# Interest Rate Swaps – Modelling and Usage in the Context of Basel III and EMIR

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**Abstract**

Interest Rate Swaps are a probate method to manage interest rate risk. This article presents the basic methods of modelling interest rate swaps and discussed the influences of Basel III and EMIR onto pricing and regulation.

**Key words**

Basel III, Swap, EMIR (European Market Infrastructure Regulation), CCP (Central Clearing Party), OTC (Over the Counter), CVA (Credit Value Adjustment)

**JEL Classification:** G15, G21, G28

## 1. Introduction and Aim of the Paper

Interest Rate Swaps are a typical product to hedge interest rate risks. Especially banks use this kind of derivative instrument to manage their interest rate risk (see Fröhlich, 2012, pp.193 for further details). Up to now, these swaps normally have the character of an OTC derivative that has not to be traded at a classical market. Basel III and EMIR (European Market Infrastructure Regulation) make it more difficult for banks to make such OTC derivatives. The aim of this paper is to:

1. explain the basic methods of valuing swaps.
2. show how EMIR and Basel III influence this modulation.

The resulting structure is as follows: in section 2, the basics of modeling interest rate swaps are described. Section 3 presents the main aspects of EMIR that influence the pricing of swaps. Section 4 sums up the main results and gives an outlook to the future.

## 2. Modeling Interest Rate Swaps

### 2.1 Defining an Interest Rate Swap

Interest rate swaps belong to the so-called symmetric derivatives that consist of the obligatory exchange of interest payments based on different maturities (see Schierenbeck, Lister and Kirmße 2008, pp.354). While one party pays the fixed interest rate (payer swap), the other party has to be a roll over variable interest rate (receiver swap).Interest rate swaps normally are contracted OTC (over the counter) as both parties wish to have individual contracts.

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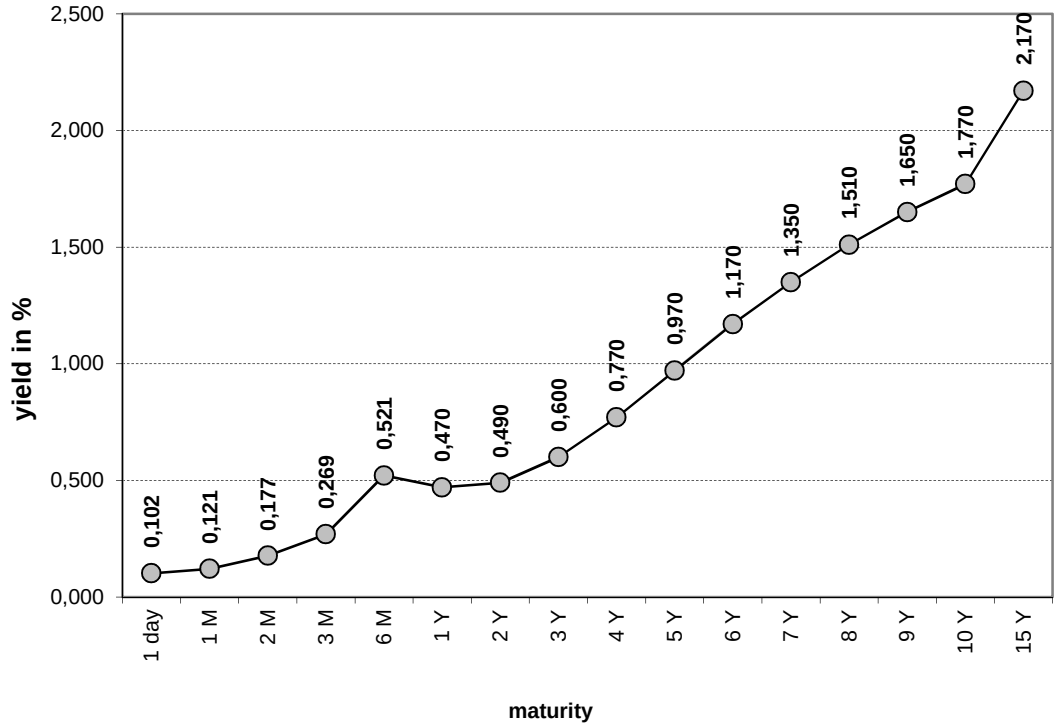
## 2.2 The Present Valuer of a Swap

Interest rate swaps are valued by the present value approach. Imagine, an interest rate swap is contracted on September 5th, 2012. Further imagine that this is the time of valuing the swap. First, a yield curve has to be defined. This is done in figure 1 (see EONIA 2012, EURIBOR 2012, Helaba 2012).

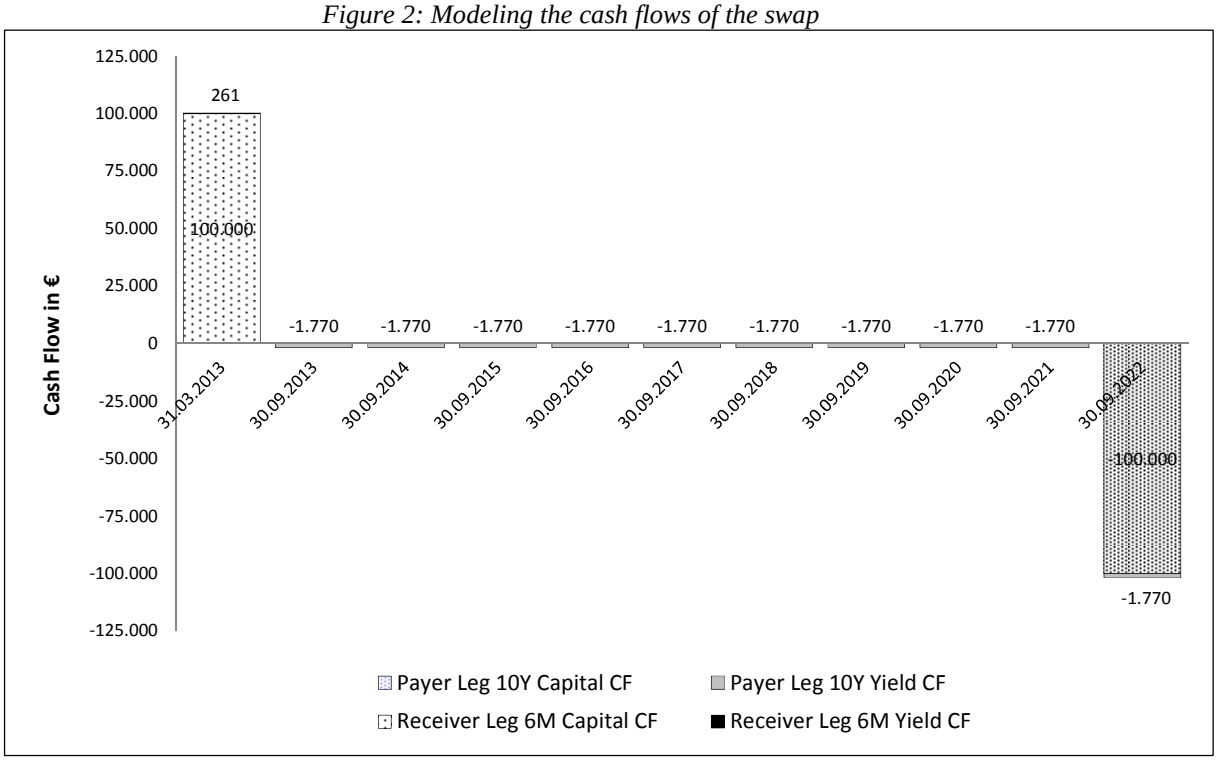
*Figure 1: Yield curve of September 5th, 2012*




This yield curve is the basis for modeling the swap. The relevant swap shall be given as a payer swap, 100.000 € basic value, maturity 10 years, connected to the 6M EURIBOR (extended example of Frère, Krahn and Reuse, 2011, pp. 5). Therefore the swap has to be divided into its parts and cash flows have to be modeled. On the one hand, we have the fixed cash flows. Ten interest rate payments (1.770%) and the fictive payback of the base amount have to be stated. On the other hand, the first variable payment is fixed by the actual EURIBOR of 0.521%, including the fictive payback of the variable tranche. It has to be kept in mind that interest rate cash flows might differ from liquidity cash flows. Even though the basic amount is not paid back, it represents an interest rate date of expiry.

The sum of all cash flows is visualized in figure 2, assuming that the swap begins to start at September 30th, 2012. The forward phase of 25 days is not modeled in this simplified example.

*Figure 2: Modeling the cash flows of the swap*




After that, the cash flows have to be valued with their present value. Therefore, the so-called ZDF (zero bond discount factors, see Rolfes, 2008, pp.308) are used. Every cash flow is discounted to $t_0$. This represents figure 3 which sums up all the cash flows and values them with the ZDF.

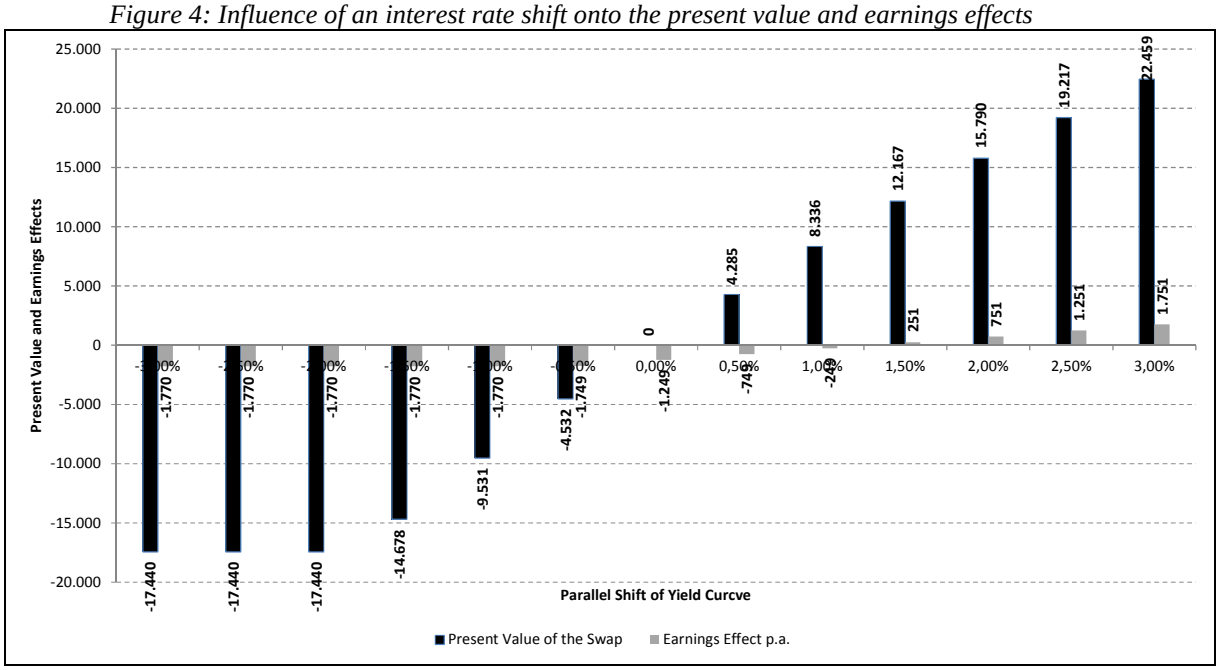
*Figure 3: Present value of the swap*

| Date | Payer Leg 10Y | | Receiver Leg 6M | | Cumulated | ZDF | Present |
|---|---|---|---|---|---|---|---|
| | Capital CF | Yield CF | Capital CF | Yield CF | Cash Flow | | Value |
| 31.03.2013 | | | 100.000 | 261 | **100.261** | 0,99740 | 100.000 |
| 30.09.2013 | | -1.770 | | | **-1.770** | 0,99532 | -1.762 |
| 30.09.2014 | | -1.770 | | | **-1.770** | 0,99027 | -1.753 |
| 30.09.2015 | | -1.770 | | | **-1.770** | 0,98219 | -1.738 |
| 30.09.2016 | | -1.770 | | | **-1.770** | 0,96968 | -1.716 |
| 30.09.2017 | | -1.770 | | | **-1.770** | 0,95257 | -1.686 |
| 30.09.2018 | | -1.770 | | | **-1.770** | 0,93188 | -1.649 |
| 30.09.2019 | | -1.770 | | | **-1.770** | 0,90913 | -1.609 |
| 30.09.2020 | | -1.770 | | | **-1.770** | 0,88500 | -1.566 |
| 30.09.2021 | | -1.770 | | | **-1.770** | 0,86014 | -1.522 |
| 30.09.2022 | -100.000 | -1.770 | | | **-101.770** | 0,83519 | -84.997 |
| | | | | | | | **0** |

The cash flows correspond to figure 2. It becomes clear that the present value of the whole construct is zero – all deterministic derivatives, contracted at the market, are valued with zero. The main adjustment is the fixed rate. Varying it would lead to a positive or negative present value directly in the beginning. This value has to be paid or received as a so-called upfront payment.

As long as the market yields do not change, the value of the swap is zero. But what happens if the yield changes? Figure 4 shows how the p.a. earrings effects but especially the present value effects differ according to a parallel shift in the yield curve.

*Figure 4: Influence of an interest rate shift onto the present value and earnings effects*




It becomes clear that a positive interest rate shift leads to a positive p.a. effect. Further it has to be stated that the present value reacts much more sensitive. This results from the effect that the present value contains of all p.a. effects of the future. It has to be kept in mind that a closing of a swap only is possible if both parties agree. The resulting price is the calculated present value – only adjusted by the accrued interests.

### 2.3 Main Results from Modeling the Swaps

The main result of the presented modeling approach is that a swap is a probate instrument to manage interest rate risk as all maturities can be generated by a synergetic product. If a bank wants to manage its interest rate risk – resulting from the different maturities of the asset and liability side – the swap can be used to close these gaps or even to increase these gaps if this is an efficient benchmark (see Reuse, 2012, p.159). Further it has to be kept in mind that interest rate swaps do not have to be balanced in a bank it they are used for a strategic management of the interest rate risk management (See IDW 2011). So the swaps are the most elegant way to manage interest rate risk – if pricing and regulatory equity requirements are adequate.

## 3. Main Aspects of EMIR and Basel III according Swaps

### 3.1 Main Idea of EMIR

The main idea of Basel III is to increase the stability of the banking system and to delever banks that derivatives. Capital requirements in form of the CVA (credit value adjustment) are regulated in Art. 101 of Basel III (see Basel Committee on Banking Supervision, 2010, pp.34). The corresponding European Market Infrastructure Regulation (EMIR) was published on March 29th, 2012 (see EMIR 2012). Its main aim is to increase supervisory activities according the “grey market” of OTC derivatives, as these instruments strengthened the financial crisis in 2008. Nowadays, no one even knows, how many OTC derivatives exist – and if they can lead to an insolvency of a bank or even a country. EMIR shall lead to more transparency in this area (see Greiner and Mair, 2012, pp.6).

The main ideas of EMIR are shown in figure 5 (based on Greiner and Mair, 2012, pp. 1; Condat and Gibson, 2012; EMIR, 2012).

*Figure 5: Main content of EMIR according swaps*

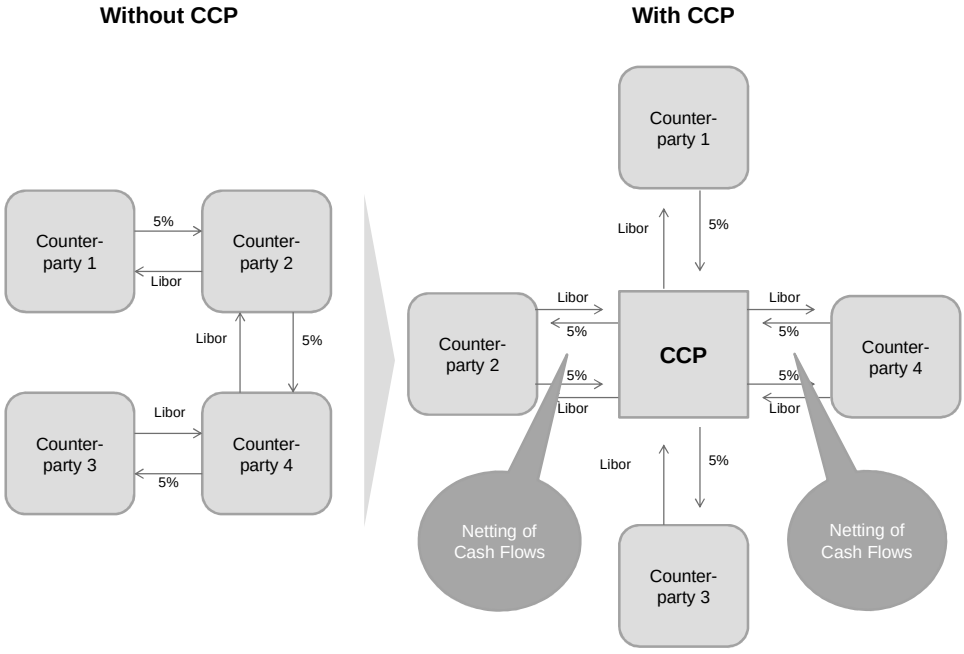
| Aspect | EMIR | Explanation |
|---|---|---|
| Clearing via CCP (central counterparty) | Art. 3 | The main aim is to reduce the counterparty risk. Transactions cleared via CCP do **not** have to be calculated with a CVA (credit value adjustment). |
| Products | Art. 4 | All eligible derivatives, also interest rate swaps have to be cleared |
| Exception | Art. 4 (2) | Transaction within a group – e.g. the German Savings Bank sector – do not have to be done via CCP. |
| Transaction register | Art. 9, 55, 77 | All transactions have to be reported to a central transaction register. |
| Electronic confirmation | Art. 11 | A confirmation has to be done by electronic means – e.g. Market Wire. |

These requirements are partly presented in the following pages. It has to be kept in mind that several details and technical aspects of the implementation still are unclear. Their final release is expected till Dec. 31st, 2012 (see Sigmundt, 2012, p.16), an implementation is expected to be June 30th, 2013 (see VOEB, 2012, p. 10).

### 3.2 Implementing a CCP

In order to increase transparency, EMIR implements a so called CCP (central clearing party). From 2013, all relevant standard derivative transactions have to be done via a CCP. The difference to the OTC construct is visualized in figure 6 (see Schillings and Skolka, 2012, p.10).

*Figure 6: Implementing a CCP*



The CCP clears all relevant derivatives. The advantage is that a netting between the cash flows is possible. The license for a CCP depends on quantitative and qualitative requirements of the national banking supervisory boards. Only solvent institutions shall become a CCP, but the exact criteria are not yet defined (see Sigmundt, 2012, pp.15). In case of a crisis, this system shall stabilize the financial markets.

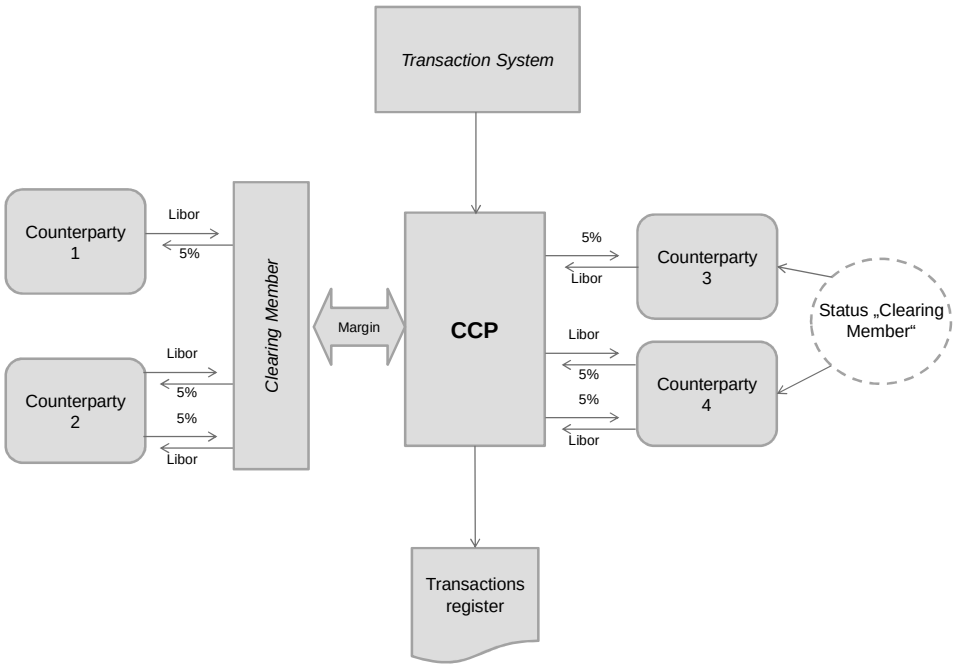
### 3.3 Electronic Confirmation and Transaction Register

The clearing system leads to more transparent as well, as figure 7 shows (see Schillings and Skolka, 2012, pp.7).

A bank can become a clearing member in the new system. This member has to fulfill special requirements in order to prevent illiquidity or insolvency. These criteria are e.g. a minimum rating, minimum capital requirements and payments into a default fund, the margin (see Sigmundt, 2012, p.12; Schillings and Skolka, 2012, p.10).

If a party does not have the status of a clearing member, it has to do the transactions via an additional clearing member party. The risk a clearing member faces when doing a transaction with such a counterparty will probably be implemented into the price of a derivative. Further, So it might be more expensive for non-clearing members to invest e.g. in swaps.

*Figure 7: Different options in the CCP system*




Transparency occurs as two additional processes have to be done: First, all contracts must be done via an electronic confirmation, e.g. Market Wire (see Sigmundt, 2012, p.15). Second, they have to be reported into a transaction register, e.g. DTCC Deriv/SERV, ICE SDR or REGIS-TR (see Holzer, 2012, p. 19). This leads to additional costs and more complex processes for the parties. After implementing EMIR, the banking supervisory will have a good overview onto the traded volume of standard derivatives.

### 3.4 Increased Regulatory Capital Requirements – the CVA Charge

Basel III increased the capital requirements for derivative transactions. All transactions cleared via CCP will have a risk weight of 2% of its actual present value (see Basel Committee on Banking Supervision, 2012, p.4). The capital requirements for derivative transactions without a CCP are different. They have to be calculated with a regulatory CVA (credit value adjustment) acc. to Art. 104 of Basel III. In practice, this will lead to additional regulatory capital requirements for those banks that do not use a CCP. In this context, the so called CVA is quantified. It results from the risk that counterparties might have a downgrade and is calculated by the following formula, used for banks without an internal model method (taken from Basel Committee on Banking Supervision, 2012, p.34).

$$K = 2.33 \cdot \sqrt{h} \cdot \sqrt{\left( \sum_i 0.5 \cdot w_i \cdot \left( M_i \cdot EAD_i^{total} - M_i^{hedge} B_i \right) - \sum_{ind} w_{ind} \cdot M_{ind} \cdot B_{ind} \right)^2 + \sum_i 0.75 \cdot w_i^2 \cdot \left( M_i \cdot EAD_i^{total} - M_i^{hedge} B_i \right)^2}$$

*with:*

h = one year

$w_i$ = weight applicable to counterparty ‘i’ based on its external rating (from AAA: 0.7% to CCC: 18.0%, see Basel Committee on Banking Supervision, 2012, p.36)

EAD = the exposure at default of counterparty ‘i’, discounted by applying the factor $(1-\exp(-0.05*M_i))/(0.05*M_i)$.

$B_i$ = Bi is the notional of purchased single name CDS hedges, not relevant for interest rate swaps.

$B_{ind}$ = Bind is the full notional of one or more index CDS of purchased protection, not relevant for interest rate swaps.

$w_{ind}$ = weight applicable to index hedges based on its external rating

Mi = effective maturity of the transactions with counterparty ‘i’.

$Mi^{hedge}$ = maturity of the hedge instrument with notional Bi

$M^{ind}$ = maturity of the index hedge ‘ind’.

This CVA leads to additional capital requirements for banks that are not a clearing member. The aim of EMIR is to make uncleared transactions too expensive to be attractive.

## 4. Impacts of EMIR and Basel III onto the Modulation of Swaps

### 4.1 General Price Development

All these new regulations have effects on the pricing of swaps. Even though an exception of intragroup deals according to the CCP obligation is possible, the effects have to be analysed in detail. This is done by figure 8.

*Figure 7: Impacts onto the pricing*

| Scenario | Explanation | Price Development | | |
|---|---|---|---|---|
| Swaps cleared via CCP will have another pricing than not cleared swaps. | As the CVA does not occur in CCP cleared transactions, less regulatory equity leads to a better price. | Prices *CCP* | better than | Price *OTC* |
| Swaps in intragroup transactions do not have to be cleared. | Further, no regulatory equity has to be reserved, but a CVA charge has to be quantified. | Prices *intra-group* | better than | Price *OTC* |
| Intragroup trades vs. CCP trades | This is the most interesting question – which effect dominates? | Prices *CCP* | ? | Prices *intra-group* |

On the one hand it becomes clear CCP cleared transactions will be cheaper for the banks as they bind lower regulatory capital. So it will be a difference if a bank does an OTC or a CCP transaction. On the other hand it has to be kept in mind that intragroup trades do not have to be cleared. This might lead to the effect that especially savings banks or cooperative banks in Germany will use this option. The question that cannot be answered up to now is, if these transactions will be cheaper or more expensive than the cleared ones.

### 4.2 Possible Methods of Different Pricing

Clearing will lead to a competition advantage especially for bigger banks: if a bank is able to clear, the equity requirements shall be reduced. As consequence, the SWAP yields might be divided into CCP cleared, intragroup and not cleared (OTC) curves. The bid/ask spread and the resulting swap curve will be the main indicators for this development. It will be interesting so see which effect leads to the most attractive pricing: intragroup or CCP cleared transactions.

## 5. Final Conclusion and Verification of Theses

This article has shown how interest rate swaps can be modeled. The based yield curve and the resulting present value are the most important value drivers for the swap. EMIR will lead to a different pricing of swaps – probably quantified in different bid/ask spreads or even in several new swap curves, based on the kind of transaction.

The main idea of Basel III and EMIR is deleveraging and making the financial sector. A lower leverage of the risk leads to less equity requirements as per Basel III, the processes of CCP lead to higher costs and more transparency. For several banks it might become unattractive to do derivative transactions. The aim of the supervisors is clear: reduce the “free float” of swaps.

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