

Interest Rate Instruments and Market Conventions Guide



Copyright © 2011-2013 OpenGamma Ltd..

This document is licensed to the public under a Creative Commons Attribution Non Commercial 3.0 Unported License

<http://creativecommons.org/licenses/by/3.0/>.

Attribution under the license should be to OpenGamma.

This document is for informational purposes only, and is provided as is. OpenGamma declines all responsibility of any errors and any loss or damage resulting from use of the contents of this document. User assumes the full risk of using this document. For more information, please see the text of the license (<http://creativecommons.org/licenses/by/3.0/legalcode>).

Edition 2.0

First edition: 24 May 2011

This edition: 16 December 2013

Contents

List of Tables	v
Preface	vi
Part 1. References	1
Chapter 1. Associations	2
1. International Swaps and Derivatives Association	2
2. British Bankers' Association	2
3. Euribor-EBF	2
4. Australian Financial Markets Association	2
5. Danish Bankers Association	2
6. Wholesale Markets Brokers Association	2
7. Japanese Bankers Association	2
Chapter 2. Exchanges	3
1. Australian Securities Exchange	3
2. BM&FBovespa - Brazil	3
3. CME Group	3
4. Eurex	3
5. IntercontinentalExchange - ICE	3
6. LCH.Clearnet	3
7. MEFF - Spain	4
8. Montréal Exchange	4
9. NASDAQ OMX	4
10. NYSE Euronext	4
11. Singapore Exchange - SGX	4
12. Tokyo Stock Exchange	4
13. South African Futures Exchange - JSE	4
Chapter 3. Day count conventions	5
1. 1/1	5
2. 30/360 methods	5
3. 30/360	5
4. 30E/360	5
5. 30E/360 (ISDA)	5
6. 30E+/360 ISDA	5
7. ACT/360	6
8. ACT/365 Fixed	6
9. ACT/365 L	6
10. ACT/365 A	6
11. NL/365	6
12. ACT/ACT ISDA	7
13. ACT/ACT ICMA	7
14. Business/252	7

Chapter 4. Business day conventions	8
1. Following	8
2. Preceding	8
3. Modified following	8
4. Modified following bimonthly	8
5. End of month	8
Chapter 5. Overnight indexes	9
1. Committee meetings	9
2. CHF-TOIS	10
3. EUR-EONIA	10
4. EUR-EURONIA	10
5. GBP-SONIA	10
6. JPY-TONAR-Uncollateralized Overnight Call Rate	10
7. USD-Effective Federal Funds Rate	10
8. AUD-RBA Interbank Overnight Cash Rate Survey / AONIA	10
9. CAD-CORRA	11
10. DKK-Danmarks Nationalbank Tomorrow/Next interest rate	11
11. NZD-NZIONA	11
12. SEK-SIOR / T/N STIBOR	11
13. SGD-SONAR	11
14. ZAR-SFX ZAR OND	11
15. ZAR-SAONIA	11
Chapter 6. Ibor-like indexes	12
1. LIBOR	12
2. GBP-LIBOR	13
3. EUR-LIBOR	13
4. EURIBOR	13
5. JPY-TIBOR	13
6. AUD-BBSW	13
7. CAD-CDOR	14
8. DKK-CIBOR	14
9. HKD-HIBOR	14
10. INR-MIFOR	14
11. NOK-NIBOR	14
12. RMB-SHIBOR	14
13. SEK-STIBOR	14
14. SGD-SIBOR	14
15. SGD-SOR	14
16. ZAR-JIBAR	15
Part 2. Exchange traded instruments	16
Chapter 7. Overnight index linked futures	18
1. Federal Funds Futures	18
2. One month EONIA indexed futures	18
3. One-Day Interbank Deposit Futures Contract - Brazil	18
Chapter 8. Short Term Interest Rate Futures Ibor based	20
1. USD	20
2. EUR	20
3. GBP	20
4. JPY	21
5. CHF	21

6. AUD	21
7. CAD	21
8. ZAR	21
Chapter 9. Interest Rate Futures Options: Premium	22
Chapter 10. Interest Rate Futures Options: Margin	23
Chapter 11. Bank bill futures (AUD style)	24
Chapter 12. Deliverable swap futures (present value quoted)	25
Chapter 13. Bond futures (non AUD/NZD)	26
1. USD	26
2. EUR-Germany	28
3. GBP	28
4. JPY	28
5. EUR - Spain	29
6. Settlement	29
Chapter 14. Options on Bond futures (non AUD/NZD): Premium	30
1. USD - CBOT	30
Chapter 15. Options on Bond futures (non AUD/NZD): Margin	31
1. EUR - EUREX	31
Chapter 16. Bond futures (AUD)	32
1. Description	32
2. Future settlement	32
Part 3. Over-The-Counter Instruments	34
Chapter 17. Forward Rate Agreement	35
Chapter 18. Interest rate swaps (Fixed for lbor)	36
1. Leg payments	36
2. Vanilla swaps	36
3. Composition	37
4. IMM dates swap	38
5. In-arrears swaps	38
6. Short and long tenors	38
7. Step-up and step-down	38
8. Amortised, accruing and roller coaster swaps	38
Chapter 19. Interest rate swaps (Basis swap; lbor for lbor)	39
Chapter 20. Interest rate swaps (Cross-currency swap; lbor for lbor)	40
Chapter 21. Swap indexes	41
1. ISDA fixing	41
2. ISDA-EUR	41
3. ISDA-USD	41
4. ISDA-GBP	41
5. ISDA-CHF	41
6. ISDA-JPY	41
Chapter 22. Overnight indexed swaps (OIS)	43
1. USD	43

2. EUR	43
3. Committee meetings	44
Chapter 23. Federal Fund swaps	45
Chapter 24. OIS indexes	46
1. EONIA swap index	46
Chapter 25. Swaption	47
1. Physical delivery swaptions	47
2. Cash-settled swaption EUR/GBP - yield-settled swaption	47
3. Cash-settled swaption USD	48
4. Up-front and forward premium	48
Chapter 26. Constant Maturity Swap (CMS)	49
Chapter 27. Forex forward and swaps	50
1. Standard order	50
2. Forward and swaps	50
3. Forward points	50
Index	52

List of Tables

5.1	Overnight indexes for the main currencies	9
5.2	Overnight indexes for other currencies	9
6.1	Ibor-like indexes for the main currencies.	12
6.2	Ibor-like indexes for other currencies.	13
6.3	Rate futures month codes.	17
8.1	Interest rate futures on Ibor details and codes: main currencies.	21
8.2	Interest rate futures on Ibor details and codes: other currencies.	21
10.1	Interest rate future options details and codes.	23
11.1	Futures on bank bills details and codes.	24
12.1	CME/CBOT deliverable swap futures in USD.	25
13.1	Main bond futures overview.	26
13.2	USD bond futures	27
13.3	EUR bond futures	28
13.4	GBP bond futures	28
13.5	JPY bond futures	29
13.6	EUR bond futures	29
14.1	USD bond futures options	30
17.1	FRA dates with differences between end of the accrual period and end of the underlying fixing deposit period.	35
18.1	Most frequent vanilla swap conventions in the main currencies.	37
18.2	Most frequent vanilla swap conventions in the main currencies.	37
18.3	Vanilla swap conventions for swaps with composition.	38
21.1	Swap fixing details.	42
21.2	Fixing sources pages and code.	42
22.1	Overnight indexed swap conventions in the main currencies	43
22.2	Overnight indexed swap conventions in other currencies	44
25.1	Swaptions settlement conventions	48
27.1	Conventional currency strength.	50
27.2	Forward points quotation factors.	51

Preface

This booklet is about finance and more precisely about interest rate derivatives. Nevertheless, it contains no models, no numerical methods and nothing new. It contains what everybody is supposed to know when they first start working in the industry: the habits, standards, conventions and all unsaid details regarding those instruments. Everybody is supposed to know about them but, to our knowledge and despair, they are not available in one unique, easily accessible document.

In our experience, as Risk Managers, Quantitative Analysts, Back-Office Officers or Traders, we have all one day or another looked for a small detail about a very familiar instrument without finding it. Is Euribor using the end-of-month rule? What is the standard payment frequency for three years AUD swap? What is the last trading date of a mid-curve option on Liffe? Those questions may sound familiar. The only way to find an answer is to ask your colleagues, search on the internet or call a counterpart; at least up to now. The goal of this booklet is to make all those details available in a single document.

Nowhere in this document we discuss pricing or valuation mechanisms, even for the simplest instruments. The link to valuation is that any valuation technique for any instrument presented should include all the relevant instrument features. Most of the standard books and articles smooth the roughness of real life. Day count and business day conventions are supposed to appear magically, when they are mentioned at all. We all know that nothing appears magically and that there is no such thing as a *free lunch*. We do not offer you any of those free lunches, but hopefully we can help you find the salt and pepper for your own lunch.

The goal of this document is to present *conventions* and *market standards* for the most common financial instruments. Those market standards are relative, and they evolve. We have done our best to collect the information and check it. For the same instrument, two groups of people may have different conventions. This is the case for example with USD swaps: some use an annual money market basis on the fixed leg and others semi-annual bond basis. The conventions evolve; this is the case for example for swaptions for which the standard changed from an up-front premium to a forward premium in September 2010.

The document is certainly not intended to be read from start to end like fiction. If quantitative finance is compared to a novel, this booklet would be the introduction of the main characters. It is a reference document and we expect the reader to read at most one chapter at a time, and more often one section or even one line. A relatively extensive index has been provided to help you find the right sections. This is also the way it was written, adding lines, currencies, and instruments when they were required in our developments.

The document has been divided in three parts. The first one is called *References*. It describes the financial associations that set most of the standards and the main exchanges for interest rate derivatives. It also contains the definitions of the day count and business day conventions. It finishes with the details on the main overnight and lbor-like indexes.

The second part is called *Exchange-traded instruments* and describes the instruments listed on exchanges, such as interest rate futures, bond futures and their options.

The third and final part is called *Over-the-counter instruments* and describes the most liquid instruments of the interbank market. In particular it contains different swaps (IRS, OIS, basis swaps, etc.) and different options (swaptions, caps/floors, CMS, etc.). The market being OTC, there is obviously more room for customization in the rules and conventions applied to any particular deal. We have tried to describe the most frequent ones.

Obviously this document is not perfect and we plan to add, complement, or correct when necessary. Do not hesitate to suggest corrections and additions.

We would like to thank readers of previous versions for providing us with feedback and conventions for more currencies. In particular, Professor Chyng Wang TEE provided details on Asian currencies, G. Kennedy suggested the addition of central bank committee meeting dates and G. Marais provided documents on South African conventions.

The document is published under a Creative Commons license (CC BY 3.0)¹, so you are free to use it in any form and redistribute it. However, we do ask that you indicate that the source is the **OpenGamma Interest Rate Instruments and Market Conventions Guide**.

The devil is in the details.

¹As this is an open license, we can not incorporate restricted information. In particular Reuters codes, which are restricted to customers with a commercial relationship with Reuters, are not provided.

Part 1

References

CHAPTER 1

Associations

Many rules and standards are proposed or collected by financial associations. The main ones are described in this chapter.

1. International Swaps and Derivatives Association

The International Swaps and Derivatives Association (ISDA) was founded in 1985.

In particular the association publishes the *ISDA Definitions*.

Reference: <http://www2.isda.org/>

2. British Bankers' Associations

The British Bankers' Association (BBA) is the trade association for the UK banking and financial services sector.

Reference: <http://www.bba.org.uk/>

3. Euribor-EBF

Euribor-EBF is an international non-profit association founded in 1999 with the launch of the Euro. Its members are national banking associations in the Member States of the European Union which are involved in the Eurozone and the Euro-system.

Reference: <http://www.euribor-ebf.eu/>

4. Australian Financial Markets Association

The Australian Financial Markets Association (AFMA) was formed in 1986.

Reference: <http://www.afma.com.au/>

5. Danish Bankers Association

The Danish Bankers Association is an organisation representing the banks in Denmark. It has the overall responsibility for CIBOR indexes.

Reference: <http://www.finansraadet.dk>.

6. Wholesale Markets Brokers Association

The Wholesale Markets Brokers Association (WMBA) is the associate of London brokers.

Reference: <http://www.wmba.org.uk/>.

7. Japanese Bankers Association

The Japanese Bankers Association is a financial organization whose members consist of banks, bank holding companies and bankers associations in Japan.

Reference: <http://www.zenginkyo.or.jp/en/>

CHAPTER 2

Exchanges

There are many exchanges where financial instruments are traded throughout the world. We have included the main ones where interest rate derivatives are listed. Over the years, a lot of mergers and acquisitions took place between the different exchanges. The names and organizational structures have changed and will certainly change again.

1. Australian Securities Exchange

In the interest rate landscape, the main products are the AUD bank bill futures and their options and AUD bond futures.

Reference: <http://www.asx.com.au/>

2. BM&FBovespa - Brazil

BM&FBOVESPA was created in 2008, through the integration between the São Paulo Stock Exchange (Bolsa de Valores de São Paulo) and the Brazilian Mercantile & Futures Exchange (Bolsa de Mercadorias e Futuros).

Reference: <http://www.bmfbovespa.com.br>

3. CME Group

The CME Group is a result of mergers between the Chicago Mercantile Exchange (CME), the Chicago Board of Trade (CBOT), New York Mercantile Exchange (NYMEX) and COMEX.

In the interest rate landscape, the main products are the interest rate futures (on Libor) and their options listed on CME, the federal funds futures listed on CBOT and the bond futures and their options listed on CBOT.

CME is also running a swap clearing business.

Reference: www.cmegroup.com

4. Eurex

Eurex is a derivatives exchange jointly operated by Deutsche Börse AG and SIX Swiss Exchange. It started its derivative trading in 1998.

In the interest rate landscape, the main products are the interest rate futures (on EURIBOR) and their options and the EUR bond futures.

Reference: <http://www.eurexexchange.com/index.html>

5. IntercontinentalExchange - ICE

ICE is a relatively recent exchange active mainly in commodity, energy and credit. It is involved in interest rate derivatives mainly through its (pending as of November 2013) acquisition of NYSE Euronext.

Reference: <https://www.theice.com>

6. LCH.Clearnet

The LCH.Clearnet Group is a clearing house, serving major exchanges and platforms as well as a range of OTC markets. LCH.Clearnet is owned 77.5% by its clients and 22.5% by exchanges.

Reference: <http://www.lchclearnet.com/>

7. MEFF - Spain

MEFF is an official secondary market regulated by Spanish laws and under the supervision of the Spanish National Securities Market Commission.

Reference: <http://www.meff.com>

8. Montréal Exchange

The Montréal Exchange (MX) is an electronic exchange dedicated to the development of the Canadian derivative markets.

Reference: <http://www.m-x.ca/>

9. NASDAQ OMX

In the interest rate landscape, the main products are Nordic futures: CIBOR futures, STIBOR futures and Swedish bond futures. They are also known for publishing the SIOR and CIBOR rates. NASDAX is also running an exchange in London: NLX (New London eXchange).

Reference: <http://www.nasdaqomx.com/>

Reference: <http://www.nasdaqomx.com/transactions/markets/nlx>

10. NYSE Euronext

NYSE Euronext results from mergers/acquisitions between Euronext, New York Stock Exchange (NYSE), Liffe and Amex. The exchange was acquired by IntercontinentalExchange (ICE) in November 2013.

In the interest rate landscape, the main products are the interest rate futures (on LIBOR and EURIBOR) and their options listed on Liffe.

Reference: <http://www.euronext.com/>

11. Singapore Exchange - SGX

In the interest rate landscape, the products are Japanese and Singaporean government bond futures, JPY (Libor and Tibor) and the Eurodollar STIR futures/options and SGD futures.

SGX is also running a swap clearing business.

Reference: <http://www.sgx.com/>

12. Tokyo Stock Exchange

In the interest rate landscape, the main products are JPY bond futures.

Reference: <http://www.tse.or.jp/english/>

13. South African Futures Exchange - JSE

The Johannesburg Stock Exchange s Interest Rate Market offers bond futures and JIBAR three months STIR futures.

Reference: <http://www.safex.co.za/>

Day count conventions

1. 1/1

The day count fraction is always 1. This is definition 4.16(a) in 2006 ISDA Definitions.

2. 30/360 methods

The *30/360 methods* group a certain number of methods that have in common to compute the accrual factor as

$$\frac{360(Y_2 - Y_1) + 30(M_2 - M_1) + (D_2 - D_1)}{360}$$

but differs on how the Y_i , M_i and D_i are computed.

3. 30/360

This is definition 4.16(f) in 2006 ISDA Definitions. The date adjustment rules are the following:

- If D1 is 31, then change D1 to 30.
- If D2 is 31 and D1 is 30 or 31, then change D2 to 30.

This day count convention is also called *30/360 US*, *30U/360*, *Bond basis*, *30/360* or *360/360*. The last three terms are the ones used in the 2006 ISDA Definitions.

There exists also a version of the day count which depends on an EOM convention. In that case an extra rule is added:

- If EOM and D1 is last day of February and D2 is last day of February, then change D2 to 30 and D1 to 30.

The ISDA definitions do not refer to the EOM convention.

4. 30E/360

This is definition 4.16(g) in 2006 ISDA Definitions. The date adjustment rules are the following:

- If D1 is 31, then change D1 to 30.
- If D2 is 31, then change D2 to 30.

This day count convention is also called *Eurobond basis*.

5. 30E/360 (ISDA)

This is definition 4.16(h) in 2006 ISDA Definitions. The date adjustment rules are the following:

- If D1 is the last day of the month, then change D1 to 30.
- If D2 is the last day of February but not the termination date or D2 is 31, then change D2 to 30.

6. 30E+/360 ISDA

The date adjustment rules are the following:

- If D1 is 31, then change D1 to 30.
- If D2 is 31, then change D2 to 1 and M2 to M2+1.

This convention is also called *30E+/360*.

7. ACT/360

This is definition 4.16(e) in 2006 ISDA Definitions. The accrual factor is

$$\frac{d_2 - d_1}{360}$$

where $d_2 - d_1$ is the number of days between the two dates.

This is the most used day count convention for money market instruments (maturity below one year).

This day count is also called *Money Market basis*, *Actual 360*, or *French*.

8. ACT/365 Fixed

This is definition 4.16(d) in 2006 ISDA Definitions. The accrual factor is

$$\frac{d_2 - d_1}{365}$$

where $d_2 - d_1$ is the number of days between the two dates. The number 365 is used even in a leap year.

This convention is also called *English Money Market basis*.

9. ACT/365 L

This convention described in ICMA Rule 251.1(i) is seldom used. It was originally designed for Euro-Sterling floating rate notes. It is used only to compute the accrual factor of a coupon. The computation of the factor requires three dates: the coupon start date (d_1), the accrual factor date (d_2) and the coupon end date (d_3).

For semi-annual coupons (the type of coupons for which it was originally designed for), the accrual factor is

$$\frac{d_2 - d_1}{\text{Days in end year}}$$

where "Days in end year" is the number of days in the year in which d_3 is (366 for leap year and 365 otherwise).

The convention is extended to annual coupons by

$$\frac{d_2 - d_1}{\text{Denominator}}$$

where "Denominator" is 366 if 29 February is between d_1 (exclusive) to d_3 (inclusive) and 365 otherwise.

The convention is also called *ACT/365 Leap year*

10. ACT/365 A

The accrual factor is

$$\frac{d_2 - d_1}{\text{Denominator}}$$

where "Denominator" is 366 if 29 February is between d_1 (exclusive) to d_2 (inclusive) and 365 otherwise.

The convention is also called *ACT/365 Actual*.

11. NL/365

The accrual factor is

$$\frac{\text{Numerator}}{365}$$

where "Numerator" is $d_2 - d_1 - 1$ if 29 February is between d_1 (exclusive) to d_2 (inclusive) and $d_2 - d_1$ otherwise.

The convention is also called *ACT/365 No leap year*.

12. ACT/ACT ISDA

This is definition 4.16(b) in 2006 ISDA Definitions. The accrual factor is

$$\frac{\text{Days in a non-leap year}}{365} + \frac{\text{Days in a leap year}}{366}.$$

To compute the number of days, the period first day is included and the last day is excluded.

Examples:

- Start date 30-Dec-2010 / End date: 2-Jan-2011: $3/365 = 0.008219\dots$
- Start date 30-Dec-2011 / End date: 2-Jan-2012: $2/365 + 1/366 = 0.8211\dots$
- Start date 30-Dec-2010 / End date: 2-Jan-2013: $367/365 + 366/366 + 1/365 = 3/365 + 2 = 2.008219\dots$

13. ACT/ACT ICMA

This is definition 4.16(c) in 2006 ISDA Definitions. This convention is defined in Rule 251 of the ICMA Rule Book. The accrual factor is

$$\frac{1}{\text{Freq}} \text{Adjustment}$$

where Freq is the number of coupons per year and Adjustment depends of the type of stub period.

None: The Adjustment is 1. The second expression reduces to 1 and the coupon is $1/\text{Freq}$.

Short at start: The Adjustment is computed as a ratio. The numerator is the number of days in the period. The denominator is the number of days between the standardised start date, computed as the coupon end date minus the number of month corresponding to the frequency (i.e. $12/\text{Freq}$), and the end date.

Long at start: Two standardised start dates are computed as the coupon end date minus one time and two times the number of month corresponding to the frequency. The numerator is the number of days between the start date and the first standardised start date and the numerator is the number of days between the first and second standardised start date. The Adjustment is the ratio of the numerator by the denominator plus 1.

Short at end: The Adjustment is computed as a ratio. The numerator is the number of days in the period. The denominator is the number of days between the start date and the standardised end date, computed as the coupon start date plus the number of month corresponding to the frequency (i.e. $12/\text{Freq}$).

Long at end: Two standardised end dates are computed as the coupon start date plus one time and two times the number of month corresponding to the frequency. The numerator is the number of days between the end date and the first standardised end date and the numerator is the number of days between the second and first standardised end date. The Adjustment is the ratio of the numerator by the denominator plus 1.

14. Business/252

This day count is also called *BUS/252*. This day count is based on the business, not calendar days. The accrual factor is

$$\frac{\text{Business days}}{252}$$

where the numerator is the number of business days (in a given calendar) from and including the start date up to and excluding the end date.

This day count is used in particular in the Brazilian market.

CHAPTER 4

Business day conventions

A *business day convention* is a convention for adjustment of dates when a specified date is not a good business day. The adjustment is done with respect to a specific calendar.

1. Following

The adjusted date is the following good business day

Examples:

- Start date 18-Aug-2011, period 1 month: end date: 19-Sep-2011.

2. Preceding

The adjusted date is the preceding good business day

This convention is often linked to loans and it is a translation of the amount that should be paid *on or before* a specific date.

Examples:

- Start date 18-Aug-2011, period 1 month: end date: 16-Sep-2011.

3. Modified following

The adjusted date is the following good business day unless the day is in the next calendar month, in which case the adjusted date is the preceding good business day.

This is the most used convention for interest rate derivatives.

Examples:

- Start date 30-Jun-2011, period 1 month: end date: 29-Jul-2011. The following rule would lead to 1-Aug which is in the next calendar month with respect to 30-Jul.

4. Modified following bimonthly

The adjusted date is the following good business day unless that day crosses the mid-month (15th) or end of a month, in which case the adjusted date is the preceding good business day.

Examples:

- Start date 30-Jun-2011, period 1 month: end date: 29-Jul-2011. The following rule would lead to 1-Aug which is in the next calendar month with respect to 30-Jul.
- Start date 15-Sep-2011, period 1 month: end date: 14-Oct-2011. The following rule would lead to 17-Oct which crosses the mid-month.

5. End of month

Where the start date of a period is on the final business day of a particular calendar month, the end date is on the final business day of the end month (not necessarily the corresponding date in the end month).

Examples:

- Start date 28-Feb-2011, period 1 month: end date: 31-Mar-2011.
- Start date 29-Apr-2011, period 1 month: end date: 31-May-2012. 30-Apr-2011 is a Saturday, so 29-Apr is the last business day of the month.
- Start date 28-Feb-2012, period 1 month: end date: 28-Mar-2012. 2012 is a leap year and the 28th is not the last business day of the month!

CHAPTER 5

Overnight indexes

Overnight indexes are indexes related to interbank lending on a one day horizon. Most indexes are for overnight loans and some for tomorrow/next loans. The rates are computed as a weighted average of actual transactions.

The most common usage of those indexes in interest rate derivatives is in overnight indexed swaps (see Chapter 22).

Some overnight indexes and their main characteristics are summarised in Table 5.1 and Table 5.2.

Currency	Name	Reference	Convention	Publication lag	Reuters
CHF	TOIS	TN	ACT/360	-1	•
EUR	EONIA	ON	ACT/360	0	•
GBP	SONIA	ON	ACT/365	0	•
JPY	TONAR	ON	ACT/365	1	•
USD	Fed Fund	ON	ACT/360	1	•

Publication lag is the number of days between the start date of the period and the rate publication. A lag of 0 means on the start date, a lag of 1 means on the period end date.

TABLE 5.1. Overnight indexes for the main currencies

Currency	Name	Reference	Convention	Publication lag	Reuters
AUD	RBA ON / AONIA	ON	ACT/365	0	•
CAD	CORRA	ON	ACT/365	1	•
DKK	DNB TN	TN	ACT/360	-1	
CZK	CZEONIA		ACT/360		•
HKD	HONIX	ON	ACT/365	0	•
HUF	HUFONIA	ON	ACT/360		•
INR	O/N MIBOR	ON	ACT/365	0	
INR	MITOR	TN	ACT/365	0	
NZD	NZIONA	ON	ACT/365	0	•
PLN	POLONIA	ON	ACT/365		•
SEK	SIOR / T/N STIBOR	TN	ACT/360	-1	•
SGD	SONAR	ON	ACT/365	0	•
ZAR	SAFEX ON Dep Rate	ON	ACT/365		•
ZAR	SAONIA	ON	ACT/365		

Publication lag is the number of days between the start date of the period and the rate publication. A lag of 0 means on the start date, a lag of 1 means on the period end date.

TABLE 5.2. Overnight indexes for other currencies

1. Committee meetings

The overnight rates are strongly influenced by the central banks monetary policy decisions. The meeting dates of the main central banks can be found on the following sites.

Reference: <http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm>

Reference: <http://www.ecb.int/events/calendar/mgchg/html/index.en.html>

Reference: <http://www.bankofengland.co.uk/monetarypolicy/Pages/decisions.aspx>

2. CHF-TOIS

The rate used shall be the TOIS rate, the T/N interbank fixing as such rate appears on Reuters page CHFTOIS. The index is calculated by Cosmorex AG, a division of Tullet Prebon.

3. EUR-EONIA

EONIA is the acronym of *Euro OverNight Index Average*. It is computed as a weighted average of all overnight unsecured lending transactions undertaken in the interbank market, initiated within the Euro area by the contributing banks (rounded to three decimal places). It is calculated by the European Central Bank. The rate is published in the evening (around 19:00 CET) of the period start date. The day count convention is ACT/360.

Reference: <http://www.euribor-ebf.eu/euribor-eonia-org/about-eonia.html>

4. EUR-EURONIA

It is the weighted average rate of all unsecured Euro overnight cash transactions brokered in London by WMBA member firms between midnight and 16:15 CET with all counterparts with minimum deal size.

Reference: http://www.wmba.org.uk/pages/index.cfm?page_id=32

5. GBP-SONIA

SONIA is the acronym of *Sterling OverNight Index Average*. It is the weighted average rate of all unsecured sterling overnight cash transactions brokered in London by WMBA member firms between midnight and 16:15 CET with all counterparts in a minimum deal size of GBP 25 million (rounded to four decimal places). The rate is published in the evening (around 17:00 CET) of the period start date. The day count convention is ACT/365.

Reference: <http://www.bba.org.uk/policy/article/sterling-overnight-index-average-sonia-a-guide/benchmarks/>

6. JPY-TONAR-Uncollateralized Overnight Call Rate

TONAR is the acronym of *Tokyo OverNight Average Rate*. It is the weighted average rate of all unsecured overnight cash transactions between financial institutions. The rate is published by the Bank of Japan (BOJ). The day count convention is ACT/365. A provisional result is published on the evening (at 17:15 JST except on the last business day of the month where it is 18:15 JST) of the period start. The final result is published in the morning (10:00 JST) of the end date.

Reference: <http://www.boj.or.jp/en/statistics/market/short/mutan/>

7. USD-Effective Federal Funds Rate

The daily effective federal funds rate is a volume-weighted average of rates on trades arranged by major brokers. The effective rate is calculated by the Federal Reserve Bank of New York using data provided by the brokers and is subject to revision. The rate is published in the morning (between 7:00 and 8:30) of the period end date. The day count convention is ACT/365.

Reference: <http://www.newyorkfed.org/markets/omo/dmm/fedfundsdata.cfm>

8. AUD-RBA Interbank Overnight Cash Rate Survey / AONIA

The rate is computed by the Reserve Bank of Australia (RBA). It is a weighted average rate at which a sample of banks transact in the domestic interbank market for overnight funds. The Interbank Overnight Cash Rate calculated from the survey is published on electronic media services (Reuters RBA30/RBA36; Bloomberg RBA09/RBA011) at the conclusion of each trading day. The rate is published in the evening of the period start date. The day count convention is ACT/365.

Reference: <http://www.rba.gov.au/mkt-operations/tech-notes/interbank-survey.html>

Reference: <http://www.cetip.com.br>

9. CAD-CORRA

CORRA is the acronym of *Canadian Overnight Repo Rate Average*. It is the weighted average rate of overnight general (non-specific) collateral repo trades that occurred through designated inter-dealer brokers between 6:00 and 16:00 EDT on the specified date as reported to the Bank of Canada. The rate is published in the morning (9:00) of the end date. The rate is published by the Bank of Canada. The day count convention is ACT/365.

Reference: <http://www.bankofcanada.ca/rates/interest-rates/money-market-yields>

10. DKK-Danmarks Nationalbank Tomorrow/Next interest rate

The Tomorrow/Next (T/N) money market rate interest rate is calculated and published by the Danmarks Nationalbank. The T/N interest rate is an uncollateralized day-to-day interest rate for money-market lending. The T/N interest rate is calculated as a weighted average of the interest rates on actual lending. Calculation of the T/N interest rate is based on daily reports from 11 banks. Each bank reports the uncollateralized day-to-day inter-bank lending and the average interest rate for these loans. The report is made with a time lag of one day, e.g. Monday's lending is reported on Tuesday. The day count convention is ACT/360.

The rate used shall be the "DKKOIS" rate, the rate published by the Danish Central Bank as such rate appears on Reuters page DKNA14 or any successor page(s) thereto.

Reference: http://www.nationalbanken.dk/dnuk/rates.nsf/side/reference_rates!opendocument

11. NZD-NZIONA

The rate used is a reference rate equal to the official cash rate in respect of that day set by the Reserve Bank of New Zealand. It is published on Reuters page "RBNZ02" as of 10:00 a.m. Wellington time. The day count is ACT/365.

12. SEK-SIOR / T/N STIBOR

STIBOR (Stockholm Interbank Offered Rate) is a reference rate that shows an average of the interest rates at which a number of banks active on the Swedish money market are willing to lend to one another without collateral at different maturities.

The reference rate for SEK is the SIOR or T/N STIBOR rate. The rate is published by the OMX Exchange. SIOR is a reference rate equal to the daily fixing for Swedish Krona tomorrow next deposits as published at approximately 11:00 a.m., Stockholm time, on the day that is one Stockholm Banking Day preceding the start date of the payment period. The rate is published on Reuters screen SIDE.

Reference: <http://www.swedishbankers.se>

13. SGD-SONAR

The SONAR rate is published by the Association of Banks in Singapore. The rate appears on Reuters page ABSIRFIX01. The rate is published at 11:00 am, Singapore time, on the period start date. The day count convention is ACT/365.

14. ZAR-SFX ZAR OND

The rate SFX ZAR OND rate is published by SAFEX JIBAR. SAFEX publishes the rate which is the average rate that it receives on its deposits with the banks, weighted by the size of the investments placed at each bank. The rate appears on Reuters page SFXR0D.

15. ZAR-SAONIA

The SAONIA rate is the weighted average rate paid on unsecured, interbank, overnight funding.¹

¹For more details on ZAR markets see also West, G. *South African Financial Markets, Financial Modelling Agency, 2009.*

CHAPTER 6

Ibor-like indexes

Ibor-like indexes are indexes related to interbank lending between one day and one year. They are usually computed as the trimmed average between rates contributed by participating banks. The rates are banks' estimates but usually do not refer to actual transactions.

The most common usage of those indexes in interest rate derivatives is in swaps and caps/floors. Some Ibor-like indexes and their main characteristics are summarized in Table 6.1 and Table 6.2.

Currency	Name	Maturities	Convention	Spot lag	Bbg	Rt
CHF	LIBOR	O/N--12M	ACT/360	2	SF00xxx	●
EUR	EURIBOR	1W--12M	ACT/360	2	EU00xxx	●
EUR	EURIBOR	1W--12M	ACT/365	2		●
EUR	LIBOR	O/N--12M	ACT/360	2	EU00xxx	●
EUR	LIBOR	O/N--12M	ACT/360	0		
GBP	LIBOR	O/N--12M	ACT/365	0	BP00xxx	●
JPY	LIBOR	O/N--12M	ACT/360	2	JY00xxx	●
JPY	Japan TIBOR	1W--12M	ACT/365	2		
JPY	Euroyen TIBOR	1W--12M	ACT/360	2		
USD	LIBOR	O/N--12M	ACT/360	2	US00xxx	●

In the Bloomberg code, the xxx should be replaced by the tenor (T/N, 01W, 11M, etc.) and followed by _Index. Indexes with a (*) discontinued in 2013.

TABLE 6.1. Ibor-like indexes for the main currencies.

1. LIBOR

LIBOR is the acronym for London Interbank Offered Rate. LIBOR is calculated (by Thomson Reuters) on behalf of the British Bankers' Association. Major banks submit their cost of borrowing unsecured funds for several tenors and currencies.

Up to 2012, there were 15 tenors in 10 currencies (AUD, CAD, DKK, EUR, JPY, NZD, GBP, SEK, CHF, USD). Some of them have been phased out in the first half of 2013. By May, the BBA has cut back to 42 Libor rates. Rates are published for six currencies (EUR, EUR same day, JPY, GBP, CHF, USD). Only seven tenors are covered: overnight/spot-next, one-week, and one, two, three, six and 12 months. In July 2013 it was announced that the NYSE Euronext will be in charge of the administration through its subsidiary *NYSE Euronext Rates Administration Limited*. The new administrator is expected to start in early 2014.

The conventions are the same for all currencies. *For all currencies other than EUR and GBP the period between Fixing Date and Value Date will be two London business days after the Fixing Date. However, if that day is not both a London business day and a business day in the principal financial center of the currency concerned, the next following day that is a business day in both centers shall be the Value Date.* The business day convention is *modified following* and the *end-of-month* rule applies. For all currencies except GBP, the day-count convention is ACT/360.

Reference: <http://www.bbalibor.com/technical-aspects/fixing-value-and-maturity>.

Reference: <http://www.nyx.com/libor>

Currency	Name	Maturities	Convention	Spot lag	Bbg	Rt
AUD	BBSW	1M-6M	ACT/365 F	0	AD00xxx	•
CAD	CDOR	1M-12M	ACT/365 F	0	CDORxxx	•
CZK	PRIBOR		ACT/360	2		
DKK	CIBOR	1W-12M	ACT/360	0	CIB0xxx	•
DKK	LIBOR(*)	O/N--12M	ACT/360	2		
HKD	HIBOR	1M-12M	ACT/365 F	0		
HUF	BUBOR		ACT/360	2		
IDR	IDRFIX		ACT/360	2		
INR	MIFOR		ACT/365 F	2		
NOK	NIBOR		ACT/360	2		
NZD	BBR		ACT/365	0		
PLN	WIBOR		ACT/365	2		
RMB	SHIBOR	ON-12M	ACT/360	0		
SEK	STIBOR		ACT/360	2		
SKK	BRIBOR		ACT/360	2		
SGD	SIBOR		ACT/365 F	2		
SGD	SOR		ACT/365 F	2		
ZAR	JIBAR	1M - 12M	ACT/365 F	0		

In the Bloomberg code, the xxx should be replaced by the tenor (T/N, 01W, 11M, etc.) and followed by `_Index`. Indexes with a (*) have been discontinued in 2013.

TABLE 6.2. Ibor-like indexes for other currencies.

2. GBP-LIBOR

The Fixing Date and Value Date are the same (0 day spot lag). The day-count convention is ACT/365. The fixing date and value date are the same.

3. EUR-LIBOR

The value date is two TARGET business days after the fixing date.

4. EURIBOR

The day-count convention is ACT/360 and the spot lag is two days. The business day convention is *modified following* and the *end-of-month* rule applies. The related calendar is TARGET. There are 43 contributor banks. The rates are published at 11:00 a.m. (CET).

Reference: <http://www.euribor-ebf.eu/euribor-org/about-euribor.html>

5. JPY-TIBOR

TIBOR is the acronym for Tokyo Interbank Offered Rate. It is published by the Japanese Bankers Association. There are two types of TIBOR: The "Japanese Yen TIBOR" rates reflect prevailing rates on the unsecured call market; the "Euroyen TIBOR" rates, the Japan offshore market. The JBA TIBOR is calculated by JBA as a prevailing market rate based on quotes for 13 different maturities (1 week, 1-12 months) provided by reference banks as of 11:00 a.m. each business day. The day-count convention is ACT/365 for the domestic market and ACT/360 for the Euroyen market.

Reference: http://www.zenginkyo.or.jp/en/tibor/the_jba_tibor/

6. AUD-BBSW

The rate is Bank Bill Rates (BBSW) and is published by the Australian Financial Markets Association. The maturities are between one and six months. The day-count convention is ACT/365 and the spot lag is one zero day. The business day convention is *modified following* bimonthly. The rates are published at 10:00 a.m.

Reference: <http://www.afma.com.au/data/bbsw.html>

7. CAD-CDOR

CDOR is the acronym for Canadian Dealer Offered Rate. CDOR is determined daily from a survey of nine market makers in bankers' acceptances (BA). The survey is conducted at 10:00 a.m. each business day, with the results being quoted on CDOR page of Reuters' Monitor Service by 10:15 a.m. on the same day. The day-count convention is ACT/365. The fixing date and value date are the same (0 day spot lag). Reference: http://www.m-x.ca/marc_terme_bax_cdor_en.php

8. DKK-CIBOR

CIBOR is the acronym for Copenhagen Interbank Offered Rate. It is a reference interest rate for liquidity offered in the inter-bank market (in Denmark) on an uncollateralised basis with maturities from 1 week to 12 months. NASDAQ OMX publishes Cibur on a daily basis at 11:00 AM. The Danish Bankers Association has the overall responsibility for Cibur. The day-count convention is ACT/360.

Reference: <http://www.finansraadet.dk>

Reference: <http://www.nasdaqomxnordic.com/obligationer/danmark/cibor/>

9. HKD-HIBOR

HIBOR is the acronym for Hungarian Interbank Forward Offer Rate. The day-count convention is ACT/365. The business day convention is modified following.

10. INR-MIFOR

MIFOR is the acronym for Mumbai Interbank Forward Offer Rate. The day-count convention is ACT/365 and the spot lag is two days. It is published for 1, 2, 3, 6 and 12 months tenors.

11. NOK-NIBOR

NIBOR is the acronym for Norwegian Interbank Offer Rate. The day-count convention is ACT/360. The business day convention is modified following.

12. RMB-SHIBOR

SHIBOR is the acronym for SHanghai Interbank Offered Rate. The day-count convention is ACT/360 and the spot lag is zero day. It is published for overnight, 1 and 2 weeks and 1, 3, 6, 9 and 12 months tenors.

Reference: http://www.shibor.org/shibor/web/html/index_e.html

13. SEK-STIBOR

STIBOR is the acronym for Stockholm Interbank Offer Rate. The day-count convention is ACT/360. The business day convention is modified following.

14. SGD-SIBOR

SIBOR is the acronym for Singapore Interbank Offered Rate. The day-count convention is ACT/365. An individual ABS SIBOR contributor bank contributes the rate at which it could borrow funds, were it to do so by asking for and accepting inter-bank offers in a reasonable market size, just prior to 1100 hrs. The indexes are computed by the Association of Banks in Singapore.

Reference: <http://www.abs.org.sg>

15. SGD-SOR

SOR is the acronym for Swap Offered Rate. It is implied from USD LIBOR and forex forwards. The indexes are computed by the Association of Banks in Singapore.

16. ZAR-JIBAR

JIBAR is the acronym for Johannesburg Interbank Agreed Rate. This rate is calculated daily by SAFEX as the average prime lending rate quoted independently by a number of different banks. The rate is available in one-month, three-month, six-month and twelve-month tenors.

Part 2

Exchange traded instruments

The exchange-traded instruments with a regular schedule (like futures) use a month code as described in Table 6.3.

Month	Code	Month	Code	Month	Code
January	F	February	G	March	H
April	J	May	K	June	M
July	N	August	Q	September	U
October	V	November	X	December	Z

TABLE 6.3. Rate futures month codes.

Overnight index linked futures

The overnight index futures are linked to an average of overnight rates on a certain period (usually a calendar month).

1. Federal Funds Futures

The *30-Day Federal Funds Futures* (simply called Fed Funds futures) are based on the monthly average of overnight Fed Funds rate for the contract month. The notional is 5,000,000 USD. The contract months are the first 36 calendar months. They are quoted on CBOT for USD.

Let $0 < t_0 < t_1 < \dots < t_n < t_{n+1}$ be the relevant date for the Fed Funds futures, with t_1 the first business day of the reference month, t_{i+1} the business day following t_i and t_{n+1} the first business day of the following month. Let δ_i be the accrual factor between t_i and t_{i+1} ($1 \leq i \leq n$) and δ the accrual factor for the total period $[t_1, t_{n+1}]$. The day count convention for the USD overnight is ACT/360.

The overnight rates between t_i and t_{i+1} are given in t_i by F_i^O . The future price on the final settlement date t_{n+1} is

$$\Phi_{t_{n+1}} = 1 - \frac{1}{\delta} \left(\sum_{i=1}^n \delta_i F_i^O \right).$$

The margining is done on the price multiplied by the notional and divided by the one month accrual fraction (1/12).

2. One month EONIA indexed futures

The contract was introduced in 2008 and is traded on Liffe.

The notional is EUR 3,000,000 and the underlying rate EONIA. The delivery month covers a European Central Bank (ECB) Reserve Maintenance Period. The number of available delivery months will be limited to the number of Reserve Maintenance Periods for which dates have been published by the ECB.

The Exchange Delivery Settlement Price (EDSP) is one minus the ESDP Rate. The ESDP rate is calculated as

$$\frac{1}{\delta} \left(\left(\prod_{i=1}^n (1 + \delta_i F_i^O) \right) - 1 \right).$$

The code on Bloomberg is OMA Cmdty and on Reuters is ●.

Reference: <https://globalderivatives.nyx.com/contract/content/29179/contract-specification>

3. One-Day Interbank Deposit Futures Contract - Brazil

They are also called ID futures. They are traded on BM&FBovespa.

The underlying is the daily interest rate compounded until the contract's expiration date. The rate is the The Average One-day Interbank Deposit Rate (ID) as calculated by CETIP.

The *expiration date* is the first business day of the contract month. The *last trading day* is the business day preceding the expiration date.

The quotations are expressed as a rate per annum compounded daily based on a 252-day year, to three decimal places.

The trading *price* is calculated from the quoted *rate* r as

$$\frac{100,000}{(1+r)^{\frac{n}{252}}}$$

where n is the number of reserves between the trade date and the day preceding the expiration date.

On the trade date t , the margin is computed as (to be multiplied by the Real value and the number of contract)

$$PA_t - PO$$

where PA_t is the contract settlement price on t .

For the positions outstanding on the previous day, the margining is

$$PA_t - (PA_{t-1} \times FC_t)$$

where FC_t is the indexation factor

$$FC_t = (1 + DI_{t-1})^{\frac{1}{252}}$$

and DI_{t-1} is the ID rate corresponding to the period $[t - 1, t]$.

Short Term Interest Rate Futures Ibor based

The type of futures described in this chapter are the Ibor-based short term interest rate (STIR) futures, also called Interest Rate Futures. They all have the same settlement mechanism but differ on notional, underlying rate index and exchange on which they are quoted.

The dates related to those futures are based on the third Wednesday of the month¹, which is the *start date* of the Ibor rate underlying the future.

The rate is fixed at a *spot lag* prior to that date (see Table 6.1 and 6.2 for the different conventions); the fixing usually takes place on the Monday or on the Wednesday itself. The fixing date is also the *last trading date* for the future. The *end date* of the Ibor rate period is one or three months after the *start date* depending on the type of future (using the conventions associated with the relevant Ibor-index).

The margining process works in the following way. For a given *closing price* (as published by the exchange), the daily margin paid is that price minus the *reference price* multiplied by the notional and by the accrual factor of the future. Equivalently it is the price difference multiplied by one hundred and by the *point value*, the point value being the margin associated with a one (percentage) point change in the price. The reference price is the trade price on the trade date and the previous closing price on the subsequent dates.

The futures price in t is denoted Φ_t^j . On the fixing date at the moment of the publication of the underlying Ibor rates L_t^j , the future price is $\Phi_t^j = 1 - L_t^j$. Before that moment, the price evolves with demand and offer.

The *tick value* is the value of the smallest increment in price. The price usually changes in 1.0 or 0.5 basis points increments.

The futures are designated by character codes. The first part depends on the data provider and is usually two to four characters. The main codes are given in Table 8.1. The second part describes the month, with the codes given in Table 6.3, and the year, with its last digit. As interest rate futures are quoted up to 10 years in the future only, there is no ambiguity by using only one figure for the year. Note also that it means that when a future reaches its last trading date, a new one is created a couple of days later with the same name but for a maturity 10Y in the future.

1. USD

USD interest rate futures are traded on CME and on Liffe. For three-month futures, the nominal is USD 1,000,000 and the accrual factor is 1/4. The fixing index is Libor. For one month futures, the nominal is 3,000,000 and the accrual factor is 1/12. In both cases, the nominal multiplied by the accrual factor is 250,000.

2. EUR

The EUR three-month interest rate futures are traded on Liffe, Eurex and NLX. The nominal is EUR 1,000,000 and the accrual factor is 1/4. The fixing index is Euribor.

3. GBP

The GBP three-month interest rate futures are traded on Liffe and NLX. The nominal is GBP 1,000,000 and the accrual factor is 1/4. The fixing index is Libor.

¹When the day is a non-good business day it is adjusted to the following day

Currency	Tenor	Exchange	Underlying	Notional	Bloomberg	Reuters
CHF	3M	Liffe	LIBOR	1,000,000	ES	•
EUR	3M	Eurex	EURIBOR	1,000,000	FP	•
EUR	3M	Liffe	EURIBOR	1,000,000	ER	•
EUR	3M	NLX	EURIBOR	1,000,000	XNI	•
GBP	3M	Liffe	LIBOR	500,000	LL	•
GBP	3M	NLX	LIBOR	500,000	XNL	•
JPY	3M	SGX/CME	TIBOR	100,000,000	EY	•
JPY	3M	SGX	LIBOR	100,000,000	EF	•
USD	3M	CME	LIBOR	1,000,000	ED	•
USD	1M	CME	LIBOR	3,000,000	EM	•
USD	3M	SGX	LIBOR	1,000,000	DE	•

The Bloomberg code should be followed by the month and year code and `_Comdty`.

TABLE 8.1. Interest rate futures on lbor details and codes: main currencies.

Currency	Tenor	Exchange	Underlying	Notional	Bloomberg	Reuters
CAD	3M	MX	CDOR	1,000,000	BA	•
DKK	3M	OMX	CIBOR	1,000,000	CIB	•
ZAR	3M	SAFEX	JIBAR	100,000	JBRA	•

The Bloomberg code should be followed by the month and year code and `_Comdty`.

TABLE 8.2. Interest rate futures on lbor details and codes: other currencies.

4. JPY

The JPY three-month interest rate futures are traded on CME and on SGX for Tibor based futures and on SGX for Libor based futures. The nominal is JPY 100,000,000 and the accrual factor is 1/4.

5. CHF

CHF interest rate futures are traded on Liffe. The nominal is CHF 1,000,000 and the accrual factor is 1/4. The fixing index is Libor 3M.

6. AUD

Underlying index: AUD BBSW 3M. Margin based on $\text{Price}/(1 + X \text{ DT})$.

7. CAD

The CAD three-month interest rate futures (three-month Canadian Bankers' acceptance futures) are traded on MX. The nominal is CAD 1,000,000 and the accrual factor is 1/4. The fixing index is CDOR.

The contract months are the quarterly March, June, September and December up to three years plus two nearest non-quarterly months (serials).

Reference: http://www.m-x.ca/produits_taux_int_bax_en.php

8. ZAR

The three-month ZAR interest rate futures contracts are traded on SAFEX. The notional is ZAR 100,000 and the accrual factor is 1/4. The fixing index is three months JIBAR. The futures trade eight quarter ahead.

Reference: http://www.jse.co.za/Libraries/Interest_Rate_Market_-_Products_Documentation/Jibar_Futurescontract_specifications.sflb.ashx

Interest Rate Futures Options: Premium

An option on futures is described by the underlying future, an option expiration date θ , a strike K and an option type (Call or Put). The expiration is before or on the futures last trading date: $\theta < t_0$.

The option on futures dealt with in this section are American type and pay the premium up-front at the transaction date. There is no margining process for the option. This type of option is traded on CME and SGX. On CME, the options are on eurodollar futures (one and three months); on SGX, the options are on eurodollar futures (three months), on JPY Libor futures and on JPY Tibor futures.

There are three types of options: the quarterly options, the serial options and the mid-curve options. The quarterly options expire on the last trading date of the underlying future, i.e. $\theta = t_0$. The serial and mid-curve options expire before the future's last trading date. For the serial option, the delay is one or two months (plus one weekend). For the mid-curve option the delay is one, two or four years.

The quoted price for the options follows the same rule as the future. For a quoted price, the amount paid is the price multiplied by the notional and by the accrual factor of the underlying future.

Interest Rate Futures Options: Margin

An option on futures is described by the underlying future, the *option expiration date*, the *strike* and an option type (Call or Put). The expiration is before or on the future's last trading date.

The option on futures dealt with in this section are American type and have a future-like margining process. This type of option is traded on the Liffe for EUR, GBP, CHF and USD futures (three months) and Eurex for EUR (three months). The list of option types is provided in Table 10.1.

Ccy	Tenor	Exchange	Underlying	Type	Bbg	Rt
USD	3M	LIFFE	LIBOR	Option on future	FD	•
USD	3M	LIFFE	LIBOR	Mid-Curve Options	OD	•
EUR	3M	LIFFE	EURIBOR	Option on future	ER	•
EUR	3M	LIFFE	EURIBOR	Mid-Curve Options	OR	•
EUR	3M	LIFFE	EURIBOR	2 year Mid-Curve Options	2R	•
EUR	3M	Eurex	EURIBOR	Option on future	FPA	•
EUR	3M	Eurex	EURIBOR	One-year mid-Curve Options		
GBP	3M	LIFFE	LIBOR	Option on future	LO	•
GBP	3M	LIFFE	LIBOR	Mid-Curve Options	OL	•
GBP	3M	LIFFE	LIBOR	2 year Mid-Curve Options	2L	•
CHF	3M	LIFFE	LIBOR	Option on future	ES	•

Bbg: Bloomberg code; Rt: Reuters code

TABLE 10.1. Interest rate future options details and codes.

Note that there are two margin processes involved in this instrument: one on the underlying future and one on the option itself.

The quoted price for the options follows the same rule as for the future. For a quoted price, the daily margin paid is the current closing price minus the reference price multiplied by the notional and by the accrual factor of the underlying future. The reference price is the trade price on the trade date and the previous closing price in the subsequent dates.

For the standard options (not mid-curve), the last trading date is the same as the last trading date of the underlying future. For the mid-curve options, the last trading date is one business day before the last trading date of the future in the same month.

For example the EUR mid curve options with expiry in Mar-2012 (OR12) on the Mar-2013 future (ER13), have a last trading date on the Friday 10-Mar-2012 while the Mar-2012 futures (ER12) and their associated standard options (ER12) trade up to Monday 13-Mar-2012.

Bank bill futures (AUD style)

The AUD bill futures are traded on ASX. The futures settle physically. At expiry different bills can be delivered. The bills eligible for delivery are bills with between 85 and 95 days to maturity at the settlement date. The issuers of the bills can be any bank in the approved banks list¹.

The party short of the future chooses the bill it wants to deliver². The short party has a delivery option. This is a situation similar to the one in the bond futures in main currencies.

The *expiry date* θ (also called the announcement date) is the second Friday of the future month and the *delivery date* t_0 is the next business day (Monday). The futures are quoted with fixing up to five years.

Let $t_i (1 \leq i \leq N)$ denote the possible maturity dates of the bills³. At settlement the price received for the bill will depend on the last quoted future index that we denote F_θ . The yield associated with this index is $R_\theta = 1 - F_\theta$. The price paid is

$$\frac{1}{1 + \delta_i R_\theta}$$

where δ_i is the accrual factor associated to the dates t_0 and t_i . For AUD bill futures this factor is the number of calendar days between the two dates divided by 365. In exchange of the price the short party delivers the bill with a notional equal to the notional of the future⁴.

Currency	Tenor	Exchange	Underlying	Notional	Bloomberg	Reuters
AUD	3M	ASX	Bank Bill	1,000,000	IR	•

TABLE 11.1. Futures on bank bills details and codes.

¹There are currently four approved banks: Australia and New Zealand Banking Group Limited, Commonwealth Bank of Australia, National Australia Bank Limited, and Westpac Banking Corporation.

²Actually for each contract the short party can choose up to 10 different bills of AUD 100,000 each.

³In practice there are nine possible dates taking the weekend into account.

⁴The notional of the bill futures is AUD 1,000,000. This notional can be split into several physical bills, up to 10 pieces of AUD 100,000.

Deliverable swap futures (present value quoted)

The futures are traded on CBOT/CME.

The futures nominal is USD 100,000 per contract. The margining feature is the future-type daily margin on the quoted price¹. The underlying swap has the standard conventions for USD swaps: semi-annual bond basis versus Libor three months (see Table 18.1). The futures are quoted for swaps with tenors 2, 5, 10 and 30 years. The underlying swap has a fixed rate as decided by the exchange on the first trading date of the contract. The rate is changed in increments of 25 basis points. The rate is not fixed at a predefined value like the reference coupon of bond futures.

The *delivery dates* follow the quarterly cycle standard to interest rate futures. The *delivery date* is the third Wednesday of the quarterly months (March, June, September, December). The *last trading date* or *expiry date* is two business days prior to that date, usually on the Monday.

On the expiry date, the parties agree to enter into a swap where the party long the futures receives fixed on the swap and the party short the futures pays fixed. The delivered swap is cleared on CME Clearing. The *effective date* of the swap is the delivery date. The fixed rate of the swap is the one attached to the swap futures. The swap has also an up-front payment on the delivery date. The up-front payment is obtained from the futures settlement price on the last trading date, denoted F_θ . The amount received by the long party is $(1 - F_\theta) * N^2$.

Contract	Nominal	Coupon	Bbg	Volume
2-Year	100,000	0.50%	CTP	9,588
5-Year	100,000	1.00%	CFP	36,313
10-Year	100,000	2.00%	CNP	46,675
30-Year	100,000	2.75%	CBP	1,562

The Bloomberg code should be followed by the month and year code and `_Comdty`. The month code can be found in Table 6.3. Volume and coupon as of March 2013.

TABLE 12.1. CME/CBOT deliverable swap futures in USD.

¹Note that the price is quoted in (percentage) points and 32nd of points, like the bond futures contracts.

²If the amount is negative, it should be interpreted as the absolute value is paid by the long party

Bond futures (non AUD/NZD)

Bond futures are exchange traded instruments. One of their particularities is that the underlying is not a single instrument but a basket. For most of the instruments, the short party has the option to deliver any of the instruments in the basket.

The basket is composed of government bonds from a unique issuer (country) with rules on their remaining maturity, initial maturity and issue size to be eligible.

The bond futures are traded on different exchanges for different countries. In general there are several maturity buckets for each underlying country. A list is given in Table 13.1.

Underlying country	Currency	Exchange	Number of contracts
Canada	CAD	MSE	3
Germany	EUR	Eurex	4
Germany	EUR	NLX	3
Italy	EUR	Eurex	2
Japan	JPY	TSE	3
Japan	JPY	LIFFE	1
Japan	JPY	SGX	1
Spain	EUR	MEFF	1
United Kingdom	GBP	Liffe	3
United Kingdom	GBP	NLX	1
United States	USD	CBOT	5
Switzerland	CHF	Eurex	1

TABLE 13.1. Main bond futures overview.

The bonds in the basket are transformed to be comparable through a conversion factor mechanism. The factor is such that in a certain reference yield environment all the bonds have the same price. The reference yield acts in a way like a strike for the delivery process.

There are other embedded options for some currencies. Some of those options are:

Timing option: The delivery notice can be done on a period and not only on one date. This gives some American option flavor to the futures.

Wild card option: The underlying bonds can be selected after the price of the future has been fixed. During the delivery period, there is a daily option between the end of future trading at 2 p.m. and the end of bond trading at 6 p.m. After the last trading, there can be a period (up to seven days) where the future price is fixed but the delivery notice is not given yet.

In the descriptions below, the texts in *italics* are quotes from the exchanges.

1. USD

The futures on United States debt are traded on the Chicago Board of Trade.

The description of the price used for delivery is: *The invoice price equals the futures settlement price times a conversion factor, plus accrued interest. The conversion factor is the price of the delivered bond (USD 1 par value) to yield 6 percent.*

The conversion factor is provided by the exchange and does not need to be computed by the users. Nevertheless there are clear rules to compute them. The values do not change through the life of the future.

Note that the last trading day and last delivery date are not the same for the all the underlyings. The delivery takes place one day after notice.

The price is quoted in (percentage) point and 32nd of a point.

1.1. Long Futures. The Ultra T-Bond Futures, U.S. Treasury Bond Futures and 10-Year U.S. Treasury Note Futures have the same last trading date and last delivery day. The last trading day is the *seventh business day preceding the last business day of the delivery month. Trading in expiring contracts closes at 12:01 p.m. on the last trading day.* The last Delivery Day is the *Last business day of the delivery month.*

Previously the U.S. Treasury Bond futures referred to all bonds with maturities above 15 years. That range has recently (March 2011) been divided into two different futures.

1.2. Ultra T-Bond Futures. The underlying of the Ultra T-Bond Futures are *U.S. Treasury bonds with remaining term to maturity of not less than 25 years from the first day of the futures contract delivery month.*

1.3. U.S. Treasury Bond Futures. Formerly called the 30 years future, even if since March 2011 expiry, the deliverable grade for T-Bond futures are *bonds with remaining maturity of at least 15 years, but less than 25 years, from the first day of the delivery month.* Also known as *Classic bond futures.*

The Treasury Bond futures are less liquid than 10 and 5 years note futures (see Table 13.2). To match the US Treasury naming convention, the futures would be better called Note Futures.

1.4. 10-Year U.S. Treasury Note Futures. *U.S. Treasury notes with a remaining term to maturity of at least six and a half years, but not more than 10 years, from the first day of the delivery month.*

1.5. 5-Year U.S. Treasury Note Futures. The last Trading Day is *Last business day of the calendar month.* The last Delivery Day is the *third business day following the last trading day.*

The eligible bonds are *U.S. Treasury notes with an original term to maturity of not more than five years and three months and a remaining term to maturity of not less than four years and two months as of the first day of the delivery month.*

1.6. 3-Year U.S. Treasury Note Futures. The last trading day is the *last business day of the contract month.*

The nominal is USD 200,000. The eligible bonds are *U.S. Treasury notes that have an original maturity of not more than 5 years and 3 months and a remaining maturity of not less than 2 years and 9 months from the first day of the delivery month but not more than 3 years from the last day of the delivery month.*

1.7. 2-Year U.S. Treasury Note Futures. The nominal is USD 200,000. The eligible bonds are *U.S. Treasury notes with an original term to maturity of not more than five years and three months and a remaining term to maturity of not less than one year and nine months from the first day of the delivery month and a remaining term to maturity of not more than two years from the last day of the delivery month.*

Contract	Maturity	Nominal	Yield	Codes	Volume
Ultra T-Bond	> 25Y	100,000	6.00%	UB/UL/UBE	1,387,996
30-YR Bond	15Y to 25Y	100,000	6.00%	ZB/US/	6,193,917
10-YR Note	6.5Y to 10Y	100,000	6.00%	ZN/TY/	21,265,689
5-YR Note	4Y2M to 5Y3M	100,000	6.00%	ZF/FV/	10,198,247
3-YR Note	2Y9M to 3Y	200,000	6.00%	Z3N/3YR	0
2-YR Note	1Y9M to 2Y	200,000	6.00%	ZT/TU/	3,132,990

The codes are for CME Globex (Electronic Platform)/Open Outcry (Trading Floor)/Clearing Code. The volume is the monthly volume for October 2013.

TABLE 13.2. USD bond futures

2. EUR-Germany

In EUR, the futures are traded on Eurex and NLX, except for the Euro-Buxl which is traded only on Eurex.

A *delivery obligation arising out of a short position may only be fulfilled by the delivery of certain debt securities issued by the Federal Republic of Germany with a remaining term on the Delivery Day within the remaining term of the underlying*. To be eligible, the debt securities must have a minimum issue amount of EUR 5 billion.

The delivery day is *the tenth calendar day of the respective quarterly month, if this day is an exchange day; otherwise, the exchange day immediately succeeding that day*. The last trading day is two exchange days prior to the Delivery Day of the relevant maturity month.

The maturity ranges for the eligible bonds are given in Table 13.3. The futures names are: Euro-Buxl Futures, Euro-Bund Futures, Euro-Bobl Futures, and Euro-Schatz Futures.

Note that the reference yield for the Euro-Buxl, which is more recent than the others, is 4% (and not 6% like for the majority of futures).

Contract	Maturity	Nominal	Yield	Bbg	Rt	Volume
Euro-Buxl	24Y to 35Y	100,000	4.00%	UB	•	222,821
Euro-Bund	8.5Y to 10.5Y	100,000	6.00%	RX	•	11,778,488
Euro-Bobl	4.5Y to 5.5Y	100,000	6.00%	OE	•	7,252,498
Euro-Schatz	1.75Y to 2.25Y	100,000	6.00%	DU	•	8,659,722

The volume is the monthly volume for December 2011. Bbg: Bloomberg code. Rt: Reuters code.

TABLE 13.3. EUR bond futures

3. GBP

The futures are traded on Liffe. The Long Gilt futures is also traded on NLX.

The *first notice day* is two business days prior to the first day of the delivery month. The *last notice day* is the first business day after the Last Trading Day. The *last trading day* is two business days prior to the last business day of the delivery month. The *delivery day* is any business day in delivery month (at seller's choice).

The deliverable bonds are subject to a coupon range of 3.00% around the reference yield.

Contract	Maturity	Nominal	Reference yield	Code	Volume
Long Gilt Futures	8Y9M to 13Y	100,000	6.00% / 4.00%	G _L	476,025
Medium Gilt Futures	4Y to 6Y3M	100,000	6.00% / 4.00%	WX	183
Short Gilt Futures	1Y6M to 3Y3M	100,000	6.00% / 3.00%	WB	1,131

The volume is the monthly volume for December 2010. The change of coupon from 6% to a lower coupon took place with the December 2011 contract.

TABLE 13.4. GBP bond futures

4. JPY

The futures are traded on TSE.

The notional is JPY 100,000,000. The *final settlement day* is the 20th of each contract month. The *last trading day* is the 7th business day prior to each delivery date. Trading for the new contract month begins on the business day following the last trading day.

There was also a 20-year JGB Futures but its trading was halted in December 2002 due to lack of volume.

Contract	Maturity	Nominal	Reference yield	Code	Volume
10-year JGB Futures	7Y to 10Y	100,000,000	6.00%	JB	657,356
5-year JGB Futures	4.0Y to 5.25Y	100,000,000	3.00%	JJ	

The volume is the monthly volume for February 2012.

TABLE 13.5. JPY bond futures

5. EUR - Spain

The Bono 10 futures contract on the Spanish 10-year Government Bond was launched on 29 May 2012 by MEFF. The volumes are currently very low (253 contracts traded in October 2013).

The underlying asset is Notional Government Bond with a 6% annual coupon and a maturity of 10 years. The contract face value is EUR 100,000. The expiration date is the 10th day of the maturity month. If holiday next business day. The last trading and registration day is two business days prior to the expiration date. The bonds in the basket are the Spain Government Bonds with a remaining life of no less than eight years and six months.

The settlement price at expiration is calculated by dividing the cheapest to deliver bond market price (ex-coupon) at the end of the session by the conversion factor of the bond. The market price of the cheapest to deliver bond will be the closing price for that bond determined by SENAF.

Contract	Maturity	Nominal	Yield	Bbg	Rt	Volume
Bono 10	> 8.5Y	100,000	6.00%	FBBA	•	???

Bbg: Bloomberg code. Rt: Reuters code.

TABLE 13.6. EUR bond futures

Reference: <http://www.meff.es/asp/Comun/Pagina.aspx?l1=Financiero&f=NuevoBono10&id=ing>

6. Settlement

Suppose there are N bonds in the basket. Let $\text{AccruedInterest}_i(t)$ denote the accrued interests of bond i for delivery date t . The conversion factor associated to each bond is denoted K_i . The bond future notice takes place in at a date before the delivery. Usually the lag before notice and delivery is one or two days. If the *futures price*¹ is denoted by F , in the delivery, the short party can choose the bond he delivers from the basket (denoted below i) and receives at the delivery date in exchange of the delivery of the amount

$$F.K_i + \text{AccruedInterest}_{i^*}(t_0).$$

¹The term *price* is the standard jargon for futures, but it would be more correct to speak of *number* or *reference index*. The future price is never actually paid. It is only a reference number for subsequent payment computation. The price could be shifted by an arbitrary amount without impact on the economy.

Options on Bond futures (non AUD/NZD): Premium

An option on futures is described by the underlying future, an option expiration date θ , a strike K and an option type (Call or Put). The expiration is before or on the future last trading date: $\theta < t_0$.

The options on futures dealt with in this section are American type and pay the premium up-front at the transaction date. There is no margining process for the option. This type of option is traded on the CBOT for bond futures.

1. USD - CBOT

The contract months are the first three consecutive contract months (two serial expirations and one quarterly expiration) plus the next four months in the March, June, September, and December quarterly cycle. The serials exercise into the first nearby quarterly futures contract. Quarterlies exercise into futures contracts of the same delivery period.

The *last trading day* is the last Friday which precedes by at least two business days the last business day of the month preceding the option month. The options are quoted in of 1/64 of a point.

There are options on *Ultra T-Bond Futures*, *U.S. Treasury Bond Futures*, *10-Year U.S. Treasury Note Futures*, *5-Year U.S. Treasury Note Futures* and *2-Year U.S. Treasury Note Futures*.

Contract	Maturity	Nominal	Codes	Volume
Ultra Bond	> 25Y	100,000	OUB/OUL	3,786
Classic Bond	15Y to 25Y	100,000	OZB/CG-PG	1,247,787
10-YR Note	6.5Y to 10Y	100,000	OZN/TC-TP	7,710,256
5-YR Note	4Y2M to 5Y3M	100,000	OZF/FL-FP	1,752,940
2-YR Note	1Y9M to 2Y	200,000	OZT/TUC-TUP	197,574

The codes are for CME Globex (Electronic Platform)/Open Outcry (Trading Floor) Call-Put. The volume is the monthly volume for October 2013.

TABLE 14.1. USD bond futures options

Options on Bond futures (non AUD/NZD): Margin

An option on future is described by the underlying future, an option expiration date a strike K and an option type (Call or Put). The expiration is before or on the future last trading date.

The options on futures dealt within this section are American type and have a future-style method of margining process for the option. This type of option is traded on the Eurex for bond futures.

1. EUR - EUREX

The contract months are the first three consecutive contract months (two serial expirations and one quarterly expiration) plus the next month in the March, June, September, and December quarterly cycle. For calendar months, the maturity month of the underlying futures contract is the quarterly month following the expiration month of the option. For the quarterly months, the maturity month of the underlying futures contract and the expiration month of the option are identical.

Last Trading Day for option series introduced from September 1, 2011, is the last Friday prior to the first calendar day of the option expiration month, followed by at least two exchange days prior to the first calendar day of the option expiration month.

Exception: If this Friday is not an exchange day or if this Friday is not an exchange day and followed by only one exchange day prior to the first calendar day of the option expiration month, then the exchange day immediately preceding that Friday is the Last Trading Day. An exchange day within the meaning of this exception is a day which is both an exchange day at the Eurex Exchanges and a federal workday in the U.S.

Reference: http://www.eurexexchange.com/trading/products/INT/FIX/OGBL_en.html

Bond futures (AUD)

The Australian and New Zealand futures are settled in cash against a standardized bond. The standardized bond yield is computed as the average of actual bond yields for AUD and as a linear interpolation of actual bond yields for NZD.

1. Description

The AUD bond futures traded on SFE have very different characteristics. The main one is that they settle in cash versus the average yield of the underlying bonds. The exact mechanism of the settlement, which is not trivial, is described in the next section.

The average yield cash delivery implies that the futures behave roughly like a weighted average of the underlying. The weights are not exactly equal but they do not change too much with the rate level. One bond will never represent the future correctly but the mixture of bonds that best represent the future does not vary too much over time (and rates).

There exist two maturity types for the SFE Australian Treasury bond futures, the three (Bloomberg: YMA<CMDTY>, Reuters:) and the ten (Bloomberg: XMA<CMDTY>, Reuters:) year futures. Except for the maturity all the characteristics of both futures are similar. Both have a notional of AUD 100,000 per contract. The three year future is usually more liquid than the ten year one.

The yield used in the settlement is fixed through a randomly selected list of dealers, excluding the extreme quotes. To our knowledge, the selection of underlying bonds is not subject to a very precise rule. A certain number of bonds are selected by the exchange. There are often around three underlying bonds. Their maturities are usually between two and four years for the three-year futures and between eight and twelve for the ten-year futures.

Reference: <http://www.asx.com.au/>

2. Future settlement

The time t futures price¹ is denoted by Φ_t . Suppose there are N bonds underlying the future.

All the margining payments related to SFE bond futures are done according to a reference bond price R_t computed from the future index in the following way. Let $m = 6$ for the three year futures and $m = 20$ for the 10 year futures.

$$(1) \quad \begin{aligned} Y_t &= 1 - \Phi_t \\ v_t &= \frac{1}{1 + Y_t/2} \end{aligned}$$

$$(2) \quad R_t = 0.03 \frac{1 - v_t^m}{Y_t/2} + v_t^m.$$

In practice the reference price is multiplied by the notional, which is AUD 100,000 by contract.

The formula for R may seem artificial. It is simply the value of a semi-annual three (or ten) year bond with a C=6% coupon at a semi-annual yield of Y_t . The value is

$$\sum_{i=1}^m C/2 \frac{1}{(1 + Y/2)^i} + \frac{1}{(1 + Y/2)^m} = C/2 \frac{v - v^{m+1}}{1 - v} + v^m = C/2 \frac{1 - v^m}{Y/2} + v^m.$$

¹The term *price* is the standard jargon for futures, but it would be more correct to speak of *quoted number* or *quoted index*.

The contract settles in cash. The settlement is done against the average of the yield of the underlying bonds. Let $Y_{i,\theta}$ ($1 \leq i \leq N$) be the yields on the fixing date for the underlying bonds. The reference yield for the settlement is

$$(3) \quad Y_\theta = \frac{1}{N} \sum_{i=1}^N Y_{i,\theta}.$$

From the yield the final future index and equivalent bond price are computed as above.

Part 3

Over-The-Counter Instruments

Forward Rate Agreement

Forward rate agreements (FRA) are OTC contracts linked to an Ibor-like index. At the trade date a *reference rate* (R), a start period, and a *reference index* are agreed. The end period is equal to the start period plus the index tenor (i.e a 6m start period and a 3m tenor give a 9m end period). The instrument *reference period* is computed in the following way. Its start date is computed from today by adding the index spot lag and then the start period (using the business day convention and calendar of the index). Its end date is computed from today by adding the index spot lag and then the end period. The *fixing date* (or exercise date) is the spot lag before the start date. The accrual factor between the start date and the end date (in the index day count) is denoted δ . In some (rare) cases the dates described above are not computed but decided arbitrarily by the counterparties (usually changing the dates by one day or two for convenience reasons).

The FRA *settlement date* is the start date (not the end date). On the settlement date the pay-off is, for the FRA buyer,

$$\delta \frac{L_\theta - R}{1 + \delta L_\theta}$$

where L_θ is the value of the reference index on the fixing date. The pay-off for the FRA seller is obviously the same amount with an opposite sign.

The term *FRA buyer* can be interpreted in the following way: the buyer pays a fixed price R and in exchange receives a good (the index rate L_θ).

Note that all the cash-flows are settled on the start date and not the end date. In some accounting schemes, the payment is accrued between the start date and the end date. The instrument stays "alive" from an accounting point of view even if it has already fully settled. Note also that the FRA's end date may be (slightly) different from the end date of the theoretical deposit underlying the Ibor rate. This potential mismatch comes from a difference in adjustment of the non-good business days between the different ways to compute the periods. To use the example above, a period of six months followed by a period of three months is not always equal to a period of nine months. Several cases of dates mismatch are proposed in Table 17.1. The difference in the table is up to five days.

FRA	Trade date	Spot date	Fixing	Start accr.	End accr.	End fixing
1Mx4M	9-Sep-13	11-Sep-13	9-Oct-13	11-Oct-13	13-Jan-14	13-Jan-14
1Mx4M	10-Sep-13	12-Sep-13	10-Oct-13	14-Oct-13	13-Jan-14	14-Jan-14
1Mx2M	10-Sep-13	12-Sep-13	10-Oct-13	14-Oct-13	12-Nov-13	14-Nov-13
1Mx4M	14-Mar-14	18-Mar-14	16-Apr-14	22-Apr-14	18-Jul-14	22-Jul-14
1Mx3M	14-Mar-14	18-Mar-14	16-Apr-14	22-Apr-14	18-Jun-14	23-Jun-14

Dates in TARGET calendar.

TABLE 17.1. FRA dates with differences between end of the accrual period and end of the underlying fixing deposit period.

FRA can also be traded as IMM FRA, i.e. FRA with accrual dates equal to consecutive IMM dates as used in STIR futures (see Chapter 8). The underlying Ibor rate has as tenor the one relevant for the IMM dates frequency (three months Ibor for quarterly dates and one month Ibor for monthly dates).

Interest rate swaps (Fixed for lbor)

1. Leg payments

The dates on different instruments are spaced by a given payment period. Due to holidays, conventions and broken periods, the way to compute those dates should be detailed. The description below refers to the usual method; as the products are OTC, any variant is possible if agreed by the parties.

The dates are computed from the start (or settlement) date. The last date will be the start date plus the total length (tenor) of the leg. The intermediary dates are spaced by the given payment period except potentially one. The non-standard period is the first one. For example a 15 month leg with a 6 month period will pay after 3 (15-2x6), 9 and 15 months. The dates will be adjusted by the business day convention and the end-of-month rule. All the dates are first computed without adjustment and then all the dates are adjusted. This means that if a swap start on the 5th of the month and its maturity is on a Saturday and adjusted to the following Monday (7th), the intermediary payments take place on the 5th (potentially adjusted) of the intermediary months, not on the 7th.

The non-standard period is called the *stub*. It can be *short* (shorter than one period) or *long* (between one and two periods). The reason the non-standard period is the first one is that once that period is finished, the instrument has the same date as a standard one. If the stub was the last period, the swap would never become a standard one. The term *roll* (like *29 roll*) is also used. It means that the (unadjusted) dates will be on the given day and not the one usual one. When it is used, it is often around the end-of-month.

The fixed for lbor floating interest rate swaps exchange a leg of fixed payments for a leg of floating payments linked to a lbor-like index.

The start (or settlement date) of the swap is usually a certain lag (called spot lag) after the trade date. The most used lag is two business days. The start date can also be forward. In that case the start date is the trade date, plus the forward period plus the spot lag. The forward period is a given number of months or of years.

The payments on the fixed leg are regularly spaced by a given period, most of them with a 6-month or 12-month period.

In fixed for floating swaps, the term *payer* and *receiver* refer to the fixed leg. A swap is a payer for one party if that party pays the fixed leg (and received the floating leg). A payer swap for one party is a receiver swap for the other party.

Like for FRA, the terms *buyer* and *seller* are also used. The swap buyer buys the floating leg for a given fixed price; he is the fixed leg (and swap) payer.

2. Vanilla swaps

In a vanilla IRS, all the coupons have the same notional and all the coupons on the fixed leg have the same rate.

The payments on the floating leg are also regularly spaced, most of them with 3 months or 6 months period. The period between the payments is equal to the lbor index tenor. The fixing date for floating payment is the index spot lag before the period start date. The lag is the one given by the index and is usually the same as the swap spot lag.

Note that the dates of the fixing period corresponding to the deposit underlying the lbor-index can be slightly different from the floating coupon period. The difference is created by the adjustments due to non-good business days.

The standard conventions for vanilla swaps in different currencies are provided in Table 18.1 and Table 18.2.

Currency	Spot Lag	Fixed Leg			Floating Leg	
		Period	Convention	Reference	Period	Convention
USD (NY)	2	6M	30/360	LIBOR	3M	ACT/360
USD (London)	2	1Y	ACT/360	LIBOR	3M	ACT/360
EUR: 1Y	2	1Y	30/360	Euribor	3M	ACT/360
EUR: >1Y	2	1Y	30/360	Euribor	6M	ACT/360
GBP: 1Y	0	1Y	ACT/365	LIBOR	3M	ACT/365
GBP: >1Y	0	6M	ACT/365	LIBOR	6M	ACT/365
JPY	2	6M	ACT/365	Tibor	3M	ACT/365
JPY	2	6M	ACT/365	LIBOR	6M	ACT/360
CHF: 1Y	2	1Y	30/360	LIBOR	3M	ACT/360
CHF: >1Y	2	1Y	30/360	LIBOR	6M	ACT/360

The spot lag is the lag in days between the trade date and the first fixing period start date.

TABLE 18.1. Most frequent vanilla swap conventions in the main currencies.

Currency	Spot Lag	Fixed Leg			Floating Leg	
		Period	Convention	Reference	Period	Convention
AUD: 1Y-3Y	1	3M	ACT/365	BBSW	3M	ACT/365
AUD: $\geq 4Y$	1	6M	ACT/365	BBSW	6M	ACT/365
AUD	1	6M	ACT/365	LIBOR(*)	6M	ACT/365
DKK	2	1Y	30/360	Cibor	6M	ACT/360
DKK	2	1Y	30/360	LIBOR(*)	6M	ACT/360
INR: $\leq 1Y$	2	1Y	ACT/365	MIFOR	3M	ACT/365
INR: $>1Y$	2	6M	ACT/365	MIFOR	6M	ACT/365
HKD	0	3M	ACT/365	HIBOR	3M	ACT/365
NOK	2	1Y	30/360	NIBOR	6M	ACT/360
NZD	0	6M	ACT/365	BKBM	3M	ACT/365
PLN	2	1Y	ACT/ACT ISDA	WIBOR	6M	ACT/365
SEK	2	1Y	30/360	STIBOR	6M	ACT/360
SGD	2	6M	ACT/365	SIBOR	6M	ACT/365
SGD	2	6M	ACT/365	SOR	6M	ACT/365
ZAR	0	3M	ACT/365	JIBAR	3M	ACT/365

The spot lag is the lag in days between the trade date and the first fixing period start date. The Libor marked (*) have ceased to be published in May 2013.

TABLE 18.2. Most frequent vanilla swap conventions in the main currencies.

3. Composition

In some cases, the period between the payments is not equal to the Libor index tenor but a multiple thereof. The fixing rates are compounded over the sub-periods up to the payment at the end. The main currency for which this method is the standard for vanilla swaps in CAD. The conventions in that case are given in Table 18.3.

The description of a compounded coupon is the following. The time associated are denoted $(t_i)_{i=0, \dots, n}$. The fixing rate for the period $[t_{i-1}, t_i]$ is denoted r_i ($i = 1, \dots, n$) and the accrual factor in the index convention is δ_i . The fixing takes place at a date prior to the start of the accrual period with the difference between the fixing date and the start date being the index spot lag.

Currency	Spot	Fixed Leg		Floating Leg			Convention
		Period	Convention	Reference	Reset	Pay	
CAD: 1Y	0	1Y	ACT/365	CDOR	3M	1Y	ACT/365
CAD: >1Y	0	6M	ACT/365	CDOR	3M	6M	ACT/365
CNY	2	3M	ACT/365	CNY-Repo	1W	3M	ACT/365

The spot lag is the lag in days between the trade date and the first fixing period start date.

TABLE 18.3. Vanilla swap conventions for swaps with composition.

The coupon pays in t_n the amount (to be multiplied by the notional)

$$\left(\prod_{i=1}^n (1 + \delta_i r_i) \right) - 1.$$

In case a spread is agreed on the compounded leg, there are three standard ways to deal with the compounded of spread: *Compounding*, *Flat Compounding*, and *Compounding with spread as simple interest*. Those methods are described in the ISDA document *Alternative compounding methods for over-the-counter derivative transactions* (2009) available at www.isda.org/c_and_a/pdf/ISDA-Compounding-memo.pdf.

4. IMM dates swap

Like for FRA, there exists IMM date IRS. Those swaps pay the fixed and floating leg in IMM dates. The most common are quarterly IMM dates on the floating leg based on the Ibor three months rates. It is also common that the fixed leg payment is every second (semi-annual) to every fourth (annual) IMM date.

5. In-arrears swaps

Another type of Ibor swaps is a swap with fixing in-arrears. In that case the start date for the Ibor period is the payment date. The fixing date for floating payment is the index spot lag before the period end date. The reference period for the Ibor index and the accrual period for the coupon are disjoint.

6. Short and long tenors

For some swaps, the period between payments is not equal to the index tenor. The payment period can be shorter than the index period (short tenor swap) or longer (long tenor swap). Typically this type of swap has a three-month payment period on a six- or twelve-month Ibor index (short) or an annual payment on a three- or six-month Ibor index (long). The short/long tenor swap can also be of the (fixing) in-advance or in-arrears type.

7. Step-up and step-down

The rate paid on the fixed leg coupons does not need to be the same for each coupon. The swap is called step-up when the coupons increase and step-down when they decrease.

8. Amortised, accruing and roller coaster swaps

The coupon notional does not need to be the same for all coupons. In most cases the notionals are the same for both legs over the same period.

If the notional is decreasing through time, it is called *amortised* swap. If the notional increase, the swap is called *accruing*. If the notional first increases and then decreases up to maturity, it is referred to as *roller coaster*.

Interest rate swaps (Basis swap; lbor for lbor)

In a basis swap, both legs are floating legs and depend on an lbor index in the same currency (see Chapter 20 for swaps with legs in different currencies). In most cases, the indexes have different tenors. A spread above the lbor index is paid on one of the legs. The quoting convention is to quote the spread on the shorter tenor leg, in such a way that the spread is positive.

Suppose you trade a swap USD LIBOR 3M vs USD LIBOR 6M quoted at 12 (bps) for ten millions paying three months LIBOR. You will pay on a quarterly basis the USD LIBOR three months rate plus the spread of 12 bps multiplied by the relevant accrual factor and the notional and receive on a semi-annual basis the USD LIBOR six months rate without any spread.

This is the conventions for almost all currencies, with the notable exception of EUR. In EUR, the basis swap are conventionally quoted as two swaps. A quote of EURIBOR 3M vs EURIBOR 6M quoted at 12 (bps) for ten millions paying the three months has the following meaning. You enter with the counterpart into two swaps fixed against EURIBOR. In the first swap you receive a fixed rate and pay the three months EURIBOR. In the second swap, you pay the same fixed rate plus the spread of 12 bps and receive the six months EURIBOR. Note that with that convention the spread is paid on an annual basis, like the standard fixed leg of a fixed versus lbor swap. Even if the quote refers to the spread of a three months versus six months swap, the actual spread is paid annually with the fixed leg convention.

The composition of lbor index described in Section 3 is not restricted fixed for lbor swaps. Some basis swaps are also traded on a compounded basis to align the payment on both legs. For example a basis swap one month LIBOR versus three months LIBOR can be quoted with the one month Libor compounded over three periods and paid quarterly in line with the three months period. Note that the exact convention on the spread compounding needs to be indicated for the trade. The composition of the shorter tenor leg is currently the standard in USD.

Interest rate swaps (Cross-currency swap; lbor for lbor)

In this chapter we restrict ourselves to cross-currency swaps for which both legs are floating legs linked to lbor indexes.

The notional is not the same on both legs as they are in different currencies. The notional on one leg is usually the notional in the other leg translated in the other currency through an exchange rate. The rate is often the exchange rate at the moment of the trade as agreed between the parties. The notional is paid on both legs, at the start and at the end of the swap.

In some cases the FX rates used are not in line with the market rate. Usually this is to disguise some debts from accounting rules. Those type of cross-currency swaps at non-market exchange rates were famously used by Greece to hide some of its debt when it entered the Euro. The swaps used for curve construction are swaps with at-the-money exchange rate.

There exists also some cross-currency swaps with forex rate reset, called *market-to-market cross-currency swap*. They are defined in Article 10 of the 2006 ISDA Definitions. In each period a the forex rate is observed at the beginning of the period and used for the following period. The notional of one of the legs is unchanged and the other is adapted according to the new exchange rate. At each payment date, a MTM amount is paid. The amount is calculated as the new notional in the adapted leg minus the previous notional. This is equivalent, up to netting, to exchanging the notionals at each period start and each period end. This feature is created to reduce the credit risk created by the movement of exchange rates.

Both legs of the swap are linked to an lbor-like index. In the standard swaps, the lbor tenor on both legs is the same. The payments are done on the same days for both legs to reduce the credit risk. It means that the payment calendar is the joint calendar of both currencies involved in the swap.

The most liquid cross-currency swaps exchange three month payments. Even if one currency has a six month index as its most used index, the cross-currency swaps use three months payment. This is in particular the case with USD/JPY and USD/EUR swaps that use three months payments, even if the six months EUR Euribor and six months JPY Libor are the standard floating references for the IRS in those currencies.

The cross-currency swaps also pay a spread on one of the legs. In which currency the spread is paid depends on the currency pairs. When one of the currencies is USD, the convention is usually USD LIBOR flat versus the other currency lbor plus a spread. There are two exceptions to the rule which are Mexican Pesos (MXN) and Chilean Pesos (CLP).

Swap indexes

The most common usage of these indexes is in Constant Maturity Swaps (CMS) and CMS cap/floors.

1. ISDA fixing

Swap rates for CHF, EUR, GBP, JPY and USD are established by ISDA in co-operation with Reuters (now Thomson Reuters) and Intercapital Brokers (now ICAP plc.). The main characteristics of the swaps are given in Table 21.1.

The main pages with the fixing are ISDAFIX on Reuters and ISDA on Bloomberg. The associated codes for some data providers are in Table 21.2.

Reference: <http://www.isda.org/fix/isdafix.html>

2. ISDA-EUR

There are four fixes: two for swaps vs Libor and two for swaps vs Euribor. For Libor the fixes are at 10:00 London time and 11:00 London time. For Euribor, they are at 11:00 CET-Frankfurt time and 12:00 CET-Frankfurt time. The maturities are 1 to 10 and 12, 15, 20, 25, 30 years. All the swaps are versus 6 months except the one year maturity which is versus 3 months.

3. ISDA-USD

There are two fixings, one at 11:00 New York time and one at 15:00 New York time. The maturities are 1 to 10 and 15, 20, 30 years. All the swaps are versus 3 months.

4. ISDA-GBP

There is one fixing, one at 11:00 London time. The maturities are 1 to 10 and 12, 15, 20, 25, 30 years. All the swaps are versus 6 months except the one year maturity which is versus 3 months.

5. ISDA-CHF

There is one fixing, at 11:00 London time. The maturities are 1 to 10 years. All the swaps are versus 6 months except the one year maturity which is versus 3 months.

6. ISDA-JPY

There are two fixings, one at 10:00 Tokyo time and one at 15:00 Tokyo time. The maturities are 1 to 10 and 12, 15, 20, 25, 30, 35, 40 years. All the swaps are versus 6 months. Note that for JPY there is also an 18 months fixing.

Currency	Spot	Fixed Leg		Reference	Floating Leg		Time
		Period	Conv.		Period	Conv.	
EUR: 1Y	2	1Y	30/360	Euribor	3M	ACT/360	11:00 CET
EUR: >1Y	2	1Y	30/360	Euribor	6M	ACT/360	11:00 CET
EUR: 1Y	2	1Y	30/360	Euribor	3M	ACT/360	12:00 CET
EUR: >1Y	2	1Y	30/360	Euribor	6M	ACT/360	12:00 CET
EUR: 1Y	2	1Y	30/360	Libor	3M	ACT/360	10:00 London
EUR: >1Y	2	1Y	30/360	Libor	6M	ACT/360	10:00 London
EUR: 1Y	2	1Y	30/360	Libor	3M	ACT/360	11:00 London
EUR: >1Y	2	1Y	30/360	Libor	6M	ACT/360	11:00 London
USD	2	6M	30/360	Libor	3M	ACT/360	11:00 New York
USD	2	6M	30/360	Libor	3M	ACT/360	15:00 New York
GBP: 1Y	2	1Y	ACT/365	Libor	3M	ACT/365	11:00 London
GBP: >1Y	2	6M	ACT/365	Libor	6M	ACT/365	11:00 London
CHF: 1Y	2	1Y	30/360	Libor	3M	ACT/360	11:00 London
CHF: >1Y	2	1Y	30/360	Libor	6M	ACT/360	11:00 London

The spot lag is the lag in days between the trade date and the first fixing period start date.

TABLE 21.1. Swap fixing details.

Currency	Time	Underlying	Bloomberg	Reuters
EUR	11:00 CET	EURIBOR	EIISDAxx	•
EUR	12:00 CET	EURIBOR	EIISDBxx	•
EUR	10:00 London	LIBOR	ELISDAxx	•
EUR	11:00 London	LIBOR	ELISDBxx	•
USD	11:00 New York	LIBOR	USISDAxx	•
USD	15:00 New York	LIBOR	USISDP01	•
GBP	11:00 London	LIBOR	BPISDBxx	•
CHF	11:00 London	LIBOR	SFISDAxx	•
JPY	10:00 Tokyo	LIBOR	JYISDAxx	•
JPY	15:00 Tokyo	LIBOR	JYISDPxx	•

In the Bloomberg code, the xx represent the tenor in years. The code should be followed by _Index. The Reuters codes are the codes of the pages with the fixing, not the individual fixing values.

TABLE 21.2. Fixing sources pages and code.

Overnight indexed swaps (OIS)

The overnight indexed swaps (OIS) exchange a leg of fixed payments for a leg of floating payments linked to an overnight index.

The start (or settlement date) of the swap is a certain lag (called spot lag) after the trade date. The most common lag is two business days.

The payments on the fixed leg are regularly spaced by a given period. Most of the OIS have one payment if shorter than one year and a 12 month period for longer swaps. The payments on the floating leg are also regularly spaced, usually on the same date as the fixed leg. The amount paid on the floating leg is computed by composing the rates.

Let $0 < t_0 < t_1 < \dots < t_n < t_{n+1}$ be the relevant date (all good business dates) in the floating leg period. Let δ_i be the accrual factor between t_i and t_{i+1} ($1 \leq i \leq n$) and δ the accrual factor for the total period $[t_1, t_{n+1}]$. The overnight rates between t_i and t_{i+1} are given in t_i by F_i^O . The paid amount is

$$\left(\prod_{i=1}^n (1 + \delta_i F_i^O) \right) - 1$$

multiplied by the notional. The payment is usually not done on the end of period date t_{n+1} , but at a certain lag after the last fixing publication date. The reason of the lag is that the actual amount is only known at the very end of the period; the payment lag allows for a smooth settlement.

The standard conventions for OIS are provided in Table 22.1 and Table 22.2.

Currency	Spot	Fixed Leg			Floating Leg	
		Period	Convention	Reference	Convention	Pay lag
USD \leq 1Y	2	tenor	ACT/360	Fed Fund	ACT/360	2
USD $>$ 1Y	2	1Y	ACT/360	Fed Fund	ACT/360	2
EUR \leq 1Y	2	tenor	ACT/360	EONIA	ACT/360	2
EUR $>$ 1Y	2	1Y	ACT/360	EONIA	ACT/360	2
GBP \leq 1Y	0	tenor	ACT/365	SONIA	ACT/365	1
GBP $>$ 1Y	0	1Y	ACT/365	SONIA	ACT/365	1
JPY \leq 1Y	2	tenor	ACT/365	TONAR	ACT/365	
JPY $>$ 1Y	2	1Y	ACT/365	TONAR	ACT/365	

The spot lag is the lag in days between the trade date and the first fixing period start date. The pay lag is the lag in days between the last fixing publication and the payment.

TABLE 22.1. Overnight indexed swap conventions in the main currencies

1. USD

In USD the payment is two days after the end of the fixing period. These two days are computed from the last publication date, which is at the end of the last period, plus two lag days.

2. EUR

In EUR the payment is one day after the end of the fixing period. This one day is computed as the last publication date, which is at the start of the last period and one day before the end of the last period, plus two lag days.

Currency	Spot	Period	Fixed Leg		Floating Leg	
			Convention	Reference	Convention	Pay lag
AUD \leq 1Y	1	tenor	ACT/365	RBA ON	ACT/365	1
AUD $>$ 1Y	1	1Y	ACT/365	RBA ON	ACT/365	1
CAD \leq 1Y	0	tenor	ACT/365	CORRA	ACT/365	0
CAD $>$ 1Y	0	1Y	ACT/365	CORRA	ACT/365	0
INR \leq 1Y	1	tenor	ACT/365	O/N MIBOR	ACT/365	1
INR $>$ 1Y	1	6M	ACT/365	O/N MIBOR	ACT/365	1
SGD \leq 1Y	2	tenor	ACT/365	SONAR	ACT/365	1

The spot lag is the lag in days between the trade date and the first fixing period start date. The pay lag is the lag in days between the last fixing publication and the payment.

TABLE 22.2. Overnight indexed swap conventions in other currencies

3. Committee meetings

A somehow popular choice of start or end date for OIS swaps are the dates of the relevant committee meetings. The dates of those meetings are provided in Section 1.

Federal Fund swaps

Federal Fund swaps are a USD particularity. They are swaps exchanging quarterly USD Libor payment for quarterly average of USD-Effective Federal Funds Rate. They are often called the *Feds* or *Fed swaps*.

The particularity is that the rate paid is the arithmetic average of the fed fund rates; the rates are not compounded like in the traditional OIS. The quarterly coupon payment is not equal to a three months OIS. The code on Bloomberg is USBGx_Currency with x the tenor.

Let $0 < t_0 < t_1 < \dots < t_n < t_{n+1}$ be the relevant date (all good business dates) in the floating coupon period. Let δ_i be the accrual factor between t_i and t_{i+1} ($1 \leq i \leq n$) and δ the accrual factor for the total period $[t_1, t_{n+1}]$. The overnight rates between t_i and t_{i+1} are given in t_i by F_i^O . The paid amount is

$$\sum_{i=1}^n \delta_i F_i^O$$

multiplied by the notional.

There final fed funds effective fixing is applied to the last two fixing days. In formula it means

$$\sum_{i=1}^{n-1} \delta_i F_i^O + \delta_n F_{n-1}^O.$$

It is possible to trade absent the rate cut-off, but this requires the counterpart to make the payment on the same day the last fixing information is published.

In some cases the fed fund swaps are traded versus on-month Libor. This type of swaps is less liquid.

The swaps are quoted with a spread on the ON leg. A quote of x (often in basis points) means the swap exchanges Libor for ON average plus a spread of x . The spread is usually positive. The computation of the interest on the floating leg is additive with simple compounding and the spread is also additive with simple compounding. There is not several alternative like in the lbor compounding case. The payment is (up to the final day repeated fixing option):

$$\left(\sum_{i=1}^n \delta_i F_i^O \right) + \delta s.$$

CHAPTER 24

OIS indexes

The OIS indexes are reference rates for standard OIS.

1. EONIA swap index

An EONIA swap index is the average rate of rates provided by prime banks rounded to three decimal places, that each Panel Bank believes is the Mid Market rate of EONIA swap quotations between prime banks. It is quoted for spot value (T+2) and on an actual/360 day basis (with annual payments). The fixing time is 11.00 CET. The indexes cover swaps from one week to 24 months.

The indexes are computed by the Euribor-EBF association. The indexes were launched in 2005.

The rates are available on Bloomberg page **EBF** on Reuters page **•**.

Reference: <http://www.euribor-ebf.eu/eoniaswap-org/about-eoniaswap.html>

Swaption

A *swaption* is an option on a swap. It is characterized by an exercise date and an underlying swap. The exercise date is on or before the swap start date.

The option gives its holder the right (but not the obligation) to enter in the underlying swap on the exercise date. In theory a swaption can be written on any underlying swap. In practice the large majority of swaptions are written on vanilla interest rate swap.

A strike is often associated with a swaption. The strike is then the common rate of all the fixed leg coupons. But the underlying swap could have a different rate for each coupon (in a step-up or step-down swap for example) and the term strike is then ill-defined.

The terms payer and receiver for a swaption refer to the payer/receiver feature of the underlying swap. A swaption is a payer/receiver swaption if the party long the option has the right to enter into a payer/receiver swap. Note that the payer/receiver flag refers to the long party and not "us". So if one is short a receiver swaption and the swaption is exercised, he enters into a payer swap (a receiver swap for the other party which is long the option). A payer swaption for one party is also a payer swaption for the other party.

A swaption exercise date and its underlying swap start date are computed in the following way for standard swaptions. The swaption is described by an exercise tenor and an underlying swap tenor (like 6 months by 10 years). The exercise date is computed as today plus the exercise tenor, using the relevant calendar and the business day convention of the underlying swap. The swap settlement date is computed as the exercise date plus the underlying swap (or swap index) spot lag.

There are several settlement methods for swaptions. The summary of those methods for the main currencies is given in Table 25.1.

1. Physical delivery swaptions

When the swaption is with *physical delivery*, at the exercise date the parties enter into an actual swap (the underlying swap).

2. Cash-settled swaption EUR/GBP - yield-settled swaption

When the swaption is *cash-settled* a cash amount is paid (by the short party to the long party) at the exercise date (or more exactly at the spot lag after the exercise) and the actual swap is not entered into.

The cash amount to be paid to the long party is computed from a swap fixing rate using a conventional valuation formula of the theoretical underlying swap. The valuation is done using the swap fixing rate as an internal rate of return for the swap. The cash-settled swaption can be written only on a vanilla swap with the standard convention. This is the standard convention for EUR and GBP.

This cash-settlement approach is also called *yield-settled* in the US.

For a swaption with strike K and maturity M , the amount paid for a fixing S is

$$G(S)(\omega(S - K))^+$$

where $G(S)$ is the cash-annuity

$$G(S) = \sum_{i=1}^{Mm} \frac{\frac{1}{m}}{(1 + \frac{1}{m}S)^i}$$

and m the number of payments per year.

3. Cash-settled swaption USD

The term cash-settle can also refer to another way to compute the cash amount. This second approach is usually used for USD cash-settled swaptions.

The cash amount to be exchanged is calculated as the value of the underlying swap. To value the swap a full yield curve (and not only one rate) has to be agreed by the parties.

Currency	Method	Sub-method	Standard expiry
EUR	Cash-settled	Internal rate of return	11:00 CET
GBP	Cash-settled	Internal rate of return	11:00 London
CHF	Cash-settled	Internal rate of return	11:00 CET
DKK	Cash-settled	Internal rate of return	11:00 CET
NOK	Cash-settled	Internal rate of return	11:00 CET
SEK	Cash-settled	Internal rate of return	11:00 CET
USD	Cash-settled	Exact curve	11:00 New York
JPY	Physical delivery		17:00 Tokyo
AUD	Physical delivery		
Note.			

TABLE 25.1. Swaptions settlement conventions

4. Up-front and forward premium

The standard for the swaption premium has been for a long time a *spot* payment. The premium relative to the option paid by the buyer to the seller was done at the spot date from the trade date. With the crisis that started in 2007, the credit risk awareness increased and most of the major dealers decided to change the standard to a forward premium. Since September 2010, in the main currencies, the premium is paid at the same date the swaption itself is settled. This is in general at the spot date from the exercise date.

Constant Maturity Swap (CMS)

The constant maturity swaps (CMS) are in some way similar to standard interest rate swaps. The swap is composed of two legs. Each leg has its own payment type. One leg is generally a fixed leg or an lbor leg. The other leg is a floating leg the rate of which is based on an swap index (see Chapter 21).

The difference with a standard lbor leg is that the rate on which the index is based can be very different from the period on which it is paid. The CMS floating leg usually pays on a quarterly or semi-annual basis a swap rate. The most popular swap indexes are the indexes based on 2, 5, 10, 20 and 30 year swaps.

The details of the fixing and payment are similar to those of lbor coupons. The coupons can be with fixing in-advance or in-arrears. For the fixing in-advance the fixing takes place at the start of the accrual period. For the fixing in-arrears, the fixing takes place at the end of the accrual period. The lag between the reference date and the fixing is the spot lag of the swap index. Those spot lags are given in Table 21.1.

In EUR, the most popular CMS have quarterly payments on both legs. The non-CMS leg is three months Euribor.

Forex forward and swaps

One could argue that forex transactions should not be part of an *interest rate guide*. On the other side a forex swap is essentially a contract on interest rate difference and is similar to a cross-currency swap. Moreover the conventions on those transactions are often similar to the conventions on interest rate swaps.

1. Standard order

Currency pairs are usually quoted for currency pairs in a conventional order. For the main currencies, the orders are EUR/USD (not USD/EUR), GBP/USD, JPY/USD and GBP/EUR. The standard order for the main currencies is given in Table 27.1. The first currency is called the *base currency* and the other the *quote currency*.

Strength 1	Strength 2	Strength 3	Strength 4	Strength 5
EUR	GBP	AUD	NZD	USD
Strength 6	Strength 7	Strength 8	Strength 9	
CAD	CHF	JPY	Other	

TABLE 27.1. Conventional currency strength.

2. Forward and swaps

A forex forward is simply another FX transaction taking place at a forward date. The payments are one amount in one currency versus an other amount in the other currency. The amount in the other currency is the base currency amount multiplied by the exchange rate agreed. The rate is often quoted in two parts, the spot rate and the *forward points*. This is described in the section.

The forex swap is the exchange of a FX spot and a FX forward. A FX spot rate and a FX forward rate are agreed. The signs of the spot and forward amount in the same currency have different signs. Take the example of a EUR/USD trade. The jargon used for a FX swap trade would be something like: *I buy spot / sell forward 3m EUR versus USD for 10m with 10 (forward) points and a spot of 1.25*. This means that on spot date I receive 10m EUR and pay 12.5m USD and at spot+3m, I pay 10m EUR and receive $(1.25+0.0010) \times 10m = 12.51m$ USD. The spot part is called the *near leg* and the forward part the *far leg*.

A FX spot is a pure currency trade. The FX swap is mainly an interest rate trade, it is a trade on the difference of interest rate between the two currencies. As the amounts in each currency are paid and received, there is almost no currency exposure, like in a cross-currency swap with initial and final exchange of notional. In the forex market, the trader sees a FX forward as the difference of a FX swap and a FX spot and not the FX swap as the sum of a FX spot and a FX forward. The FX forward mixes the currency and rate exposure, it is not see as a building block but as a composed trade.

3. Forward points

The *forward points* are quoted for currency pairs in the conventional order. The mechanism of forward points is the same for FX forward and FX swaps. The points are added to the FX spot rate to obtain the FX forward rate. For a spot rate S and points p the forward rate is $S + p$. The points are usually quoted with a conventional factor (like the interest rates are quoted in percent). The factor depends from one currency pair to another. A list of such factors is given in Table 27.2.

Base currency	Other currency	Factor	Bbg
AUD	EUR	10,000	AUDEUR
AUD	USD	10,000	AUD
EUR	GBP	10,000	EURGBP
EUR	JPY	100	EURJPY
EUR	USD	10,000	EUR
GBP	JPY	100	GBPJPY
GBP	USD	10,000	GBP
USD	BRL	10,000	BCN
USD	CAD	10,000	CAD
USD	CHF	10,000	CHF
USD	CNY	1	CCN
USD	EGP	10,000	EPN
USD	HUF	100	HUF
USD	INR	100	INR
USD	JPY	100	JPY
USD	KRW	1	KRW
USD	MXN	10,000	MXN
USD	PLN	100	PLN
USD	TRY	100	TRY
USD	TWD	1	TWD
USD	ZAR	10,000	ZAR

The Bloomberg code is composed of the prefix given in the table, the maturity (1W, 3M, 2Y) and the postfix *_Currency*. For most of the currencies the forward point code is the same as the currency code; this is not the case for non-deliverable currencies.

TABLE 27.2. Forward points quotation factors.

Index

- 30/360 US, see Day count, 30/360
- 30E+/360 ISDA, see Day count, 30E+/360 ISDA
- 30E/360, see Day count, 30E/360
- 30E/360 ISDA, see Day count, 30E/360 ISDA
- Accounting, 40
- ACT/360, see Day count, ACT/360
- ACT/365, see Day count, ACT/365
- ACT/365 L, see Day count, ACT/ACT ISDA
- ACT/ACT ISDA, see Day count, ACT/ACT ISDA
- AFMA, see Association, Australian Financial Markets Association
- Association
 - Australian Financial Markets Association, 2, 13
 - British Bankers Association, 2, 12
 - Danish Bankers Association, 2, 14
 - Euribor-EBF, 2, 46
 - International Swaps and Derivatives Association, 2
 - Japanese Bankers Association, 2, 13
 - Wholesale Markets Brokers Association, 2
- Australian Securities Exchange, see Exchange, ASX
- Bank of Canada, 11
- Bank of Japan, 10
- BBA, see Association, British Bankers Association
- BBSW, see Index, Bank bill BBSW
- Bond basis, see Day count, 30/360
- British Bankers Association, see Association, British Bankers Association
- Business day, 8
 - End of month, 8
 - Following, 8
 - Modified following, 8
 - Modified following bimonthly, 8, 13
 - Preceding, 8
- Business/252, see Day count, Business/252
- Central bank
 - Canada, see Bank of Canada
 - Australia, see Reserve Bank of Australia
 - Committee meeting, 9, 44
 - Denmark, see Danmarks Nationalbank
 - Europe, see European Central Bank
 - Japan, see Bank of Japan
 - United-States, see Federal Reserve Bank of New York
- Chicago Board of Trade, see Exchange, CBOT
- Chicago Mercantile Exchange, see Exchange, CME
- CMS, 49
- Constant Maturity Swap, see CMS
- CORRA, see Index, CORRA
- Danish Bankers Association, see Association, Danish Bankers Association
- Danmarks Nationalbank, 11
- Data provider
 - Reuters, 12
- Day count, 5
 - 1/1, 5
 - 30/360, 5
 - 30/360 US, see Day count, 30/360
 - 30E/360, 5
 - 30E/360 ISDA, 5
 - 360/360 US, see Day count, 30/360
 - ACT/365, 6
 - ACT/365 A, 6
 - ACT/365 L, 6
 - ACT/ACT ICMA, 7
 - ACT/ACT ISDA, 7
 - Bond basis, see Day count, 30/360
 - Business/252, 7
 - English Money Market basis, see Day count, ACT/365
 - Money Market basis, see Day count, ACT/360
 - NL/365, 6
- End of month, see Business day, End of month
- English Money Market basis, see Day count, ACT/365
- EONIA, see Index, EONIA
- EURIBOR, see Index, EURIBOR
- Euronext, see Exchange, Euronext
- European Central Bank, 10
- Exchange
 - Amex, 4
 - ASX, 3, 24
 - Bovespa, 3
 - CBOT, 3, 18, 25, 26, 30
 - CME, 3, 20--22
 - CME group, 3
 - COMEX, 3
 - Eurex, 3, 20, 28, 31
 - Euronext, 4
 - ICE, 3, 4
 - IntercontinentalExchange, see Exchange, ICE
 - JSE, see Exchange, SAFEX
 - LCH.Clearnet, 3
 - Liffe, 4, 18, 20, 21, 23, 28
 - MEFF, 4, 29
 - MX, 4, 20, 21
 - NASDAQ OMX, 4, 14, 20, 28
 - NYMEX, 3
 - NYSE, 4
 - NYSE Euronext, 3, 4, 12

- SAFEX, 4, 20, 21
- SGX, 4, 20--22
- TSE, 4, 28
- Federal funds rate, see Index, Federal funds rate
- Federal Reserve Bank of New York, 10
- Following, see Business day, Following
- Forex
 - Forward, 14, 50
 - Forward points, 50
 - Swap, 50
- Forward Rate Agreement, 35
- FRA, see Forward Rate Agreement
- Future
 - Bank bill, 24
 - Bond futures, 26
 - Federal Fund, 18
 - Ibor, 20
 - Interest rate, 20
 - STIR, see Future, Interest rate
- Greece, 40
- Index
 - Bank bill BBSW, 13
 - CDOR, 14
 - CIBOR, 2, 4, 14
 - CORRA, 11
 - EONIA, 10, 18, 46
 - EURIBOR, 13, 41
 - Federal funds rate, 10, 18, 45
 - HIBOR, 14
 - Ibor-like, 12
 - JIBAR, 15
 - LIBOR, 12, 41
 - MIFOR, 14
 - NIBOR, 14
 - Overnight, 9
 - SHIBOR, 14
 - SIBOR, 14
 - SIOR, 4
 - SONIA, 10
 - SOR, 14
 - STIBOR, 14
 - TIBOR, 13
 - TONAR, 10
- IntercontinentalExchange, see Exchange, ICE
- International Swaps and Derivatives Association, see Association, International Swaps and Derivatives Association
- ISDA, see Association, International Swaps and Derivatives Association
- LIBOR, see Index, LIBOR
- Liffe, see Exchange, Liffe
- Modified following, see Business day, Modified following
- Modified following bimonthly, see Business day, Modified following bimonthly
- Money Market basis, see Day count, ACT/360
- Montréal Exchange, see Exchange, MX
- NASDAQ OMX, see Exchange, NASDAQ OMX
- New London Exchange, see Exchange, NASDAQ OMX
- New-York Mercantile Exchange, see Exchange, NYMEX
- New-York stock Exchange, see Exchange, NYSE
- NLX, see Exchange, NASDAQ OMX
- NYSE Euronext Rates Administration Limited, 12
- OIS, 43
- Overnight indexed swaps, see OIS
- Preceding, see Business day, Preceding
- Reserve Bank of Australia, 10
- Singapour Exchange, see Exchange, SGX
- SONIA, see Index, SONIA
- South African Futures Exchange, see Exchange, SAFEX
- Swap
 - Amortised, 38
 - Basis
 - As two swaps, 39
 - Cross-currency
 - Market-to-market, 40
 - Dates mismatch, 35
 - Fed Fund, 45
 - In-arrears, 38
 - Vanilla, 36
- Swaption, 47
 - Cash-settled, 47
 - Physical delivery, 47
- Tokyo Stock Exchange, see Exchange, TSE
- TONAR, see Index, TONAR
- Wholesale Markets Brokers Association, see Association, Wholesale Markets Brokers Association
- WMBA, see Association, Wholesale Markets Brokers Association



About OpenGamma

OpenGamma is the developer of the OpenGamma Platform, a next-generation platform for Unified Financial Analytics.

The OpenGamma Platform provides a modern, open architecture for building analytic solutions to end users in trading and risk management. It combines data management, a declarative calculation engine, and analytics in a single comprehensive solution.

Contact OpenGamma

Web: www.opengamma.com

Email: info@opengamma.com

Twitter: @OpenGamma

Europe

OpenGamma
185 Park Street
London SE1 9BL
United Kingdom

North America

OpenGamma
280 Park Avenue
27th Floor West
New York, NY 10017
United States of America