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Preface

Link and Learn - Introduction to Derivative Instruments - Part 2

- This presentation (along with Webinar Link'n Learn: Introduction to Derivatives Instruments Part 1) is designed to give an introductory overview of the characteristics of some of the more prevalent derivatives along with addressing some topical issues currently faced when valuing these instruments.

- Further learning references regarding valuation and analysis of these instruments will be provided at the end of this webinar.

- Part 1 depicts essentially the classical characteristics of the derivatives world while Part 2 focuses on its more recent evolutions and trends observed since the financial crisis of the late 2000s.
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Current regulatory framework

Securitization and CDOs

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OIS discounting

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Illustration: Swap trading in the past and nowadays

Conclusions and key messages
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Reminders of Part 1
Derivatives in a nutshell

Overall definition
A financial instrument whose value depends on (or derives from) the value of other basic underlying variables

5 families of instruments
- Linear instruments
- Swaps
- Non-linear instruments
- Structured products
- Hybrid products

Swaps valuation
Swaps valuation relies on the discounted cash flows method

Use of derivatives
Derivatives may be used for hedging, speculation or arbitrage, but always as a mean to transfer risk exposure

Powerful tools that may create disasters
- Examples of Barings Bank, LTCM and Société Générale
- Derivatives were not the main cause of the credit crisis but constituted an accelerating factor

Options valuation
Valuation of non-linear products (e.g. options) is performed under the discounted cash flows method, where future values of the underlying are modelled statistically
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Current Regulatory Context
A concern for all market stakeholders

**UCITS**
EU Directive 2009/65/EC (a.k.a. "UCITS IV")
Managers must ensure consistent and independent valuation of OTC derivatives

**EMIR**
EU Commission Delegated Regulation 648/2012
For OTC derivatives not centrally-cleared, counterparties must put in place risk mitigation techniques and proper procedures for collateral management, including a daily Mark-to-Market

**IFRS13**
EU Commission Regulation 1255/2012
Fair value of assets or liabilities is defined as the price that would take place in the market to exit the position

**CAPITAL REQ.**
EU Regulation 575/2013 (a.k.a. "CRR")
Directive 2013/36/EU (a.k.a. "CRD IV")
Institutions shall establish and maintain systems and controls sufficient to provide prudent and reliable valuation estimates

**PRIIPS**
EU Regulation 1286/2014
It is necessary to establish uniform rules on transparency at Union level which will apply to all participants in the PRIIPs market and thereby enhance investor protection

**AIFM**
EU Directive 2011/61/EU (a.k.a. "AIFMD")
Managers are responsible for the valuation of OTC derivatives and must ensure their independent valuation

**Corporate Companies**
Banking Industry
**Funds Industry**
Current Regulatory Context

UCITS

The UCITS Directives (Undertakings for Collective Investment in Transferable Securities) establish a harmonized legal framework in the EU for collective investment schemes.

**European Passport**
- UCITS funds established and authorised in one EU member state can be sold cross-border into other EU member states.
- Funds can be marketed within all EU countries, provided that the fund and fund managers are registered within the domestic country.

**Use of derivatives**
- UCITS are permitted to use derivatives as part of their general investment policies as well as for hedging.
- The measurement and monitoring of all exposures relating to the use of derivatives must be performed on at least a daily basis.
Current Regulatory Context

AIFMD

The **Alternative Investment Fund Managers Directive** relates to the regulation of hedge funds, private equity, real-estate funds and other Alternative Investment Funds in the EU.

**Internal valuation function**
- Should be independent from the portfolio management function
- Internal valuation model should be independently reviewed

**Externally-delegated valuation function**
- The AIFM must ensure due diligence of the third-party valuation processes
- The AIFM remains liable with respect to the AIF and its investors

**Role of the AIFM**
- The Directive requires AIF Managers to obtain authorisation and make various disclosures as a condition of operation
- The AIFM is responsible for the valuation of all assets, including OTC derivative
The European Market Infrastructure Regulation is specifically dedicated to the regulation of derivatives markets in Europe, with a two-fold objectives:

- Regulate derivatives markets to increase transparency
- Reduce counterparty credit risk

**Definition**

**Clearing (Standardized derivatives)**
- All standardized OTC derivatives must be cleared through central counterparties (CCPs)
- Harmonized framework for the provision of clearing services within Europe

**Reporting (All derivatives)**
All OTC and exchange-traded derivatives must be reported to Trade Repositories (TRs)

**Risk mitigation (Non-standard derivatives)**
Non-cleared derivatives must be subject to strengthened risk management requirements
Current Regulatory Context
CRR – CRD IV

**Capital Requirements Regulation** and Directive intend to prevent default and systemic risk within the financial system by requiring sufficient capitalization from financial and credit institutions. This supervisory framework transposes into EU legislation the Basel II/III rules on capital standards.

Internal models need to be independently validated and periodically reviewed.

Standards on capital required to support activities, as a function of the risk and positions held. Different models are allowed to compute the capital to hold, the more involved models leading to reduced capital amounts.

Trading books positions need to be revalued following prudent valuation principles (e.g. bid or ask side, prudent mark-to-model computation, inclusion of valuation adjustment).

**UCITS**
**EMIR**
**IFRS13**
**CRR-CRD IV**
**PRIIPS**
**AIFMD**
Current Regulatory Context

PRIIPs

Objectives of PRIIPs’ Regulation

- Promote the emergence of a single European insurance market
- Ensure the comparability between similar products
- Improve transparency and increase investors confidence
- Harmonize the framework of administrative and financial penalties on a Europe-wide basis

Concrete solutions brought by the Regulation

- Define a Key Information Document with standard format and content
- Make it compulsory to provide the KID to investors prior to any proposal or contract

Packaged Retail and Insurance-based Investment Products
denote a class of insurance-based investment products proposed to retail investors

Content of a KID

- Description
- Risk-reward profile: Summary Risk Indicator, performance scenarios, maximum loss, issuer default risk, etc.
- Costs disclosure
- Other useful information

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Current Regulatory Context

IFRS13

Overview

IFRS 13 “Fair Value Measurement” is an international accounting standard adopted by the IASB on 12 May 2011 and applicable since January 2013

Revision & annual update

IFRS 13 provides a unique framework for measuring fair value, defined as follows:

**FAIR VALUE**

- Fair value relates to a transaction with *independent* and knowledgeable market *participants*
- Fair value is the price to *exit* a transaction
- Fair value includes elements such as *transaction costs and risk* (e.g. issuer credit risk)

“The Price that would be received to sell an asset or paid to transfer a liability in an *orderly transaction* between market participants at the measurement date”

**VALUATION TECHNIQUES**

Principle: **maximize the use of observable data**

- Level 1 inputs: Unadjusted quoted prices in active markets for identical assets/liabilities
- Level 2 inputs: Inputs (non Level 1) that are observable for the asset/liability, either directly (e.g. prices) or indirectly (derived from prices)
- Level 3 inputs: Unobservable inputs for the asset/liability
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Securitization and Collateralized Debt Obligations
Definition and principles

Securitization is the practice of pooling various debt instruments and selling their related cash flows to third party investors under the form of securities.

**Pool of debt assets**
- Residential mortgage
- Commercial mortgage
- Student loan
- Auto loan
- Credit card debt obligation etc.

Individual assets within the pool have all their own credit rating.

**Asset-Backed Security**

**Collateralized Debt Obligation**

Interest payments, Capital repayments

**Investors**

Support the credit risk of the collateralized assets

**Contractual payments of the CDO**

What is the overall credit risk supported by investors?
Securitization and Collateralized Debt Obligations
Definition and principles

A common structure of CDO involves **slicing the credit risk** of the reference pool into different **tranches**, each with its own level of credit risk and its own rating.

- **Senior Investors** (AAA): Low interest, protection against credit risk
- **Mezzanine Investors** (A): Medium interest, reduced protection against credit risk
- **Equity Investors** (CCC): High interest (or “all that remains”), high credit risk

**Equity Tranche**
- Absorbs the first losses
- Most risky tranche
- Remunerated by highest rate of interest

**Other Tranches**
- From more to less risky:
  - Junior
  - Mezzanine
  - Senior

**Pool of debt**
- A
- BBB
- B
- CCC
- C

**Repackaging in various tranches**
Securitization and Collateralized Debt Obligations

The “waterfall” principle

1. Each securitization tranche has its own credit rating, obtaining protection from the lower tranches.

2. Cash flow waterfall
   The coupons and/or principal of a tranche are paid only if all the tranches with higher seniority have been paid off.
   All payments made by collateralized assets are pooled within the CDO.

3. Pooled amounts are used to pay more senior tranches first.
   Remainder is used to pay more junior tranches.
   If default on collateral assets, loss incurred by more junior tranches first.

2nd level securitization: tranches of CDOs can be themselves pooled to produce new securities ("CDO-square"), also decomposed into tranches.
Securitization and Collateralized Debt Obligations
Transforming lead to gold

The principle of pooling enables to produce high-quality securities (e.g. AAA) out of a pool of lower-quality assets (e.g. BBB)
Securitization and Collateralized Debt Obligations
Transforming lead to gold

The Theory of How the Financial System Created AAA-rated Assets out of Subprime Mortgages

1. People all over the country take out mortgages. Financial institutions group hundreds of subprime mortgages into Mortgage Backed Securities (MBSs).
2. The securities are grouped into tranches by levels of risk and earnings potential for bond holders. When everybody can pay their mortgage in full each month, each group of bond holders gets paid.
3. The mortgage payments are collected by a financial institution and payments distributed to bond holders. Higher rated tranches are paid first. When monthly mortgage payments are not made, payments may not reach holders of lower-rated tranches.
4. Collateralized Debt Obligations (CDOs) were created by taking the lower-rated tranches out of the MBSs and repackaging them. Most of this CDO is highly rated, even though it is built out of high-risk assets.


https://en.wikipedia.org/wiki/Collateralized_debt_obligation
Securitization and Collateralized Debt Obligations
Valuation of CDOs

Valuation requires simulating the default of underlying assets

- Estimating the **probability of default** for each asset
- Estimating the **time** an asset will default
- Estimating the **loss incurred in case of default** (is there a recovery?)
- Taking into account the **correlation between defaults** of different assets

<table>
<thead>
<tr>
<th>Low default correlation scenario</th>
<th>High default correlation scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default is likely to occur, but only for a small number of assets simultaneously</td>
<td>Default is less likely in absolute, but when one asset defaults many other assets default as well</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equity tranche</th>
<th>Senior tranche</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since default is very likely, equity tranche will certainly make losses</td>
<td>Since only a reduced number of defaults may occur, it always remains well protected</td>
</tr>
<tr>
<td>Since default is less likely, equity tranche has some chance of incurring no loss</td>
<td>Since many assets can default together, protection of lower tranches may be insufficient</td>
</tr>
</tbody>
</table>

During the credit crisis, default correlation was strongly under-estimated by market participants, resulting to strong misvaluation of CDOs (even AAA tranches were actually risky)
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Counterparty credit risk

The risk that an entity with whom one has entered into a financial contract (the counterparty) will fail to fulfil their side of the contractual agreement

Counterparty risk is typically defined as arising from two broad classes of financial products:

- **Securities financing transactions** e.g. repos and reverse repos and securities borrowing and lending
- **OTC derivatives** including interest rate swaps, FX forwards and credit default swaps

How to deal with counterparty credit risk in derivatives valuation?

- Require the party with negative MtM to post collateral in guarantee in case it goes into default
- Adjust the valuation to incorporate credit exposure

Collateral management can be burdensome and introduce operational risk

By far the most significant class due to the size and diversity of OTC market
OIS Discounting
Swap valuation: reminders and further

- The fair value of an IRS, FX swap or forward at inception is usually zero
- Once the swap is struck, its market value will evolve and soon no longer be zero because of several effects:
  - Interest rates will change over time
  - Implicit forward rates will change over time
  - Counterparty risk may change

- Valuation is performed under the **Discounted Cash Flows Method**:
  - Liquid swaps with known market prices are used to **build yield curves**, themselves used for pricing other swaps
  - Estimation of future (fixed or floating) cash flows
    - **Forecasting future floating cash flows requires a yield curve calibrated on instruments of corresponding tenor**
  - Discounting of the future cash flows
    - **Discounting is computed using a yield curve denoting the counterparty credit risk of the cash flows**
Before the credit crisis

OIS Discounting

Before the credit crisis, valuation was performed in a “Single-Curve Framework”

1. **Libor**, the short-term borrowing rate of AA-rated banks was seen as a proxy for the risk-free rate.
2. Counterparty credit risk was a minor concern and collateral agreements were far from systematic.
3. Yield curves calibrated on instruments of any tenor were more or less identical.

Consequences on swap valuation

1. A yield curve calibrated on the market prices of the most usual liquid swaps was used to forecast floating cash flows.
2. The same curve was used to discount cash flows when the swap was collateralized or when the counterparty was “sufficiently solid” (i.e. well-rated).

Before the credit crisis, valuation was performed in a “Single-Curve Framework”
OIS Discounting
During the credit crisis

1. The onset of the crisis (esp. the collapse of Lehman) raised questions about the liquidity and creditworthiness of big banks, even well-rated:
   - Regulators and public opinion called for increased transparency and regulation of OTC markets
   - Collateralization with daily margin calls became a necessity

2. Strong criticism of LIBOR as fair and risk-free reference rate
   - LIBOR, the rate of unsecured borrowing, denoted the risk of AA-rated banks, but no more the absence of counterparty credit risk
   - Suspected manipulations of the LIBOR fixing procedures led to a distrust of LIBOR
   - LIBOR6M was riskier than LIBOR3M, itself riskier than LIBOR1M, etc.

3. Central banks continued to provide abundant liquidity via their bank lending window
   - Fed funds ("cash") and short-dated T-Bills were the sole remaining assets considered as more or less free of credit risk, since dealt with highest-quality government entities and for the shortest maturity (1-day)
   - These short-dated "risk-free" assets were the only acceptable deliverable assets for collateral maintenance
OIS Discounting
Consequences of the credit crisis on valuation

- Behaviours of dealers on swap markets changed dramatically:
  - Apparition of non-negligible tenor basis
  - Large differences between yield curves calibrated on instruments of different tenors
- Consequences on swap valuation:
  - Forecasting floating cash flows requires the use of the yield curve calibrated on instruments of the corresponding tenor
  - Discounting cash flows of collateralized swaps requires the use of a “risk-free” yield curve

Best proxy: a curve calibrated on instruments with a 1D tenor (i.e. “Overnight-Indexed Swaps”), the “OIS curve”

Since the credit crisis, valuation is performed in a “Multi-Curve Framework”, with discounting under the OIS curve, considered as an “almost risk-free” curve
OIS Discounting
Multi-curve framework

An Overnight-Indexed Swap is a fixed-floating IRS where the floating rate is calculated using the daily compounded overnight rate index.

For collateralized regular IRSs (e.g. in EUR: 1Y fixed vs. EURIBOR6M), two curves are necessary:

- The OIS curve calibrated beforehand as above to discount the cash flows
- The “LIBOR6M curve”, i.e. a curve calibrated using liquid swaps indexed on LIBOR6M

Effective federal funds rate in USD, Euro Overnight Index Average (EONIA) in EUR, Sterling Overnight Index Average (SONIA) in GBP, etc.

Forecasting the floating rate of a non-liquid OIS requires a curve calibrated on a 1D tenor (i.e. liquid OISs)

Discounting collateralized cash flows requires the risk-free curve, i.e. the curve calibrated on liquid OISs

Regular IRSs need to be valued under a “Dual-Curve framework” with OIS discounting.

The multiplicity of tenors (1D, 1M, 3M, 6M) results in the “Multi-Curve framework”

Valuation results may be very different than in the pre-crisis “Single-Curve” world
OIS Discounting

Issues of the multi-curve framework

- The transition from LIBOR to OIS curves may cause large portfolio MTM changes resulting in greater income statement volatility
- Hedge accounting: hedge may prove less effective (or fail hedge effectiveness test) if e.g. hedge is discounted at OIS while the hedged item is not

- Active OIS markets do no exist for all currencies and may be limited to short to medium-term maturities (which makes it difficult to calibrate a complete discounting yield curve)
- Calibration of all yield curves should be a fully integrated process, since swaps used as calibration instruments have influence of several curves, especially when dealing with cross-currency swaps

- Discounting using a LIBOR yield curve (represents a standard AA-rated banking counterparty)?
- Discounting using the OIS yield curve shifted by some credit spread (depending on the counterparty)?
- Discounting using the OIS yield curve and account for valuation adjustments?

No market consensus so far
Recent Trends in Derivatives Markets

Summary

DERIVATIVES (SWAPS) VALUATION
Incorporation of new market realities into pricing
Multi-curve framework (depending on collateralization)

Since the crisis, rate of collateralized Overnight-Indexed Swaps is seen as the true risk-free rate instead of LIBOR

The yield curve built upon OIS is the new standard for discounting

COUNTERPARTY CREDIT RISK
Importance of proper collateral management
Inclusion of Credit Support Annexes (CSA) in swap contracts

Challenges of collateral include the operational costs, the complex management of threshold and netting agreements, the determination of cheapest-to-deliver assets, etc.

TRANSPARENCY
Essential to know precisely the exposures of the bank with respect to each individual counterparty
High standards of transparency to guarantee investors protection and best execution within MiFID

3M EUR LIBOR-OIS spread
Close to 0 until credit crisis

Sub-prime crisis (2007-2010)
Euro sovereign debt crisis (2011-2012)
Start Mid-2007

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Quantification of credit risk

Traditional management methods of counterparty risk tend to work in a binary fashion:
- For example the use of a credit limit – if the limit is breached, financial institution would refuse to enter into a transaction
- Problem with this is that only the risk of a new transaction is being considered – but potential profit of the new transaction should also be a factor in the decision making process

By pricing counterparty risk, one can move beyond a binary decision making process:
- The question of whether to enter a transaction becomes simply whether or not it is profitable once the counterparty risk component has been priced in
- In other words we adopt the following equation:

\[
\text{Risky price} = \text{Risk-free price} + \text{CVA}
\]

“Credit Valuation Adjustment” = Price of counterparty risk

Price assuming no counterparty risk
Credit Valuation Adjustment

Quantification of credit risk

\[ CVA = \text{Present Value} \times \text{Probability of default} \]
\[ = (1 - \text{Recovery rate}) \times \text{Exposure at default} \times \text{Probability of default} \times \text{Discount Factor} \]

- The transaction type i.e. is it an interest rate swap or an FX forward
- Whether there are other offsetting positions with the counterparty that will result in a netting effect (and is there a netting agreement for this to apply)
- Whether of not the transaction is collateralised
- Any hedging aspects of the underlying transaction
Credit Valuation Adjustment

Challenges

CVA **valuation methodologies** are still **not standardised**:  
- Can range from relatively simple to highly complex methods  
- Methodology used largely driven by sophistication and resources available to market participant  
- Depending on a particular participant, CVA can be quite large

Common challenge for all entities computing CVA is obtaining the necessary **market data**:  
- Requires some degree of judgement in coming up with proxy data in order to compute CVA  
- Whether or not credit spreads are available

Regardless of methodology used to compute CVA, a certain level of **expertise and management judgment** is required to ensure that CVA has been considered and appropriately applied
Recent Trends in Derivatives Markets

Summary

**DERIVATIVES (SWAPS) VALUATION**

Incorporation of new market realities into pricing

- Multi-curve framework (depending on collateralization)

**COUNTERPARTY CREDIT RISK**

Importance of proper collateral management

- Inclusion of Credit Support Annexes (CSA) in swap contracts
- Inclusion of proper valuation adjustments

**TRANSPARENCY**

Essential to know precisely the exposures of the bank with respect to each individual counterparty

- High standards of transparency to guarantee investors protection and best execution within MiFID

**VALUATION ADJUSTMENTS**

- CVA (Credit) accounts for the counterparty credit risk if no collateral
- DVA (Debit) accounts for own counterparty credit risk if no collateral

**CHALLENGES OF COLLATERAL**

- Operational costs
- Complex management of threshold and netting agreements
- Determination of cheapest-to-deliver assets

**The yield curve built upon OIS is the new standard for discounting.**

**Since the crisis, rate of collateralized Overnight-Indexed Swaps is seen as the true risk-free rate instead of LIBOR.**

**3M EUR LIBOR-OIS spread**

- Close to 0 until credit crisis

**Sub-prime crisis (2007-2010)**

**Euro sovereign debt crisis (2011-2012)**

**Start Mid-2007**

3M EUR LIBOR-OIS spread Close to 0 until credit crisis
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Illustration: Swap trading in the past and nowadays
Example of cross-currency swap

Before the 2007 crisis...

Classical valuation framework
Two yield curves are required:
- 1 single “standard” curve for forecast and discount in ccy1
- 1 single “standard” curve for forecast and discount in ccy2

Multi-curve valuation framework
Four yield curves are required:
- 1 forecast curve in ccy1 corresponding to the right LIBOR tenor
- 1 discount curve in ccy1:
  - OIS if collateralized
  - Standard Libor curve otherwise
- 1 forecast curve in ccy2 corresponding to the right LIBOR tenor
- 1 discount curve in ccy2:
  - OIS if collateralized
  - Standard LIBOR curve otherwise
  - Cross-currency and maybe tenor basis adjustments

Ccy1 is the collateral currency, ccy2 is the other one!

... and after the crisis

Regulatory and practical obligations
- Report to a trade repository (EMIR)
- Ensure there is a Credit Support Annex for collateral definition and practical details
- Fulfil MiFID transparency obligations
- Collateral management: operations, netting agreement, thresholds, etc.
- If not collateralized trade:
  - Compute CVA/DVA
  - Take netting into account
  - Consider other trades in portfolio
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Key Messages

1. Financial markets and derivatives markets in particular are put under strong regulatory pressure
   - UCITS and AIFM Directives affect the investment funds industry
   - EMIR, Capital Requirements and PRIIPs Regulations affect banking and funds industries
   - IFRS 13 re-defines the concept of fair value and may be equally applicable by funds, banks or corporate entities

2. The development of securitization in the 2000s has seen the rise of new financial instruments built upon debt securities, with the objective of transferring credit risk throughout the market
   - Asset-Backed Securities (or CDOs) have been criticized because they tend to hide the source of credit risk
   - Valuation is extremely complex and depends heavily on the default correlation between underlying securities

3. Increased care for transparency and management of credit risk have led to new valuation techniques, even for instruments as simple as IRSs
   - Multi-curve valuation framework (with OIS discounting)
   - Inclusion of valuation adjustments such as CVA and DVA

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Thanks for attending

Do you have questions?

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