (EUR)
107.00	+1.95	−0.22	−0.79	+0.94	+94,000
106.50	+1.45	−0.22	−0.29	+0.94	+94,000
106.00	+0.95	−0.22	+0.21	+0.94	+94,000
105.50	+0.45	−0.22	+0.21	+0.44	+44,000
105.00	−0.05	−0.22	+0.21	−0.06	−6,000
104.50	−0.55	−0.22	+0.21	−0.56	−56,000
104.00	−1.05	−0.22	+0.21	−1.06	−106,000
103.50	−1.55	+0.28	+0.21	−1.06	−106,000
103.00	−2.05	+0.78	+0.21	−1.06	−106,000

The maximum profit of the trade is limited to EUR 94,000 if futures prices rise. It occurs if the futures price rises above the exercise price of the short call option (i.e. 106.00). The maximum loss of EUR 106,000 arises if the futures price falls below the exercise price of the long put option (104.00).

Synthetic Long Call

Answer 239

Euro Schatz Future at the end of the options' lifetime	Long future	Long put 103.00	Synthetic long call 103.00	"Real" long call 103.00
105.00	+2.16	−0.34	+1.82	+1.79
104.50	+1.66	−0.34	+1.32	+1.29
104.00	+1.16	−0.34	+0.82	+0.79
103.50	+0.66	−0.34	+0.32	+0.29
103.00	+0.16	−0.34	−0.18	−0.21
102.50	−0.34	+0.16	−0.18	−0.21
102.00	−0.84	+0.66	−0.18	−0.21
101.50	−1.34	+1.16	−0.18	−0.21
101.00	−1.84	+1.66	−0.18	−0.21

The synthetic long call has an advantage of 0.03 points (EUR 30) over the "real" long call at expiration.

Synthetic Short Call

Answer 240

Euro Bobl Future at the end of the options' lifetime	Short future	Short put 105.00	Synthetic short call 105.00	"Real" short call 105.00
107.00	−1.92	+0.53	−1.39	−1.44
106.50	−1.42	+0.53	−0.89	−0.94
106.00	−0.92	+0.53	−0.39	−0.44
105.50	−0.42	+0.53	+0.11	+0.06
105.00	+0.08	+0.53	+0.61	+0.56
104.50	+0.58	+0.03	+0.61	+0.56
104.00	+1.08	−0.47	+0.61	+0.56
103.50	+1.58	−0.97	+0.61	+0.56
103.00	+2.08	−1.47	+0.61	+0.56

The synthetic short call has an advantage of 0.05 points (EUR 50) over the "real" short call at expiration.

Synthetic Long Put

Answer 241

Euro Bund Future at the end of the options' lifetime	Short future	Long call 106.00	Synthetic long put 106.00	"Real" long put 106.00
108.00	−1.92	+1.16	−0.76	−0.78
107.50	−1.42	+0.66	−0.76	−0.78
107.00	−0.92	+0.16	−0.76	−0.78
106.50	−0.42	−0.34	−0.76	−0.78
106.00	+0.08	−0.84	−0.76	−0.78
105.50	+0.58	−0.84	−0.26	−0.28
105.00	+1.08	−0.84	+0.24	+0.22
104.50	+1.58	−0.84	+0.74	+0.72
104.00	+2.08	−0.84	+1.24	+1.22

The synthetic long put has an advantage of 0.02 points (EUR 20) over the "real" long put at expiration.

Synthetic Short Put

Answer 242

Euro Schatz Future at the end of the options' lifetime	Long future	Short call 102.50	Synthetic short put 102.50	"Real" short put 102.50
105.00	+2.51	−2.24	+0.27	+0.24
104.50	+2.01	−1.74	+0.27	+0.24
104.00	+1.51	−1.24	+0.27	+0.24
103.50	+1.01	−0.74	+0.27	+0.24
103.00	+0.51	−0.24	+0.27	+0.24
102.50	+0.01	+0.26	+0.27	+0.24
102.00	−0.49	+0.26	−0.23	−0.26
101.50	−0.99	+0.26	−0.73	−0.76
101.00	−1.49	+0.26	−1.23	−1.26

The synthetic short put has an advantage of 0.03 points (EUR 30) over the "real" short put at expiration.

Reversal

Answer 243

You can construct a reversal by purchasing a synthetic March 2003 future, which consists of the sale of a 103.00 put and the purchase of a 103.00 call and simultaneously selling the "real" March 2003 Euro Schatz Future.

Euro Schatz Future at the end of the options' lifetime	Long call 103.00	Short put 103.00	Synthetic long future	"Real" short future	Reversal
105.00	+1.86	+0.39	+2.25	−2.22	+0.03
104.50	+1.36	+0.39	+1.75	−1.72	+0.03
104.00	+0.86	+0.39	+1.25	−1.22	+0.03
103.50	+0.36	+0.39	+0.75	−0.72	+0.03
103.00	−0.14	+0.39	+0.25	−0.22	+0.03
102.50	−0.14	−0.11	−0.25	+0.28	+0.03
102.00	−0.14	−0.61	−0.75	+0.78	+0.03
101.50	−0.14	−1.11	−1.25	+1.28	+0.03
101.00	−0.14	−1.61	−1.75	+1.78	+0.03

The profit per reversal is 0.03 points (EUR 30) per contract.

Conversion

Answer 244

A conversion can be constructed by selling a synthetic March 2003 future, which consists of the purchase of a 106.50 put and the sale of a 106.50 call and simultaneously purchasing the "real" March 2003 Euro Bobl Future.

Euro Bobl Future at the end of the options' lifetime	Long put 106.50	Short call 106.50	Synthetic short future	"Real" long future	Conversion
108.00	–1.49	–1.30	–2.79	+2.88	+0.09
107.50	–1.49	–0.80	–2.29	+2.38	+0.09
107.00	–1.49	–0.30	–1.79	+1.88	+0.09
106.50	–1.49	+0.20	–1.29	+1,38	+0.09
106.00	–0.99	+0.20	–0.79	+0.88	+0.09
105.50	–0.49	+0.20	–0.29	+0.38	+0.09
105.00	+0.01	+0.20	+0.21	–0.12	+0.09
104.50	+0.51	+0.20	+0.71	–0.62	+0.09
104.00	+1.01	+0.20	+1.21	–1.12	+0.09
103.50	+1.51	+0.20	+1.71	–1.62	+0.09
103.00	+2.01	+0.20	+2.21	–2.12	+0.09

The profit per conversion is 0.09 points, or EUR 90.

Sales Contacts

Frankfurt
Neue Börsenstraße 1
60487 Frankfurt/Main
Germany

Key Account Austria, Denmark,
Finland, Germany, Netherlands,
Norway, Portugal, Spain, Sweden
Gabriele Ristau
T +49-69-211-1 57 41
F +49-69-211-1 44 77

Key Account Asia/Pacific
Jianhong Wu
T +49-69-211-1 55 34
F +49-69-211-1 44 38

Zurich
Selnaustrasse 30
8021 Zurich
Switzerland

Key Account Greece, Italy,
Middle East, Switzerland, Turkey
Markus-Alexander Flesch
T +41-58-854-29 48
F +41-58-854-24 66

London
One Canada Square
Floor 42
Canary Wharf
London E14 5DR
Great Britain

Key Account Gibraltar,
Great Britain, Ireland
Hartmut Klein
T +44-20-78 62-72 20
F +44-20-78 62-92 20

Paris
17, rue de Surène
75008 Paris
France

Key Account Belgium,
France, Luxembourg
Laurent Ortiz
T +33-1-55 27-67 72
F +33-1-55 27-67 50

Chicago
Sears Tower
233 South Wacker Drive
Suite 2450
Chicago, IL 60606
USA

Key Account Canada, USA
Christian Ochsner
T +1-312-544-10 55
F +1-312-544-11 45

Further Information

Eurex Website

On the Eurex website **www.eurexchange.com** a variety of tools and services are available, a selection is given below:

Brokerage Services – Investors can inquire online to find appropriate brokerage services (Documents > Participant Lists > Brokers).
E-News – Register in the MyEurex section to automatically receive information about Eurex and its products by e-mail.
Margin Calculation – Eurex offers the Eurex MarginCalculator (Clearing > Risk & Margining > Eurex MarginCalculator) which allows users to determine margin requirements for all products cleared by Eurex Clearing AG.
Price Information – Look up delayed price information (Market Data > Delayed Quotes) for all Eurex derivatives.

Publications

Eurex offers a wide variety of publications about its products and services including brochures about derivatives trading strategies, contract specifications, margining & clearing and the trading system. Furthermore, Eurex offers information flyers which provide a brief overview about specific products traded at the exchange.

Selected brochures:

- Equity and Equity Index Derivatives – Trading Strategies
- Interest Rate Derivatives – Fixed Income Trading Strategies
- Products
- Risk Based Margining

All publications are available for download on the Eurex website **www.eurexchange.com** (Documents > Publications). The "Publication Search" facility (Documents > Publications > Publication Search) provides a keyword search for all Eurex publications.

Print versions are available via the Eurex Publications Service:

Frankfurt
T +49-69-211-1 15 10
F +49-69-211-1 15 11
e-mail publications@eurexchange.com

Zurich
T +41-58-854-29 42
F +41-58-854-24 66

Training Courses

The Learning Portal **trainingscenter.deutsche-boerse.com** gives you one-stop access to all Eurex training sessions and exams to satisfy your individual training needs.
T +49-69-211-1 37 67
F +49-69-211-1 37 63
e-mail trainingscenter@eurexchange.com

The following educational tools can be ordered via the Learning Portal:

- "Get Ahead with Eurex" – All About Futures and Options (DVD)
- Eurex OptionAlligator (option price calculator)

Published by
Eurex Frankfurt AG
Neue Börsenstraße 1
60487 Frankfurt/Main
Germany

Eurex Zürich AG
Selnaustrasse 30
8021 Zurich
Switzerland

www.eurexchange.com

Order Number
E2E-103-0307

ARBN Number
Eurex Frankfurt AG ARBN 100 999 764

Eurex Frankfurt AG
Neue Börsenstraße 1
60487 Frankfurt/Main
Germany

Eurex Zürich AG
Selnaustrasse 30
8021 Zurich
Switzerland

www.eurexchange.com