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INTEREST RATE SWAPS: PRACTICAL ISSUES, CORPORATE USE AND REGULATION

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Abstract

Interest rate swaps are one of the most widely trade derivatives and are extremely useful as a hedging instrument for both financial and non-financial firms. This dissertation aims to explain how IRS works in practice, and in what way companies may use them to change their cash-flows. The dissertation depicts the benefits, and some obstacles, that firms can expect from using those derivatives as hedging instruments. Furthermore, it describes and discusses the recent European regulations concerning over-the-counter derivatives, regarding interest rate swaps in particular.

Keywords: Swap, Cash-Flow, Hedging, Regulation

JEL Classification: G15, G32

Resumo

Os swaps de taxa de juro estão entre os derivados mais transacionados e são instrumentos de cobertura extremamente úteis, quer para instituições financeiras quer não-financeiras. Esta dissertação mostra com funcionam os IRS na prática, e como as empresas os podem usar para modificar os seus *fluxos de caixa*. A dissertação refere os benefícios, e alguns obstáculos, que as empresas podem esperar obter através da utilização destes derivados de taxa de juro. Para além disso, descreve e discute recente regulação europeia que diz respeito a *derivados de balcão*, especialmente em relação aos swaps de taxa de juro.

Palavras Chave: Swap, Fluxo de Caixa, Cobertura, Regulação.

Classificação JEL: G15, G32

Notation

CCP	Central Clearing Counterparty
CSA	Credit Swap Annex
EBIT	Earnings before Interest and Tax
EBT	Earnings before Tax
EMIR	European Market Infrastructure Regulation
ESMA	European Securities Markets Authority
FC	Financial Counterparty
IRS	Interest Rate Swap
ISDA	International Swaps and Derivatives Association
NFC	Non-Financial Counterparty
NPV	Net Present Value
OTC	Over-the-Counter

Contents

1 Introduction

Swaps can be used for different purposes, including both hedging and speculation among their possible uses. This dissertation will focus on the importance of interest rate swaps as a hedging instrument, their characteristics and conventions, possible strategies, advantages, problems and recent regulation.

Noteworthy of the swaps importance is the fact that they are the most heavily traded contract in the OTC interest rate segment [Gyntelberg & Upper (2013)]. According to the BIS Triennial Central Bank Survey (2013, p. 8) swaps represent 60% of the total turnover. Furthermore, as indicated in the survey, interest rate swaps grown from 155 billion US dollars in 1998 to 1.415 billion US dollars in 2013, and have grown interruptedly during the years between. However, as pointed out by Gyntelberg & Upper (2013, p.71), *non-financial customers continue to play a minor role in this market*, representing only 10% of trade swap.

The main objective of this work is to present how non-financial companies can use swaps to hedge interest rate risk, and to show how cash-flows can be changed using swaps. The dissertation attempts to throw a light on the importance of swaps by presenting all necessary information that would allow a corporate treasurer to recognize the benefit of using swaps and employ them to hedge interest rate risk and improve the firm's overall value.

The core of the following dissertation is organized in 5 main chapters: Chapter 2 is a brief summary of relevant literature and research projects which regard interest rate swaps. Chapter 3 introduces swaps and develops the characteristics of interest rate swaps in particular. It will explain how they function in practice, their conventions, their pricing

and valuation mechanisms as well as cancelation possibilities. Chapter 4 aims to show different strategies to hedge interest rate risk, which companies can use depending on their circumstances and the specific calendarization of their liabilities. Chapter 5 presents a review of academic and scientific works which evidence the main advantages that interest rate swaps (and other OTC derivatives) can bring to a firm. In an attempt to show both side of the discussion, difficulties related to their use are also exposed. Chapter 6 introduces the subject of regulation that was recently implemented in financial markets, in order to make them safer, but also presents new challenges and risks.

2 Literature Review

Coming from different sources, books and published articles to internet articles, there is a big variety of literature regarding interest rate swaps and their corporate use. In order to analyse them, it is necessary to divide them accordingly with their perspective on the study object.

Some of the authors present different uses of interest rate swaps, to explain what they are and how they can be applied. This kind of approach can be seen in Smith, Smithson & Wakeman (1993) who explained swaps, their different types, discuss their pricing mechanisms, how the market evolved into developing them and how it would continue to evolve. Goodman (1993) describes how corporate treasurers can use swaps to transform companies' cash-flows, in order to take advantage of different market conditions dependent on the firm's funding structure. Brown & Smith (1993) took one step further showing how more *taylor-made* swaps and swaptions could be used to manage callable debt. Das (1994) created a highly useful compendium of knowledge about swaps and other derivatives' market aspects. It intends to be a practical reference book for finance professionals, and it gives a comprehensive global framework regarding financial exchange contracts. Gay & Venkateswaran (2010) provided the reader with a practical insight to the pricing and valuation of derivatives. The authors explain the steps required for a valuation of an existing swap, describe the process of pricing a new one, and provide the reader with some examples. They focus on interest rate swaps, but also mention other derivatives, such as, cross-currency and commodity swaps.

Other authors focus their attention on how and why financial and non-financial companies use derivatives. Their objective is to understand if companies use swaps, in order to maximize the firms' global value. Smith & Stulz (1985) developed a theory of hedging

behaviour that aims to maximize a firm's value. They considered: taxes, contracting costs and the hedging impact on the company investment decisions. The authors concluded that a firm that attempts to maximise its value can hedge for different reasons: i) taxes. As hedging reduces the variability of the pre-tax firm value, the expected corporate tax (assuming it follows a convex function) will be reduced and the expected post-tax value will increase (provided hedging costs are low enough); ii) reduce the costs of financial distress. As hedging reduces the variance of the firm value; iii) Managerial risk aversion. Corporate managers hedge more when they have incentives in their contracts to do so, this in turn will help to maximize the firm's value. Nance, Smith & Smithson (1993) provided us with evidence that supporting hedging increases the firm's value by reducing expected taxes and the cost of financial distress and additionally creating more growth options in their investment opportunities. Titman (1992) modelled the company's decision to borrow short-term versus long-term and how the introduction of interest rate swaps affected this choice. The author showed that, in the absence of a swap market, firms prefer long-term financing, to avoid interest rate uncertainty. When a swap market exists, firms which expect their credit quality to improve tend to borrow short-term and hedge the interest rate risk using a swap. It is an example of the possibilities swaps can offer companies regarding liability management.

Li & Mao (2003), having in mind banks natural disadvantage in holding fixed interest rate risk due to their floating liabilities, developed a model on interest rate swaps. They reached the conclusion, that it would be more advantageous for a firm to borrow from a bank at a floating rate, considering their limitations in granting fixed interest rate loans. Guay & Kothari (2003) researched on the relative amount of interest rate risk hedged by non-financial firms using derivatives and raise questions on the small role this activity represents in those firms.

Stulz (2004) was keen in pointing out the benefits of derivatives, as well as exposing the risks involved in their use. He referred the importance of derivatives (forward contracts, options, swap and other exotic derivatives), as they allow companies to achieve payoffs that would be inaccessible without them. The author discusses the high trading costs that firms without large trading portfolios would incur in order to replicate derivatives, using others actives present in the financial markets (replicating portfolio). Stulz (2004) concluded that derivatives are seldom a redundant asset. Further, he mentioned the contribution of derivatives in both, the reduction of volatility and return's market risk of a stock. As disadvantages related with derivatives usage the author refers to: i) the lack of liquidity and difficulty with valuating more complex derivative structures; ii) eventual difficulties in closing down some derivative transactions; iii) doubts regarding if company managers are fully aware of all the risks involved in derivatives they sign, particularly exotic contracts; iv) the social loss present in derivatives, as *somebody's loss is somebody else's gain* (p. 186); v) concerns about derivatives been a potential systemic risk source. Stulz (2004) concludes stating that, on balance, derivatives make the economy more efficient but firms need to use them properly.

Faulkender (2005) explored the issue of whether firms are hedging or attempting to *time the market* when using swaps and other derivatives. He concluded that it was frequent for manager to attempt to *time the market* and that the slope of the yield curve at the time the debt is issued is an explanatory factor in the firm's final interest rate exposure.

Campello, Lin, Ma & Zou (2011) studied data [SEC filings of all U.S. non-financial firms from 1996 to 2002] that regards to corporate hedging activities. They show how hedging can lower the probability for negative realizations and reduce the expected costs of financial distress. The authors found that hedging firms have more access to credit, pay

lower interest rates and experience less capital expenditure restrictions in their loan agreements. This allows the company to invest more.

More recently, Ahmed, Azevedo & Guney (2013) attempted to examine the effect of hedging on the firm value and financial performance, using data from 288 non-financial firms from the FTSE-All share index from 2005 to 2012. In contradiction to the previous studies the authors found a negative relation between overall interest rate hedging (including swap) and firm value (with the exception of forward contracts). Interestingly enough, Nova (2015) also studied the impact of hedging on firms' market value, using a very similar sample, from non-financial firms listed in the FTSE-350 share index based on the data from years 2005-2013. However, Nova (2015) reached different conclusions than Ahmed, Azevedo & Guney (2013). The author concluded that certain types of derivatives have a positive effect on firm value, whereas in other derivatives a negative impact was found [accordant with Ahmed et al. (2013)]. Those features can be seen on Nova's (2015, p. 41) table 6, that options have a value-destroying effect and IRS a positive effect on value. That is contradictory with Ahmed et al. (2013). Furthermore, Nova (2015) concludes that hedging is positively linked with higher firm values, as the market recognizes derivatives as having a positive contribution to value creation. Regarding this inconsistency, it comes to mind the difficulty in formulating hypothesis, building models, and sample collecting, what makes those types of researches not straightforward procedures.

Yet another approach is to focus on the use derivatives exclusively in financial firms. Brewer, Minton & Moser (2000), using a data sample of U.S. commercial banks from June 1985 to December 1992, study the relation between bank participation in the derivatives market and bank lending. They found that banks which use interest rate

derivatives have experienced a bigger growth in their loan portfolios, than banks which did not used derivatives. Purnanandam (2007) analysed the interest rate risk management behaviour in commercial banks. He found that banks that use derivatives have a more stable lending volume and remaining immune to monetary police shocks. The author justifies this from the fact that non-derivatives users' banks follow more conservative asset liability management policies under tighter monetary policy cycles. Because of that their lending volume declines significantly with a reduction in the money supply.

New issues had arrived with new mandatory regulation from the European and North American authorities. A lot of the literature regarding interest rate swaps, and OTC derivatives is destined to explain which steps financial and non-financial firms need to take in order to fulfil their legal obligations. For instance, Maizar, Jaquet & Spillmann (2010) introduce the subject of corporate risk management showing how important it is for companies to deal with credit risk, especially after the unexpected bankruptcy of Lehman Brothers. From this point the authors expose a legal framework that can be used together with derivatives, explaining the mechanics of both the ISDA master agreement and the Credit Support Annex (CSA) agreement. The ISDA master agreement is a standard bilateral agreement that contains general terms and conditions regarding payment methods and conventions related with derivative contracts. This document already deals with credit events, such as, failure to pay or deliver, bankruptcy and default on third parties. However, it does not include the posting of collateral in order to reduce credit risk. The CSA agreement does exactly that, by being an add-on document that allows both counterparties to mitigate their credit risk. It requires the party with a negative market value portfolio to post collateral, as a guarantee in case of default. The authors exemplify the benefits of those agreements by showing that with a signed CSA both companies see their credit risk reduced. They also state that the CSA became an

indispensable condition in order to access the market and reach competitive quotations. Some disadvantages are also referred to: i) CSA agreements can be time consuming and resource intensive; ii) difficulties planning the firm's liquidity, coming from the obligation of posting collateral (sometimes daily). The article also offers legal opinions regarding the legal enforceability of both agreements.

Both of the articles, Bopp, Long, Steiner & Springer (2015) and Long (2015) contain a detailed report on the recent rules for mandatory central clearing in Europe. The authors present and clarify those regulations from a legal point of view, they do not offer their opinions, or critical input. It is explained that on August 16, 2012, EMIR (European Market Infrastructure Regulation) was implemented, forcing the mandatory clearing of certain OTC derivative transactions. In that regard ESMA (European Securities Markets Authority) proposed regulatory measures, which require that all financial counterparties (FCs) and non-financial counterparties (NFCs) which exceed specified thresholds, to central clear IRS deals through central clearing counterparties (CCPs). The clearing thresholds, types of contracts that must be cleared, categories of entities that must comply with those obligations and required dates for those regulations to become effective are referred to, and will be presented in this dissertation.

Some of other authors focus on the aforementioned regulatory changes from the perspective of claiming central clearing of swaps as a system to reduce systemic risk and prevent future market problems. Others regard this new measures not as a solution, but as another obstacle, that firms nowadays need to surpass in order to trade swaps. Hull (2010) shows how vast amounts of OTC derivatives can be centrally cleared and explains the advantages that come from this behaviour, including, a reduction of counterparty's risk and a more transparent market for regulators. The author points out that monitoring

the exposure on non-standard derivatives can be just as important as in standard ones, since those derivatives are also a potential source of systemic risk. Pirrong (2011) explains how central clearing counterparties are structured and what effect they will have on the financial markets. He criticises mandatory central clearing, especially its complexity, and the fact that it might be subject to moral hazard and adverse selection.

3 Theoretical Background

Swaps started as parallel loan products in the 1970s and a more significant market appeared in the 1980s. A swap can be defined as an exchange of cash-flows, between two counterparties, over a period of time. Many types of swaps do exist in the market, and many more can be created, what makes them a very versatile and flexible instrument [Smith, Smithson & Wakeman (1993)].

The swap market can be divided into four main categories:

1. Interest rate swaps: the exchange of two different types of interest rate in the same currency, usually, a fixed against a floating interest rate.

2. Cross-currency swap: A contract that involves the exchange of the principal and the interest in one currency for the principal and the interest in another currency. The principal exchange is optional at the beginning, but mandatory at the maturity of the swap, eliminating any uncertainty due to foreign exchange movements [BNP Paribas Derivatives Handbook (2006)].

3. Equity swap: an exchange between the return of an equity (or equity index) and, usually, a floating rate.

4. Commodity swaps: an exchange of net cash flows calculated to reflect changes in designated prices, such as oil, wheat or any other commodity [Smith, Smithson & Wakeman (1993)].

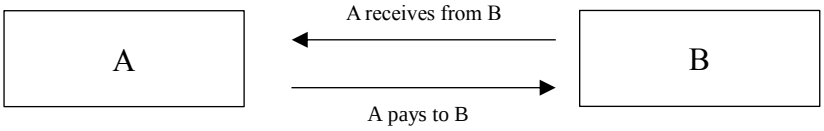
All of swaps described above can oscillate from a vanilla form, a standard swap, to a more *tailor-made* version of themselves. As pointed out by Lang (2010), swaps are not exchanged traded in an organizer market, but are a contract between two private entities.

This makes them customisable, allowing for the hedge of the exact risk and nominal size the counterparties see fit.

3.1 Interest Rate Swaps: Practical Issues

An interest rate swap (IRS) is a contract in which one counterparty exchanges one interest rate for another, in the same currency, over a period of time, oven an agreed notional amount. Every exchange is done at the end of every swap period, being the counterparty with less to receive from the other to pays a net value to the first. If fixed rate > floating rate, the counterparty that paid fixed rate will pay the other. If the opposite is true (fixed rate < floating rate), the counterparty that received fixed rate will pay the other. [Smith, Smithson & Wakeman (1993)]. It can be graphically represented as an exchange of cash-flow between two counterparties, as seen in figure 1.

Figure 1 – Swap's Exchange of Cash-Flows



In practice, if counterparty A pays a swap, it will pay a given currency fixed interest rate and receive this currency floating rate (also called variable rate) for a defined period of time (divided in *n* periods), over an agreed amount *M*. Counterparty B will do the mirror of this, that is, it will pay the floating rate and receive the same fixed rate. The two sides of every swap (pay and receive) are usually called legs. By the standard rule, the floating rate is fixed 2 business days before the beginning of every period. If the swap is starting on 4th January, its floating rate will be fixed on the 2nd January. All those variations can be switched to something that the counterparties would prefer, what makes the swap a very versatile tool.

The swaps market has a bid/ask spread: if a client asks for a swap quote to pay a fixed rate, it will be show an offer rate (also called, ask). If the client needs to receive the fixed rate, it will be shown a bid. For illustration purposes this bid/ask spread, and other transaction costs, will be ignored, and a mid-rate (the average between the two) will be used.

As an example, assuming that today is the 2nd January 2017, for a EUR 10 million swap, in which the client wants to pay a fixed rate annual 30/360 and receive 6M EURIBOR, with maturity 5 years starting spot. An illustration of a termsheet for this operation is presented in table 1.

Table 1 – 5-year IRS

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2022
Notional Amount:	EUR 10.000.000
Party A pays	
Floating Rate:	6M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0.066%**
Daycount:	30/360, Adjusted
Payment dates:	annually, on 04 January of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

This IRS has 10 periods and at the end of each one the counterparties will exchange cash-

flows. Table 2 presents the payments dates and cash-flow exchanges for all the swap's periods. In this IRS, the legs have different periodicities (annual and semi-annual) and, in consequence, in some of those periods only one leg is *in play*. In this case the floating rate will have 10 payments, and the fix only 5 payments. As such, on the 4th of July 2017 (6 months from the 4th of January 2017) the client (payer of the fixed rate) will receive the 6M EURIBOR fixed on the 2nd January 2017. Because we already know this variable, it was fixed before the start date, we can calculate the 1st cash-flow: $10.000.000 \times (-0{,}22\%) \times \frac{181}{360} = -11.061{,}11$. As such, the client will receive -11.061,11 in the 1st semester. Because it is a negative value, the client will *in fact* pay this amount to the bank.

An issue that can already be observed from this simple example is the fact that currently many interest rates (like the 6M EURIBOR) are negative. As long as nothing is said in the contract to prevent it (inserting a floor on the variable rate for instance), this of course affects the IRS cash-flows and respective price quotation, and it is the reason some shorter maturity swaps present negative fixed rates as well.

On the 4th of January 2018 both legs will matter, as the client (party B) will pay: $10.000.000 \times 0{,}066\% \times \frac{360}{360} = 6.600$.

At the same time, the client will receive the floating rate (unknow today: 2nd of January 2017): $10.000.000 \times \ 6M\ EURIBOR\ \times \frac{181}{360} = ?$.

Of course, like mentioned above, operationally speaking, there will only take place one net payment: the difference between the fixed (known) and the variable amount (unknown).

Table 2 – Cash-Flows of the 5-year IRS

Begin	Maturity	Payment Dates	Fixed Rate	Basis	Fixed CF	Fixing Dates	Floating Rates	Basis	Floating CF
04 Jan 2017	04 Jul 2017	04 Jul 2017			0.00	02 Jan 2017	-0.22%	181/360	-11,061.11
04 Jul 2017	04 Jan 2018	04 Jan 2018	0.066%	360/360	6,600.00	30 Jun 2017	6M EURIBOR	184/360	?
04 Jan 2018	04 Jul 2018	04 Jul 2018			0.00	02 Jan 2018	6M EURIBOR	181/360	?
04 Jul 2018	04 Jan 2019	04 Jan 2019	0.066%	360/360	6,600.00	02 Jul 2018	6M EURIBOR	184/360	?
04 Jan 2019	04 Jul 2019	04 Jul 2019			0.00	02 Jan 2019	6M EURIBOR	181/360	?
04 Jul 2019	04 Jan 2020	06 Jan 2020	0.066%	362/360	6,636.67	02 Jul 2019	6M EURIBOR	186/360	?
04 Jan 2020	04 Jul 2020	06 Jul 2020			0.00	02 Jan 2020	6M EURIBOR	182/360	?
04 Jul 2020	04 Jan 2021	04 Jan 2021	0.066%	358/360	6,563.33	02 Jul 2020	6M EURIBOR	182/360	?
04 Jan 2021	04 Jul 2021	05 Jul 2021			0.00	30 Dec 2020	6M EURIBOR	182/360	?
04 Jul 2021	05 Jul 2017	04 Jan 2022	0.066%	360/360	6,600.00	01 Jul 2021	6M EURIBOR	183/360	?

To exemplify, let us consider the 6M EURIBOR on 30th of June 2017 (the fixing date for the period starting on 4th of July 2017) to be -0.083%. The client would receive: $10.000.000 \times (-0{,}083\%) \times \frac{181}{360} = -8.300$.

Netting both values, the client pays the sum of both EUR 6.600 and EUR 8.300, EUR 14.900 to the bank, because he is receiving a negative interest rate.

Of course, what is expected in the positive interest rate of this 5-year swap is that future fixations of the 6M EURIBOR will become positive, and will balance the initially negative ones. That is implied because although futures interest rates are unknown, they are estimated using spot rates and prices from the capital market. Those matters will be analysed more profoundly in *Pricing and Valuation*.

A note could be made that, if the client has this swap for purposes or hedging, for example, a floating rate note (a bond that pays floating rate) is currently receiving interest rate from this bond. If that is the case, the variable interest rate level becomes irrelevant for the clients funding because he is hedged.

Regarding business day conventions, they are essential parameters to define that every date, for all swap periods, will be set in a good business day. *Adjusted* stands for the fact the dates will be adjusted if they do not fall on business days. *Modified following* is a widely used business day convention, although there are other possible ones. If the defined date is not in a good business day the following one will be used, unless the first following business day is in the next calendar month, in which case that date will be the first preceding day that is a good business day. In the example, the 4th of July 2017 is a good business day for the euro and that day will be used. But if it would be the case of a USD deal, the 4 of July happens to be a holiday (is the Independence Day of the United

States) and that would make the correct date for the end of this period/ beginning of the new one the 5th of July 2017.

There exist several *basis* for the different currencies. Regarding the euro and the dollar there are two 2 standard *basis* for contracts: act/360 and 30/360. The first is commonly used in the monetary market (operations shorter than one year) and the second in the capital market (operations longer than a year). For example, EURIBOR is an act/360 basis rate. In contrast, GBP LIBOR uses an act/365 basis. In USD contracts the act/360 basis is commonly used.

The abbreviation *act* represents the actual number of days in the period. In the example presented above, there are 181 days from 4th of January 2017 to 4th of July 2017, so the basis would be 181/360. In the fixed leg the standard basis is the 30/360. What means that for every complete month we count 30 days, in this case we had 12 full months, so the basis is 360/360.

The acronym TARGET stands for *Trans-European Automated Real-time Gross Settlement Express Transfer system* and is the settlement system for payments used in the Eurosystem and also available for non-Eurozone countries.

Those rules are standard practices that come from different financial associations and exchange markets. Among other sources, they can be consulted in OpenGamma (2013), *Interest Rate Instruments and Market Conventions Guide*. They are important for the calculation of the precise amounts of cash-flows exchanged in the swap.

3.2 Pricing and Valuation

As pointed out by Gay & Venkateswaran (2010), the swap price refers to the interest rate that is used to determine the fixed rate payments of the swap.

As the authors show, to price a *vanilla* IRS (that exchanges a fixed interest rate for a variable rate), it is necessary to consider the cash-flows of two bonds. The 1st bond has a fixed rate coupon and the 2nd bond has a floating rate coupon. The value of the bonds is given by the following equations:

$$B^{fix} = \sum_{t=1}^{n} \frac{\bar{C}}{\left(1 + {}_0R_t\right)^t} + \frac{\mathrm{F}}{\left(1 + {}_0R_n\right)^n} \tag{1}$$

$$B^{flt} = \sum_{t=1}^{n} \frac{\tilde{C}_t}{\left(1 + {}_0R_t\right)^t} + \frac{\mathrm{F}}{\left(1 + {}_0R_n\right)^n} \tag{2}$$

Where: F = face value of the bond; $\bar{C}$ = fixed rate coupon; $\tilde{C}_t$ = floating rate coupon associated with period *t*; ${}_0R_n$= rate on a zero-coupon bond with maturity *t*. Every cash-flow needs to be discounted at an interest rate that corresponds to their payment date. This means that it is essential to have a forward curve of rates *R* that are adjusted to the dates of the coupons received and the same risk associated with the cash-flows of the IRS we want to represent. These rates are also called *zero rates*. Since the zero rates are not promptly available, a curve needs to be estimated with future rates implied in the interest rate market.

The value V of a receive fixed rate, pay floating rate swap, can be expressed as a replicating portfolio of a long position in a fixed rate bond and a short position in floating rate bond, and can be expressed by the following difference:

$$V = B^{fix} - B^{flt} \tag{3}$$

Likewise, the value V of a pay fixed rate, receive floating rate swap can be represented

as following:

$$V = B^{flt} - B^{fix} \tag{4}$$

At this point it is necessary to recognize two key points: i) at the trade date the fair value of the swap is zero; and ii) The value of a floating rate bond at either issuance or any reset date its par (assumed par amount equal to 1)[1]. Because of that:

$$V = B^{fix} - B^{flt} = 0;$$

$$B^{fix} - 1 = 0; \text{ thus:}$$

$$B^{fix} = 1 \tag{5}$$

From equation 5, one can conclude that, at the trade date, the swap price is the coupon rate $\bar{C}$ that makes fixed rate bond B^{fix} equal to the floating rate bond B^{flt}, thus causing the swap value V to equal zero (fair value at inception).

At its trade date, the swap fair value is zero, but as pointed out by Gay & Venkateswaran (2010, p. 409), *both the passage of time and changing market interest rates can cause the swap to take a positive or negative value*. Using the swap replication portfolio the value of the swap, corresponds to the sum of the present value of the future CF of the fixed rate and the floating rate bonds. This value is the swap's net present value (NPV) or *mark-to-market* accounting value.

Despite all this, as pointed by Smith, Smithson & Wakeman (1993), the pricing and

[1] For the details of this demonstration see Nunes (2001)

valuation of an IRS is not a straightforward procedure and needs to take in consideration many variables. Forward rates are of central importance. Fundamentally an interest rate swap is a package of forward interest rates putted together against an equivalent fixed rate. It must be indifferent to have those implied forward interest rates or the corresponding forward interest rates present in other financial contracts, like forward rate agreements (FRA), bonds or futures. That means the price of the swap is not dictated by the intermediary nor by the swap market. It is constructed by the instruments of fixed income present in the financial markets in general. If the financial markets implied expectations of the forward interest rate curve were not respected by the swap market it would become possible to build an equivalent swap using the fixed income market, and financial arbitrage would be profitable.

Also important are the transactions cost involved and the credit risk of the counterparties. Transaction costs are reflected in the bid/ask spread. They are not determined by the intermediary but by the market via the cost of trading the assets necessary to hedge the swap. The credit risk is a value that attempts to compensate counterparties from the risk of the other one default. It depends on the characteristics of the entities and is represented by a premium added to the bid/ask spread, that covers non-performance risks. It is relevant that in a swap, credit risk relates only to the exchange of cash-flows during the swap's life time. Its principal (notional amount) is never at risk, like it would be in a normal loan. As such the default risk in the swap market is significantly lower than the loan market. Currently, practices and regulation are in place that attempt to reduce credit risk, or even make it non-existent. Chapter 6 analyses credit risk management and regulations regarding it.

3.3 Unwinding Positions

There exist two direct methods for companies to unwind their positions on a swap. The simpler one is to ask the counterparty for the swap cancellation, in exchange for a final payment that corresponds to the NPV of the swap.

The alternative is to do the reverse swap: if A is currently in a swap paying the fixed rate against the variable, the reverse position simply will be receiving the fixed rate against the variable [Smith, Smithson & Wakeman (1993)].

In the absence of any profits, both alternatives will have the same financial result, as the rate differences will necessarily have the same financial result of the simple cancellation of the contract.

3.4 Swaptions: Option over IRS

A swap is a contract in which both parties have an obligation to exchanges cash-flows. An option gives its holder the right, not the obligation, to buy or sell an asset in a specified date (or dates) at a pre-determined price/rate, called strike [Smith, Smithson & Wilford (1993)].

As such, a swaption is an option to enter in a swap position. In exchange for an upfront premium, the holder of the swaption buy the right, not the obligation, on a specified date (European option), or set of dates (Bermuda option), or interval of dates (American option), to enter in an underlying swap. This underlying swap can be any type of swap, from a more vanilla one to an over-the-counter swap. By convention, the holder that has the right to be in a swap paying a fixed rate is said to own a call option, and the holder of a swaption that has the right to enter a swap receiving a fixed rate is the owner of a put option [Brown & Smith (1993)].

3.5 Caps, Floors and Collars

Caps, floors and collars are interest rate derivatives that can be used to limit interest rate movements without losing the positive advantages of interest rates movements. Although they are an independent form of derivatives, they can be associated with some swap structures. For this reason, it is important to know about this type of instruments, even if the focus of this work is interest rate swaps.

In a cap the purchaser pays a premium for protection from the rise of interest rates. It limits the interest at a maximum rate that the holders pay for a predefined amount. A floor is the mirror of the cap, it gives the purchaser minimum rate for him to receive, for a predefined amount, for which a premium is paid. The floor functions as a hedge against the depreciation of rates in a floating rate asset, and guarantees a minimum return from it. The collar is the simultaneous purchase of a cap and selling of a floor at a lower rate than the cap, for the same amount. It offers protection from a rise of interest rate levels, though it limits the benefit of their decline. The advantage of this option is that is less expensive than the cap, as the premium received from selling a floor reduces the cost of purchasing the cap [Beets (2004)].

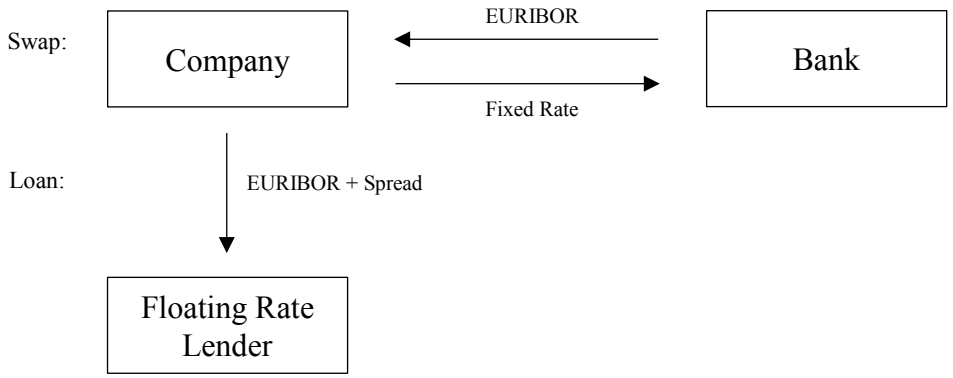
For example, nowadays, with the advent of negative EURIBOR rates in the market, it is not uncommon to add a floor to every period of the floating leg (so called a *floorlet*), ensuring that the swap payer does not receive a negative EURIBOR. Those practices increase the swap rate, making the swap more expensive, but it can haves advantages, as it ensures that the fixed rate payer does not have any negative cash-flows on the receiving side of the swap. Because of the floor, the floating rate would always be equal or higher than zero. As such, this type of derivatives can be a useful complement to an interest rate swap.

4 Strategies for Managing Corporate Liabilities

Companies can use a variety of risk management products to transform their liabilities in a way that is perceived as better for them. With a swap a debt type can be easily changed into something more desirable for the company managers. They are versatile and effective instruments to manage debt, and other liabilities. They create the possibility for managers to actively choose what is better for current, future and past issuances and bank loans. Those strategies can become useful, as the cheapest way to issue debt is not necessarily the most straightforward [Goodman (1993)].

In many cases, the firm's preference would be to issue new or future debt at a fixed rate, but its lenders prefer to grant loans at a floating rate. This can make the direct access to fixed rate loans difficult or not cost effective. It may also be the case, that the company already has a floating rate debt, and its renegotiation to a fixed rate debt would imply a cost superior to the contracting of an interest rate swap.

Figure 2 – Interest rate swap combined with a loan



Combining a floating rate loan (EURIBOR + spread) with a IRS, in which the company pays a fixed rate and receives a floating rate (EURIBOR), the firm converts a floating rate loan into a fixed rate loan. The company would start paying fix rate + spread. Figure 2

illustrates a strategy like this.

4.1 Fixing the Interest Rate on New Debt

As seen from Goodman (1993), a firm may achieve a fixed interest rate in a number of ways, including debt issued directly at fixed rate, or by issuing floating-rate debt and swap it to fixed rate debt. It is common practice for banks to grant loans using floating rates, but some clients may prefer to be funded at a fixed interest rate. This situation can be easily reversed with an IRS: the company can switch from an unwanted type of debt to a preferable one without need to renegotiate it.

Table 3 – 10-year IRS

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2027
Notional Amount:	EUR 10.000.000
Party A pays	
Floating Rate:	6M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0.6508%**
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

As an example, a company is about to start a 10-year loan, of EUR 10 million, at a rate of 6M EURIBOR + 2%. In order to attain a fixed rate, the firm should pay a swap of the

same amount and payment dates as the loan. As such, it would close a swap as presented in table 3.

The company (party B) payed a fixed interest rate at 0.6508% against 6M EURIBOR. After this the company synthetically starts paying 2.6508% to the bank.

4.2 Fixing the Interest Rate of a Future Issuance of Debt

It can be useful to fix the interest rate of future debt that the company expects to issue in the future. The managers may fear a hike in the interest rates levels that would be detrimental for the viability of some of the future projects. This can be achieved with a forward start swap, that is exactly like a regular IRS, the only difference is that it starts in a future date, the expected date of the new issuance. Today the company can close a swap in which it pays fixed rate and receives a floating rate, starting in the date the future issuance is expected. Like this, when the new debt is issued, the swap starts and guaranties a fixed rate agreed in the swap plus the credit spread present in the variable rate of the loan.

To illustrate this, if today (2nd January 2017) a firm expects an issuance in a 3 months' period of a 10 million bond. It can today close a EUR 10.000.000 swap, starting 04 April 2017 and maturing 4th April 2027, that receives 6M EURIBOR. This swap is quoted in table 4.

It will pay a fixed rate of 0.7005%, semi-annual act/360. Eventually 3 months' from today, the company issues the bonds that pays a variable rate, for instance, 6M EURIBOR + 2%. With this the firm, will pay 2.7005% for their new funding. Like this, in the present moment, the firm is able to hedge their future interest rate level.

Table 4 – Forward start 10-year IRS

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Apr 2017
Maturity Date:	04 Apr 2027
Notional Amount:	EUR 10.000.000
Party A pays	
Floating Rate:	6M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0.7005%**
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

As point out by Goodman (1993), forward swaps are a good instrument for managers that see the present level of interest rates as attractive but do not need funding right now, although are expecting a future issuance of debt, such as to fund a new project. Like this they do not need to rush the issuing of a new bond (or a bank loan) and still are guarantee the present interest rate in the future.

However, *the borrowing rate can be decomposed into two parts - a base interest rate and a credit spread* [Goodman (1993, pp. 387-388)]. Using a swap a firm is able to hedge the base interest rate of the future issuance, but it is not certain that the current credit spread remains constant.

Titman (1992) commented on the company's decision to borrow short-term or long-term

funds: in the absence of a swap market, the uncertainty of the interest rate would make firms prefer to issue longer maturity debt. The author proposes that, in the absence of transaction costs, lower rated firms which expect an improvement of their credit rating, may gain from rolling over short term loans, turning them into long term debt through the use of swaps.

This strategy can be useful, especially if a future improvement in the company credit rating is expected. In that case the firm can issue short term debt and, to hedge against a hike in interest rates, close a swap for a longer maturity. However, even when we assume a fixed credit spread, short term loans (or issue short term debt) can be a good strategy. To secure a stable interest rate, the firm could close a swap with a longer maturity, paying fixed rate to benefit from a more stable interest rate level. This way the only variation in the firm's funding rate comes from their credit risk.

4.3 Managing the Cash-Flows of Corporate Debt that already exists

A swap can also be used to change an already existing cash-flow into something different. In case of a floating rate liability, such as a bond or a bank loan, a company can close a swap and with it start paying a fixed rate. In turn, it receives the floating rate that it is currently paying in order to hedge the debt. It is important to match the original debt payment dates with the new swap dates. As in examples mentioned before, the periodicity of the debt should match the swaps'. That is necessary in order to achieve a good hedging.

As pointed out by Goodman (1993), this can be particularly useful if the managers believe interest rates are in that moment at a good level, believe they are going to rise, or are distressed that if they go up the project can start to lose value and/or the company is especially vulnerable to an interest rate hike.

For example, a company has a 5-year loan of EUR 10.000.000 for that it needs to pay in the 4th day of every month 6M EURIBOR + 2%. If this firm decides do fix the interest rate for this loan, it would close a swap paying 0.0653% (table 5) against 6M EURIBOR monthly, starting on the beginning of the next period. In this specific case, it is of note that the 6M EURIBOR is payed monthly although is fixated semi-annually.

Table 5 – 5-year IRS with monthly payments

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2022
Notional Amount:	EUR 10.000.000
Party A pays	
Floating Rate:	6M EURIBOR
Fixing:	semi-annually
Daycount:	act/360, Adjusted
Payment dates:	monthly, on 04 of every month, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0.0653%**
Daycount:	act/360, Adjusted
Payment dates:	monthly, on 04 of every month, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

With this it would achieve a total rate of 2.0653%, monthly paid.

Of course, the mirror action can be taken: when the company wants to switch from a fixed interest rate to a floating interest rate, which can be achieved by receiving the variable interest rate of a swap against the fixed rate. However, it is important to point out that, swap a high fixed coupon rate to a floating rate is not a way to escape an already high

funding rate. This high rate will be present in the spread, and with it in the final rate. But a floating rate on funding will mean that the company can start to benefit from an eventual reduction on the market interest rates [Goodman (1993)].

An example would be the mirror situation of the previous one. The current loan is a 5-year one, of EUR 10.000.000, and has a fixed rate of 2.5% on the 4th day of every month. As the mid swap is quoted at 0.0653%, the firm would close a swap while receiving this rate and paying 6M EURIBOR. Globally, this would translate in a funding rate of 6M EURIBOR+2.5%-0.0653%, that is 6M EURIBOR + 2.4347%.

4.4 Amortising Swaps

Throughout the lifetime of the swap its notional amount can be amortised, creating a different notional amount for every period. This type of structure is not limited to interest rate swaps alone; amortisations can be applied to cross-currency swaps [Das (1994)] and other structures. It is also possible for the swap's principal to both increase and decrease numerous times until it reaches maturity. Those kinds of swaps are usually called a rollercoaster swap, i.e. a swap with a fluctuating notional amount.

Swaps with a single notional amount can be perfect, for example, to hedge a bond issue that pays all the outstanding in a simple payment at maturity. However, it is common for companies to start a loan with a large amount, have a few years paying only interest on the capital (grace period) and then start to gradually pay the capital. With an amortising schedule firms have a hedge more adapted to their needs.

According to Das (1994, p. 299), the most common application of this type of structure relates to construction funding. Some projects may not require the major part of funding capital at their inception, but have a significant increase when they are implemented, later

start to amortize capital and, at the maturity, have a residual amount left to pay.

In table 6 is shown an illustrated example of a firm that requires a 10-year funding, for fluctuating amounts as described in table 7, assuming a semi-annually payed loan. In this swap, the company would pay 0.3533% and receive 6M EURIBOR, to hedge a loan with the same amounts and dates.

As such, if the bank lend the funds at 6M EURIBOR + 2%, this will generate a rate of 2.3533%, semi-annually act/360.

Table 6 – 10-year amortising IRS

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2027
Notional Amount:	*see table 7*
Party A pays	
Floating Rate:	6M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0.3533%**
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

Table 7 – Amortisation schedule

Begin	Maturity	Notional
04 Jan 2017	04 Jul 2017	5,000,000
04 Jul 2017	04 Jan 2018	5,000,000
04 Jan 2018	04 Jul 2018	10,000,000
04 Jul 2018	04 Jan 2019	10,000,000
04 Jan 2019	04 Jul 2019	10,000,000
04 Jul 2019	04 Jan 2020	9,375,000
04 Jan 2020	04 Jul 2020	8,750,000
04 Jul 2020	04 Jan 2021	8,125,000
04 Jan 2021	04 Jul 2021	7,500,000
04 Jul 2021	04 Jan 2022	6,875,000
04 Jan 2022	04 Jul 2022	6,250,000
04 Jul 2022	04 Jan 2023	5,625,000
04 Jan 2023	04 Jul 2023	5,000,000
04 Jul 2023	04 Jan 2024	4,375,000
04 Jan 2024	04 Jul 2024	3,750,000
04 Jul 2024	04 Jan 2025	3,125,000
04 Jan 2025	04 Jul 2025	2,500,000
04 Jul 2025	04 Jan 2026	1,875,000
04 Jan 2026	04 Jul 2026	1,250,000
04 Jul 2026	04 Jan 2027	625,000

4.5 Managing an eventual future issuance of debt using a Swaption

Not unlike in the example in chapter 4.2, where the firm hedges the interest rate of a future issuance of debt, it is possible to outtake a similar action using a swaption. In this case, the hedger pays a premium to the seller of the option, and buys the right to enter an underlying swap (identical to the one in table 4) in 3 months' time. This swaption is represented in table 8. The premium can be quoted sometimes as a percentage of the notional amount, in that case it would be quoted as 1.1416082%.

Table 8 – Swaption on a 10-year IRS

Swaption Seller:	Bank
Swaption Buyer:	Client
Option Style:	European
Premium (Mid):	**EUR 114.160,82**
Payed:	04 Apr 2017
Exercise date:	31 Mar 2017
Settlement:	If the buyer exercises this option, both parties enter into the following underlying swap
Underlying Swap:	
Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2027
Notional Amount:	EUR 10.000.000
Party A pays	
Floating Rate:	6M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0,6508%**
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

Using this strategy, the firm can guarantee a swap that starts 3 months forward at the exact fixed rate it would in normal conditions. If rates hike, the company would benefit from this fixed rate. If interest rates fall it can even unwind the swap, at a positive NPV, and close a new swap at a lower fixed rate. The downside of this will happen, if market interest rates fall and/or the company does not need funding in 3 months time. In that case the

payment of the premium is lost.

4.6 Using a zero Floorlet together with a Swap

It is possible for the borrower to take advantage from negative interest rates as they represent to him a more advantageous loan. As the company pays a floating rate plus a spread, if the floating rate drops significantly enough it can become higher than the spread, thus turning the total rate a negative one. However, in many cases, banks protect themselves from such events adding a clause in the loan contract that inserts a zero floor in the floating rate. If this is the case, to hedge such loan the interest rate swap should have a zero floor in the floating rate. In table 9 is quoted the same 10-year swap present in chapter 4.1, but now with a zero floor in the 6M EURIBOR rate.

Table 9 – 10-year IRS with a zero floor in the EURIBOR rate

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2027
Notional Amount:	EUR 10.000.000
Party A pays	
Floating Rate:	Max (0 ; 6M EURIBOR)
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**0.8586%**
Daycount:	act/360, Adjusted
Payment dates:	semi-annually, on 04 January and 04 July of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

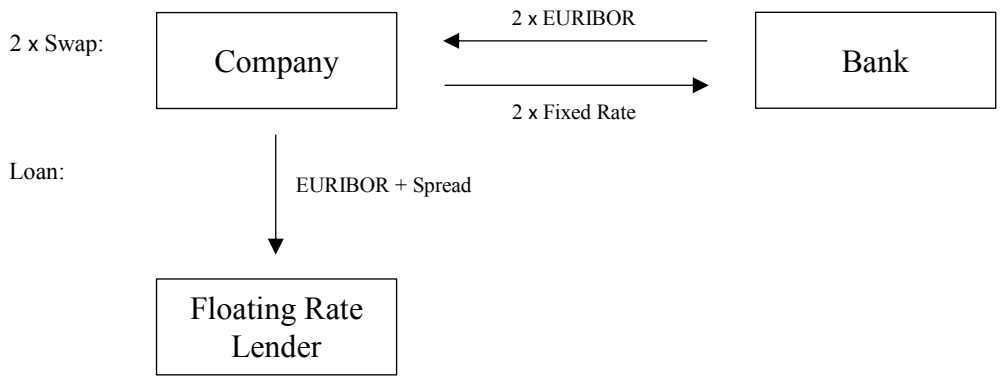
Source: Bloomberg SWPM function

Assuming that the loan rate is equal to 6M EURIBOR + 2% the firm will achieve through this IRS a cost funding of 2.8586%. It is, of course, worse than the 2.6508% (rate without the floorlet), because it safeguards the company from a negative floating rate.

4.7 Reversing the Floating Rates of Debt

It is possible that a firm, paying a floating interest rate debt, develops a strong believe in a steep rise of interest rates. If so, to take advantage of that scenario, the company needs to contract a swap, paying fixed rate and receiving floating rate, in twice the amount of its loan. This strategy is illustrated in figure 3.

Figure 3 - Two interest rate swaps combined with a loan



With this structure the firm will start paying a total rate equal to: $2\times FixedRate - EURIBOR + Spread$. As such, if the market's interest rates (EURIBOR) increase the company will see their cost of funds reduced.

For comparison purposes, let's consider the example from chapter 4.1, in that to hedge a 10-year loan paying floating rate equal to 6M EURIBOR + 2%, the firm contracts a 10-year swap paying a fixed rate of 0.6508% and receiving EURIBOR. If this strategy is applied the debt new cost will become: $[2 \times 0.6508\% - EURIBOR + 2\% =$

$3.3016\% - EURIBOR$]. If we consider $EURIBOR = (-0.22\%)$ [i.e. EURIBOR at 2nd January 2017] we have the following rate: $3.3016\% - (-0.22\%) = 3.5216\%$. This is a higher rate than the fixed of 2.6208% from chapter 4.1, however this new rate has the upside of benefiting from an increase in base interest rates. If the EURIBOR rates hike 1% to 0.78% this would generate a rate equal to 2.5216%. This is an improvement in comparison to the 2.6208% fixed rate.

Because 2.6208% would be the fixed rate the firm would achieve from a standard swap, the break-even of this strategy would be equal to $2 \times 0.6508\% - EURIBOR(X) + 2\% = 2.6208\%$. EURIBOR(X) being the EURIBOR rate value that needs to be present in the market so that the company is indifferent between the simple standard swap or this strategy. If $EURIBOR(X) > 0.6808\%$ this approach will begin to be successful.

It is important to highlight that this is not a hedging strategy. It is a speculation strategy that only makes sense to take if the firms' managers have an exceptional confidence in the rise of interest rates.

5 Corporate Use of Swaps

There are incentives for corporations to actively manage their liabilities and assets. For instance, the type of debt chosen and its maturity can have an important impact on the company funding cost. Furthermore, simpler solution of debt issuing, i.e. bonds and loans already at a fixed rate, not always guarantee the cheapest rate possible [Goodman (1993)].

Moreover, economic agents experience a risky financial environment, with volatility and rate movements that are hard to predict. It is important for decision makers to understand the extent to which their firms are exposed to the different risks. They should recognise the financial tools they have and how can they use them to, if necessary, manage interest rate exposure [Smith, Smithson & Wilford (1993)].

5.1 Advantages from using Swaps

As shown in chapter 3.2, swaps can be constructed with a replicate portfolio. This implies that instead of using a swap, or other derivatives, everybody can build their own hedging products from underlying assets (e.g. bonds) and derivatives would be redundant. As pointed out by Stulz (2004), this assumption makes sense when applied to financial firms with large trading operations, which trade often, and can cheaply access the more liquid market of the underlying asset. Such firms can market derivatives, match *buys* and *sells* of the same product and, in that case, they do not need to hedge them, what makes their costs even more competitive. However, for individual and non-financial firms, derivatives are very seldom replicable assets. They face higher trading costs, cannot deal with the frequent need of constant monitorization, and, since it is not their area of expertise, non-financial firms encounter have additional difficulties at identifying the correct replicating strategy. As explained by Stulz (2004), the great benefit gained from the use of derivatives

is the ability to achieve payoffs that would be unavailable, or could only be reached at greater cost, without derivatives.

Perhaps the biggest advantage swaps can offer is their flexibility as a hedging product. They can be tailored to meet the exact needs of its users. Unlike the other derivatives, an OTC swap can be made to match any particular date or amount that is necessary for the company [Brown & Smith (1993)].

It is a mistake to assume that firms which do not use swaps, or other derivatives, are not hedging their interest rate exposure, as they may issue debt already aligned with their needs. As Faulkender (2005) observed, a firm that, from the start, issues debt correctly aligned with its desired interest rate exposure has no need to hedge. However, the fact is that, some firms, may find very difficult to fund themselves directly at a fixed rate. As mentioned by Li & Mao (2003) there is a natural advantage from commercial banks in dealing with problems like adverse selection and moral hazard. Because of that, it may be better for companies to fund themselves using the banking system. According to the authors, for banks is more advantageous to grant loans on floating interest rates as that is the form their liabilities are. As such, it will be more competitive for firms to fund themselves with a bank loan that demands they pay a floating interest rate and simultaneous, to hedge the loan, enter a swap in that they pay fixed rate and receive the floating rate, which they will use to pay the bank.

Hedging is a consistent part of the company financial policy and can maximize the firm overall value. This can happen through a tax reduction, achieved from the tax schedule of companies being (usually) a convex function, and from a reduction of the cost of financial distress, as hedging reduces the variance in the firm's value [see for instance, Smith & Stulz (1985) and Nance, Smith & Smithson (1993)].

Acccording to Stulz (2004), if firms hedge their liabilities there will be a reduction on the volatility of stock returns and exposure to market risks. This decrease in the company risk is advantageous to the shareholder, as they can expect the same return with lower risk. Nevertheless, this can be a difficult point to explain to the investor. If, by using derivatives, a company directly improves its financial results, i.e. in the event of a rate hike after paying fixed rate in a swap (thus allowing the company to pay a lower interest rate than the rest of the market), the shareholder will be obviously pleased. However, if there is a rate drop after paying fixed rate in a swap, the investor could become convinced that hedging was not a good decision after all. The concept that risk reduction and return stability is advantageous for the firm may be contrary to an investor's desire to immediately maximise profits.

Despite evidence from literature which seems to suggest that hedging can add value to the equity, Guay & Kothari (2003) pointed out that non-financial firms hedge in small scale, in comparison to the economical exposure or cash-flow measures. They empirically reinforced that the median firm only hedges 3% to 6% of its aggregate interest rate and currency exposure. That shows a reduced use of derivatives from non-financial companies.

Campello, Lin, Ma & Zou (2011) stated that with the aforementioned risk reduction from hedging may come an easier credit access, with lower credit spreads asked from the banks and less capital restrictions in loan agreements. This would allow for a bigger investment input and the possibility to add more gains to the shareholders.

5.2 Potential Problems from Using Swaps

A downside for the use of swaps comes from one of their greatest advantage: flexibility. The fact of being over-the-counter products can make swaps very illiquid. In fact, the

more tailored made it is, the less liquid it can become. That in turn can make the swap harder to evaluate, and present accounting issues or even make the swap difficult to unwind [Brown & Smith (1993)].

Even for highly experienced financial firms can be the complex to determine the value of a derivative when its trading is illiquid. This matter is explained by Walwyn & Byres (1997), who stated that the Bank of England proposed dealers to evaluate different derivatives and found that while they would arrive to similar numbers on the most actively traded ones, there was significant differences in the more complicated (less traded) derivatives. Also, as mentioned in Warren Buffett's letter to shareholders of Berkshire Hathaway (2003), there is a distrust in mark-to-market procedures for non-exchanged traded derivatives.

Another issue raised in Stulz (2004) and present in Warren Buffett's letter (2003), relates to difficulties in *close down* derivatives. If that is the case, a potential solution for this problem would be an assignment.: to find a 3rd counterparty to take substitute the firm that wants to leave the position. Although this indeed can be an option for a more vanilla type of swap, it can be more difficult for derivatives of longer maturities or more OTC structures, as Stulz (2004) mentions.

Those challenges can arise even in the case of more liquid swaps. For example, when a firm holds a swap hedging a loan and, for some reason, the need for this loan disappears. The prepayment of a bank loan with a swap attached to it can present a problem to companies, because although the bank may accept the prepayment of the loan without complication, or with a payment of a small penalty, the cancellation of the swap is not so simple. As shown in chapter 3.3, a swap unwind implies the payment of the swap NPV, that is, all the future cash-flows of the swap discounted at today present value. This value

can come as a surprise for the firm. It can be a steep one, as the NPV calculation involves market expectations regarding future fixings of interest rates.

In order to present this situation from happening is to have, at the inception of the loan with an attached swap, a swaption for the reverse swap of the deal. Dates should be strategically selected to be present when this unwind request can be more likely. Other possibility would be to insert an option into the swap, what would allow the client to cancel it. It could be a bermuda option that would give the right to cancel the swap, at zero cost, at certain dates of the swap life. Those solutions come, of course, at a cost, that would be included in the client swap rate/price. It remains an issue if after the cost is taken into account in the final funding cost the final rate is viable for the client.

Another problem, mentioned in Stulz (2004), is the firms' awareness of all the risks involved in some of the derivatives they trade. Derivatives, such as interest rate swaps, are useful instruments in the hedging of financial risks, but they can also create other risks on the company level, like operational risk, especially if used episodically by inexperienced managers. On the whole, they help to make companies to be more economically efficient, but firms need to use derivatives carefully. They must be able to fully understand those instruments, and measure positions properly. What means that individuals who are in charge of signing derivative contracts need to have an adequate training and skills. As Stulz (2004) concludes, the firm board must be aware of the importance derivative positions can have on their company. Consistent with this, Nance, Smith & Smithson (1993) find that *large firms hedge more*. This is relatable, as is expectable that bigger companies are more capable of having the adequate personnel to understand risk and hedge it properly.

Companies should definitively use derivatives as risk management tools, but they need

to be aware of the issues that can be posed by them. As exemplified by Stulz (2004) it is not because airplanes may crash people refuse to board them, but is necessary to make them as safe as possible.

5.3 Market Timing

Market timing is an important theme that can be associated with interest rate swaps and other derivatives that regards their advantages and adverse problems. A firm which attempts to *time the market* is one that believes funding costs can be reduced by actively managing the company's interest rate exposure with accordance to its financial manager's personal expectations regarding the future outlook of interest rates.

Faulkender (2005) addressed this phenomenon concluding that firms do attempt to *time the market*. Firms try to reduce their short-term cost of capital by actively changing their interest rates position. With a steeper yield curve, and expectations of increase in interest rates are bigger, firms are more likely to favour floating-rate debt, preferring lower short-term interest rates instead of guarantying a higher fixed rate for the long run. When the opposite is true, a flatter yield curve, and expectations of interest rates increase are smaller, firms are more likely to prefer fixed rate debt, since the difference between the short-term and long-term scenario is not so rewarding. Faulkender (2005, pp. 959-960) goes further, stating that *the yield spread remains a strong determinant of the selected interest rate exposure, suggesting the managers may be myopic and/or they are speculating*. Attempting to explain this behaviour, the author confirmed his theory while speaking with individuals who work in treasury departments. Those conversations reinforce the idea that firms tend to modify their rate exposure when there is a large difference between fixed and floating rate. This procedure allows firms to attain a reduced short-term interest rate, and thus report higher quarterly earnings.

The author points out that there is a rationality in this procedure, since managers' contracts usually emphasise current year profits (e.g. bonus), instead of long-term positive performance. Also, some individuals may think that, because of their experience or education, they would be able to predict future interest rate movements. Although it can be questionable if that is their mandate and such actions will give value to their shareholders in the long run.

A problem with such actions is that they can lead to significant future misfortunes, that can be blamed on derivatives and not on managerial decisions. Also, it might pose the question regarding the role of financial managers and treasurers in a non-financial firm and how the shareholders would prefer them to act. Another issue is if companies have established the appropriate compensation and incentive schemes for personnel in charge of making such decision. This worry is also expressed by Smith & Stulz (1985, p. 399) as they mention that *managerial compensation contracts must be design so that when managers increase the value of the firm, they also increase their expected utility*. In fact, without the proper incentives managers may not attempt to maximise the firm value. Smith & Stulz (1985) state that a manager that possesses a significant fraction of the company hedges more, when compared to others that have their financial compensation at the end of every period.

5.4 Managing Interest Rate Risk and Banking

Banks manage financial risks and one of the advantages which they can provide to their clients (a firm or an individual person) is their assistance in the process of managing interest rate risk. When a loan is approved, it can be contracted at a fixed or at a floating interest rate. So far, this work presented that by using swaps, firms can change their funding rate into another, more appropriate for their purposes. Yet, banks can also grant

loans at a fixed rate, best suited for their client, and handle the management of the interest rate risk by themselves. In a situation like this, the risk simply shifts from the client to the bank, as now the bank may need to hedge it. For example, in case of an interest rates hike, the client still pays the same rate but, if the bank's funding is at floating rate, the bank starts to pay more for their funding.

Managing interest rate risk is essential to the bank as fluctuations in the interest rates could depreciate the bank financial condition and increase is probability of insolvency, as pointed out by Brewer, Jackson & Moser (2001). The authors state that, in order to hedge its interest rate risk, the bank needs to match its assets inflows to its liabilities outflows. A perfect match would leave the bank's earning unaffected by interest rate changes: to achieve this goal swaps and other derivatives can be used. Some banks adjust the portfolio of assets and liabilities in order to make a profit if interest rate go in a certain direction. This can be very profitable if managers happen to be right but can also be risky, especially if done excessively or without caution. It can be seen not as hedging, but as taking a position in the market.

Brewer, Jackson & Moser (2001) found on their empirical article, that banks which use derivatives to hedge risk hold lower levels of capital (expensive) when compared to institutions that do not use them. This implies that interest rate management replaces capital, that is more expensive and that is viewed as an advantage. Consistent with the idea of positive results from hedging, the authors found evidence that the complementary use of financial derivatives (including swaps) in the traditional lending activity of commercial banks can have a positive influence on growth of commercial and industrial loans.

Furthermore, and according to the same authors, larger banks are much more likely to use

derivatives than smaller banks. That is in accordance with Purnanandam (2007) who points out that derivatives users' lending volumes are less affected by changes in the central banks' rates making them more immune to the adverse effects of monetary policies. This can be the reason why larger banks are less sensitive to monetary policies than smaller banks.

Another advantage pointed by Purnanandam (2007, p. 1804) is the conception that banking hedging activities are consistent with companies hedging activities, since both are beneficial in reducing financial distress and decreasing financial costs. The author finds that commercial banks which use derivatives to hedge interest rate risk, *adjust their lending, borrowing and investing policies less*, experiencing smoother cash-flows than banks that do not use derivatives for this purpose.

5.5 Practical example

To illustrate the presented arguments a practical example can be showed. A company with a stable EUR 1.000.000 annual EBIT, has contracted a EUR 5.000.000 loan for 4-year period at the annual rate of 12M EURIBOR + 2%. In order to hedge this floating rate, it has the possibility of closing a swap paying an annual -0.04% fixed rate and receiving 12M EURIBOR, as quoted in table 10.

If the firm does contract the swap it will guarantee a funding rate of 1.96% $[(-0.04\%) + 2\%]$ throughout the 4-year period of the loan. In the 1st panel of table 11 it is assumed that the floating rates will hike, having a constant annual increase of 0.25 basis points in the 12M EURIBOR rates (-0.083% is the 12M EURIBOR rate in 2nd January 2017). In this scenario, the company would experience a financial benefit from having a fixed rate loan at the beginning of the period, and would have a higher EBT value with a swap than without a swap.

Table 10 - 4 year IRS with annual payments

Party A:	Bank
Party B:	Client
Trade Date:	02 Jan 2017
Effective Date:	04 Jan 2017
Maturity Date:	04 Jan 2021
Notional Amount:	EUR 5.000.000
Party A pays	
Floating Rate:	12M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	annually, on 04 January of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**-0,040%**
Daycount:	act/360, Adjusted
Payment dates:	annually, on 04 January of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

In the 2nd panel of table 11 the opposite scenario is considered. It is assumed that the floating rates will drop and have a constant annual decrease of 0.25 basis points in the 12M EURIBOR rates. In this case, it would be financially better if the company keeps the loan unhedged, paying a floating rate.

Looking at both tables we can see that when using a swap the company EBT will be the same in both scenarios. Evidently, when the loan's interest rate is hedged, its payment is immune to rate fluctuations. In this example, the firm will pay EUR 98.000 annually and, considering a constant annual EUR 1.000.000 EBIT, this will translate in a EUR 902.000 EBT every year. This stability is one of the biggest advantages a swap can bring. In this framework, for the same amount of earnings it seems to reduce the company risk level.

Table 11 – Swap's impact with fluctuating EURIBOR rates

	Year 1	Year 2	Year 3	Year 4
EBIT	1.000.000	1.000.000	1.000.000	1.000.000
Panel 1: rising EURIBOR rates				
EURIBOR projection	-0,083%	0,167%	0,417%	0,667%
Spread	2%	2%	2%	2%
Loan Interest Rate	1,917%	2,167%	2,417%	2,667%
Unhedged Loan Payment	95.850	108.350	120.850	133.350
Fixed Rate	-0,040%	-0,040%	-0,040%	-0,040%
Floating Rate	-0,083%	0,167%	0,417%	0,667%
Total Rate	1,960%	1,960%	1,960%	1,960%
Hedged Loan Payment	98.000	98.000	98.000	98.000
EBT without a swap	904.150	891.650	879.150	866.650
EBT with a swap	902.000	902.000	902.000	902.000
Difference	-2.150	10.350	22.850	35.350
Panel 2: decreasing EURIBOR rates				
EURIBOR projection	-0,083%	-0,333%	-0,583%	-0,833%
Spread	2%	2%	2%	2%
Loan Interest Rate	1,917%	1,667%	1,417%	1,167%
Unhedged Loan Payment	95.850	83.350	70.850	58.350
Fixed Rate	-0,040%	-0,040%	-0,040%	-0,040%
Floating Rate	-0,083%	-0,333%	-0,583%	-0,833%
Total Rate	1,960%	1,960%	1,960%	1,960%
Hedged Loan Payment	98.000	98.000	98.000	98.000
EBT without a swap	904.150	916.650	929.150	941.650
EBT with a swap	902.000	902.000	902.000	902.000
Difference	-2.150	-14.650	-27.150	-39.650

The fact of the matter is that, at the beginning of the year 1, the future movements of the market's interest rates are unknown. As such, it is impossible to identify a choice that will guarantee the best possible financial outcome for the firm. Unless the managers have a

strong long term expectation regarding the future fixings of the EURIBOR rates, and decide to use those convictions to base their decision (speculation), the safest scenario seems to be hedging the loan. At the very least, the company will be protected from a negative shift in interest rate levels, although at the cost of been unable to take advantage of a positive improvement.

Table 12 - Swaption on a 3-year IRS starting in 1 year

Swaption Seller:	Bank
Swaption Buyer:	Client
Option Style:	European
Premium (Mid):	**EUR 20.918,86**
Payed:	04 jan 2017
Exercise date:	04 jan 2018
Settlement:	If the buyer exercises this option, both parties enter into the following underlying swap
Underlying Swap:	
Party A:	Bank
Party B:	Client
Trade Date:	02 jan 2017
Effective Date:	04 jan 2017
Maturity Date:	04 jan 2021
Notional Amount:	EUR 5.000.000
Party A pays	
Floating Rate:	12M EURIBOR
Daycount:	act/360, Adjusted
Payment dates:	annually, on 04 January of every year, subject to adjustment in according with the business day convention
Party B pays	
Fixed Rate (Mid):	**-0,040%**
Daycount:	act/360, Adjusted
Payment dates:	annually, on 04 January of every year, subject to adjustment in according with the business day convention
Business Days:	TARGET - Modified Following

Source: Bloomberg SWPM function

A point can be made that a swaption would be useful in this situation. In the beginning of the 1st year the firm could contract an european swaption, which underlying asset would be a 3-year swap, starting in 1 year, with a strike identical to the 4 years' swap (-0.04%). Such swaption is quoted in table 12 (using the same underlying swap from table 10).

With a premium payed of around EUR 21.000 the firm would have the right to enter a 3-year swap (in 1 year time, the remaining period of the 4-year swap) at the same rate the 4-year swap is priced today. Like this, the firm would maintain the possibility of taking advantage of future positive market movements and, if rates hike in 1 year time, and the 3-year swap is priced at -0.04% or higher, then the company can exercise the swaption to guarantee a fixed rate lower than the market rate. The critics would say that: i) the company spent part of their results on a premium what was unnecessary in order to have a hedge, and that may be unused in the future; ii) it is possible that rate hikes only after the 2nd year. Like that the company could not exercise the swaption at the end of the 1st year, and would be unhedged. Of course, at that time, another swaption could be bought for the remaining period, but that would represent the payment of another premium. The swap, besides being the simpler solution, also requires no investment, although at the cost of taking advantage of an eventual improvement of interest rates.

6 Credit Risk Management and Regulation of Interest Rate Swaps

As pointed in Maizar, Jaquet & Spillmann (2010), since the bankruptcy of the Lehman Brothers Holding Inc. on 15th of September 2008 the market become increasingly more aware of credit risk and the repercussions that may occur in the global economy from the insolvency of a major financial institution or corporation. Such concern, in particular, can be extended to *counterparty risk* in over-the-counter derivatives.

The authors state that when a derivative, like an interest rate swap, has a positive market value (mark-to-market), the counterparty that holds it is subject to *counterparty risk*. When its holder is a non-financial firm, that has a bank as their counterparty, in case of its bankruptcy, the firm not only loses its hedge, but may also have to replace it under worse conditions. The reverse situation is true. If the bank side of the swap has positive market value, the bank has *counterparty risk* in this specific swap. As such, if the company becomes insolvent, this might result in a loss for the bank.

There are several ways to mitigate the *counterparty risk* in relation to over-the-counter derivatives.

6.1 The ISDA Credit Support Annex (CSA)

ISDA stands for *International Swaps and Derivatives Association*, an organization of participants in the OTC derivatives market which offers a standardized contract called the *ISDA Master Agreement* to help regulate OTC derivatives transactions. As stated in Maizar, Jaquet & Spillmann (2010), this contract is the most important standard agreement used in the derivatives market. Originally, it was published in 1987, reissued in 1992 and, more recently, in 2002. The *ISDA Master Agreement* is a bilateral framework agreement that contains the general terms and conditions for any swap and OTC

derivative. It standardizes many issues may come with trading a derivative, like payment methods, conventions, credit events, etc. The agreement cannot be amended but it encompasses a schedule that can be modified if desired. Although mentioning credit events (e.g. failure to pay or deliver, bankruptcy and default on third parties), this document does not include any specific measure to reduce credit risk.

The Credit Support Annex (CSA) is a document that can be attached to the *ISDA Master Agreement*. It allows parties to reduce their credit risk by requiring from the side that is out-of-the-money to transfer collateral to the in-the-money counterparty. CSA also defines all the terms and conditions under which collateral is posted between counterparties. The main clauses involved in the CSA are present in table 13.

Table 13 - Credit Support Annex main clauses

Threshold	Value above which collateral needs to be posted.
Eligible Collateral	Type of assets that can be accepted as collateral. Most common eligible are cash or government bonds. Other securities, if accepted, usually come with a haircut (percentage of the bond notional that is accepted as collateral).
Valuation Dates	Regularity of when the portfolios market values (mark-to-market) are measured and collateral can be changed between counterparties. This frequency can be daily, weekly, etc.
Minimum Transfer Amount	The difference between the mark-to-market and the value posted as collateral need to exceed this amount for new collateral to be needed. This provides operational efficiency as it prevents the necessity to exchange small amounts.
Distributions and Interest Amount	Defines an interest rate for posted cash to earn (EURIBOR, LIBOR, etc.) as the counterparty that posted it is unable to use it. In bonds, the entity that posts the security continues to receive the coupons.
Rating Triggers	If a counterparty is downgraded by one or more rating agencies to a specified level certain conditions may change or new ones be implemented. Commonly, the threshold can go to zero or the frequency of the valuation date can be reduced.

The greatest advantage that comes with this mechanism is that it allows for both counterparties to find themselves less exposed to each other's credit risk. In turn, credit charges are reduced or eliminated and better prices/rates are achieved. A CSA is an important condition to access to the swap market and find counterparties that accept the firm's risk. It saves, both the bank and corporations, time on internal approving process. Finally, companies can develop flexible trading relation with a few core banks and trade with them not worrying with avoiding concentration risk, but seeking the best price for their hedge.

Some disadvantages related to the CSA can also be pointed. It is time consuming and resource intensive. Both financial and non-financial firms need to have resources capable of monitoring swaps and other derivatives valuations, as well as manage payments. For a bank, or a big corporation with a lot of derivatives under management, it can be necessary to have an entire department to manage such derivatives. Other disadvantage is that, the CSA can difficult for treasurers to plan their liquidity needs with effectiveness, as they do not know how the market will evolve and if they will be required to post collateral under the CSA. I can be said that if the firm have several different transactions, moving on different directions, they could cancel each other in terms of their mark-to-market value. That may be true for a financial institution, but for a company that want to hedge against a rise of interest rates, and always pays fixed rate against floating rate of several interest rate swaps, is likely that those valuations will indeed move in the same direction. Although, it is necessary to point out that, it is also possible that firm will receive collateral from the swap. Another negative situation created by CSA is the negative carry associated to collateral in cash. If a corporation pays EURIBOR + 1% for its loan and receive only EURIBOR for that cash posted under the CSA they will have a cost of 1% a year. A way to avert this problem would be to have the firm funding cost set as the posted

cash interest rate in the CSA agreement or simply use eligible bonds as collateral instead of cash.

An indirect problem that can arise from the aforementioned issues (time consuming, resource intensive, difficulties managing collateral posting) is that companies may feel discouraged to hedge. Firms may start to avoid contracting swaps because banks require them to post collateral as guarantee for the negative mark-to-market of their swaps or, in alternative, explicitly charging them for the credit risk the bank is taking in not having a CSA with the company. This is a clashing outcome, as it was the desire to reduce credit risk that allowed for the CSA introduction. Although such agreements have many merits, they may result in a hedging decrease from companies (smaller ones in particular), and a subsequently increase in the credit risk of the global economy.

However, as seen in Maizar, Jaquet & Spillmann (2010), and despite the above mentioned disadvantages, the collateralization of swaps is a cautious measure that prevents firms from having high levels of credit risk, and/or losing their hedge due to unexpected insolvency events.

6.2 Central Clearing of Swaps

Despite the existing possibility of CSA agreements in the OTC derivatives markets, Slonkosky (2015) points out that, conceivably, huge risk exposures may be hidden from sight. Financial regulators, both in the United States and the European Union, are increasingly worried with this type of trades and feel the need to transfer them to more transparent central marketplaces, under their watchful eye. The OTC derivatives market is about ten times the size of the exchange-traded market [Hull (2010)]. Moreover, interest

rate swaps represent 60%[2] of the global OTC derivatives market and it shows important levels of concentration in major currencies and financial centres [Gyntelberg & Upper (2013)].

As noted by Hull (2010), a big concern for regulators in general is that OTC market can be a potential source of systemic risk. When a derivatives dealer closes a transaction with a risk hedging company, it will, in turn, lay off this risk in other transactions, with other dealers. Because of this connection, the default of one large financial institutions may lead to the default of another, and this can result in more losses on other firms and, eventually, the collapse of the entire system. This scenario is very worrying to the regulators.

It is noteworthy that financial institutions do not ignore systemic risk. A lot of resources are devoted to the control of counterparty risk, be it from large financial institutions or coming from smaller firms and individual clients of the banking system. Especially in the case of larger firms, financial or non-financial, in an attempt to reduce credit risk a lot of bilateral collateralized agreements (CSA) have been implemented and became norm.

Another aim of the regulators is to provide OTC markets with additional transparency in order to allow controllers to recognize and understand the transactions undertaken by financial institutions and be fully able to monitor risks in order to avoid an eventual systemic failure.

As such, with the objective of reducing credit risk and increasing transparency allowing financial regulators to better control the market, both United States and European Union proposed legislation requiring for those contracts to be placed in central clearinghouses.

[2] Source: BIS (2013)

The central clearing of OTC derivatives happens after both counterparties closed a deal and report it for central clearing. If the deal is clearable, the clearinghouse will accept it and it will become the counterparty for both party A and B, taking the credit risk from both. In turn, it will manage this risk by requiring an initial margin and asking for eventual margin reinforcements, depending on the daily variations of the deal (or deals) inserted on the platform. A counterparty can have one or more OTC derivatives (a portfolio) done with a single clearinghouse. The deals will net and a single margin requirement will be asked [Hull (2010)]. It works in a similar way to the CSA agreement, but this time, instead of several counterparties, we have in the end a single counterparty.

Regarding Europe, as seen in both Bopp, Long, Steiner & Springer (2015) and Long (2015), on 16th of August 2012 the EMIR (European Market Infrastructure Regulation) came into force requiring that more standardised OTC derivatives will be mandatory cleared through central clearing counterparties (CCPs). This applies to all financial counterparties (FC), and non-financial counterparties (NFC) that exceed the clearing thresholds expressed in the article 11 of the Commission Delegated Regulation No 149/2013. The standardized clearing thresholds amounts (in gross notional value) by asset class are showed in table 14.

Table 14 - Clearing thresholds amounts

Credit derivative contracts	EUR 1 billion
Equity derivative contracts	EUR 1 billion
Interest rate derivative contracts	EUR 3 billion
Foreign exchange derivative contracts	EUR 3 billion
Commodity derivative contracts and other derivatives	EUR 3 billion

Source: Official Journal of the European Union, 23 Feb 2013 L 52/20

In the case of interest rate swaps the clearing threshold is set at EUR 3 billion, excluding derivatives done solely for hedging purposes or mitigating commercial risks. That means that all NFC operating in Europe need to calculate the gross national amount of all non-hedging OTC derivatives done within the worldwide corporate group (even if outside Europe) to determine if they exceed any of the threshold amounts. If so, they are required to clear their derivative transactions using a CCP (NFC+). If a company does not exceed those thresholds central clearing will not be required (NFC-).

This regulation is already in effect but the dates that entities are force to respect are different depending from different categories. Those dates are presented in table 15.

Table 15 – Categories for mandatory central clearing

Category 1	Clearing members; 21 Jun 2016.
Category 2	FCs and alternative investment funds that are NFCs with an aggregate month-end average outstanding gross notional amount of non-centrally cleared derivatives exceeding EUR 8 billion; 21 Dec 2016.
Category 3	FCs and alternative investment funds that are NFCs with an aggregate month-end average outstanding gross notional amount of non-centrally cleared derivatives below EUR 8 billion; 21 Jun 2017.
Category 4	NFC s that are not categories 1, 2 or 3; 21 Dec 2018.

Source: Official Journal of the European Union, 1 Dec 2015 L 314/17-18

Regarding the standardization level required for the swaps to be able to be cleared, most swaps fall under the requirements, as the characteristics of the swap illegible for clearing are very wide and encompass must swaps trader in the market. Even amortising/ rollercoaster swaps, which are very *tailor-made* by nature, must be cleared if done by a FC or NFC+.

Some critics views those regulations as a costly response to a problem that does not exist, as OTC derivatives credit risk can be handled by CSA agreements. Slonkosky (2015, p.

14) pointed out that, all central clearing does is to transfer risk from counterparties and bilateral agreements (such as CSAs) and concentrate it in large central clearing organizations (the CCPs), making the CCPs the source of the systemic risk [Comotto, 2015)].

Other criticism, pointed out by Comotto (2015), is that CCPs are expensive, as a lot of financial assets are not acceptable as collateral by the CCPs, initial margins and haircuts are high in comparison to current market practice and remuneration from cash paid is low. Another adverse situation relates to sudden changes in haircuts and collateral eligibility, that can generate pro-cyclical shocks in the financial system, as those changes would be synchronized: done at the same time by one or two of the most used clearinghouses.

A critique addressed by Pirrong (2011) regards that, central clearing suffers from moral hazard and adverse selection. i) Moral hazard arises when the credit risk of OTC derivative instruments is all a central clearinghouse and higher risk firms have the same costs as the lower risk firms. Subsequently, central clearing allows the former to expand in relation to the other. A CCP attempts to measure creditworthiness using standard information but typically does not impose different margin requirements to worse members. Those margins come from the risk/ mark-to-market of the deal and not the firm itself.

ii) The adverse selection problem is based on the fact that many of the financial firms that trade derivatives are specialized in analysing the risks and pricing mechanisms of OTC derivatives and may know more about the risks cleared then the clearinghouse. That can have negative repercussions when firms tend to over-trade products to which the CCP underestimates risk and under-trade products to which the CCP overestimates risk.

Relatable to this is the fact that some OTC instruments are less liquid and/or very

complex. Sophisticated financial firms can have more information on those types of deals, as sometimes they are created by them, than the CCP itself. Such financial firms could, theoretically, find the derivatives to which the CCP under values the risks and charges a smaller margin (underestimating the default probability) and trade more of their products. This can pose as a problem for the clearinghouse, and is potentially an issue that the CCP can overlook until it is too late.

Nevertheless, as Pirrong (2011) points out, mandatory central clearing is one of the most important consequences of recent legislative regulatory changes. It will transform the way credit risk is allocated, final swap rates are calculated and swaps are managed.

7 Conclusions

Interest rate swaps and strategies which aim to trade an index floating rate for a fixed rate are present in the financial markets, are relatively straightforward to price and have liquidity even in more OTC structures (with unique periodicities and amortising schedules). Unlike complex derivatives, there is usually the possibility of asking for their valuation, or for an unwind price to cancel them in case they are no longer needed as a hedging instrument. This makes them an invaluable instrument to hedge interest rate risk and manage companies cash-flows, that firms' treasurers cannot ignore.

After using a fitting hedging strategy, non-financial companies can focus their attention on their core business. They will not have to worry about the possibility that interest rates may hike and make their funding rate unsustainable for their projects' rentability.

Interest rate swaps offer to non-financial institutions the opportunity to hedge interest rate risk easily and in a flexible way. As a *taylor-made* product, it can be adapted to the firms' specific cash-flows. There is evidence that OTC derivatives use can provide companies with a risk reduction that allows for a consequent improvement to the firms' overall value. Some research shows that, from such risk reduction, there may also come an easier credit access with lower credit spreads.

However, derivatives come with challenges and it is important that managers in charge of companies' financial decisions-use OTC derivatives with knowledge while being aware of the implied risks. Unwind requests can be problematic, as they may imply the full payment of the swap's negative *mark-to-market* value. Market timing may also be the source of negative outcomes. If companies attempt to *time-the-market* they should do so after internal deliberation, while being fully aware of the risks. Aside from that, individual

managers should restrain themselves from taking positions on the financial markets, that their firms are not suited for.

As for financial institutions, swaps offer them the opportunity to help their clients manage interest rate risk. Offering a compressive fixed rate loan, which can be a bank product, may attract new clients, as well as, increase the bank's profits. Furthermore, banks can use swaps to manage their own interest rate risk exposure. With such act, it is expected that they would become less sensitive to changes in the monetary policy and would start to have smoother cash-flows.

Regarding the new regulation on OTC derivatives it seems obvious that it presents significant new challenges to derivatives users. It can be challenging for smaller companies, which seek to have a fixed rate for their debt, to have the capacity to face all the liquidity and technical constraints that come from CSA agreements and mandatory central clearing of OTC derivatives. It may seem simpler that the bank manages this coverage by lending at fixed rate, without complications for the client, and then hedged their funding liabilities using interest rate swaps. Of course, this comes at a cost for the bank, that is required to central clear swaps using a CCP. It is conceivable that financial institutions could start to charge those costs by adding an extra spread to their offered fixed rate. However, higher prices could prevent companies from hedging their risks, simply because it makes it too expensive in their eyes. Also, it is hard to define how much this added spread should be. Since interest rate fluctuations are unknow (that is the reason why the hedge is needed), it is not possible to calculate a rate that correctly expresses the necessary collateral. As hedging is important for non-financial companies, they will also need to adapt to this new legislation.

It would be interesting to know if new regulation regarding OTC derivatives have already

prevented companies from hedging risks, or at least made them hesitate before contracting derivatives. This type of information would be important for legislators, to help them understand the difficulties caused to firms by the aforementioned regulations and have them in consideration while making adjustments to their policies. As pointed out by Brown-Hruska (2010), when global policy makers consider the regulatory reform and the role of derivatives throughout the financial crisis, it is hoped that they will be mindful of the importance of OTC derivatives have in financial markets and the economy as a whole.

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