FACULTAD DE CIENCIAS ECONÓMICAS Y EMPRESARIALES, MÁSTER UNIVERSITARIO EN FINANZAS

HEDGING AND SPECULATION TWO DIFFERENT FACES OF DERIVATIVES

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1 ABSTRACT

In this End of Master Paper, we would like to introduce another point of view on derivatives and their behaviour in the market and how they can be used. We also introduce some real cases happened in real life regarding derivatives, such as the cause of the financial crisis of 2008. We analyse some strategies and techniques used for hedging and speculation with the appropriate contracts, possible thanks to the working experience in the treasury department in hedging division and trading desk at Sabadell Bank and we will apply the theory to the reality. Another concept the we will analyse several times, will be the concept of hedging and speculation, together, because there are only few solutions which represent the pure meaning of hedging; other strategies have a little component of speculation. Regarding speculation, we will see the importance of the information in order to make great profit in few hours and also the possibility to speculate in long-term, hoping in the improbable event. The purpose of this paper is to connect the theoretical side of derivative with the practical one, explaining how derivatives are used daily by companies and investors taking into account the characteristic of these contracts.

Keywords: Behavioural Finance, Derivatives, Hedging, Speculation, Global Markets, Securitization

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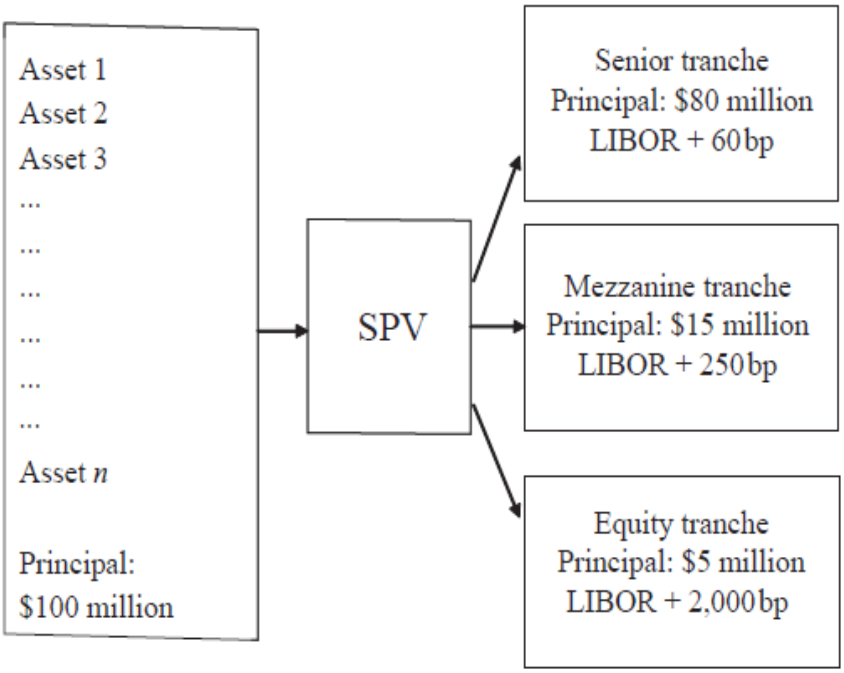
3 INTRODUCTION

With this paper, the purpose is to understand better the structure and behaviour of the different kinds of derivatives explaining their mechanism. In the section 4 “derivatives” there will be the explication of some features that most derivatives have in common for then going deeper in each of them. Then we will explain the concept of hedging and speculation with derivatives and how companies and speculator design their strategy basing on their choices, their objective and their budget and amount of currency available. Before going deeper in these concept, we will explain the methodology used for the paper explaining how the mix between theory and practice has been used for this project. In this same section, we explain why derivatives are so important, even for common people, and how some of the worst bankruptcies were based on a bad management of derivatives and showing the worst part of these products.

The importance of financial markets today is undisputable, even if most people do not know how markets affect their lives, on financial markets depend the destiny of companies, political parties and sovereign states. Inside the whole mole of financial markets there is a set of products that is very important as shares or bonds: derivatives. The importance of these product is crucial for firms and sovereign states, because we have examples of how a bad usage of these products may produce huge consequences that push down the equilibrium of the financial market systems and countries economies. In order to understand how derivatives generally work we should describe them even if there is not an academic definition, thus we take the definition of John C. Hull considered one of the most important academic and master of this topic: “A derivative can be defined as a financial instrument whose value depends on (or derives from) the values of other, more basic, underlying variables. Very often the variables underlying derivatives are the prices of traded assets”. It seems easy to understand, but the world of derivatives is full of threats and as we said before, unfortunately, there are many cases of scandal or deep crisis with derivatives involved.

There are many cases of the bankruptcy due to derivatives and improper management of the same and also financial scams based on derivatives and always there is one element in common: the huge amount of money burnt in the process. After 223 years, the British investment banks Barings PLC was forced into bankruptcy in one night: Nick Leeson, a young trader of the firm, placed a short straddle on Nikkei 225 thinking that nothing would have changed significantly the index during the night, but the morning after this operation the Kobe earthquake hit awfully Japan the index dropped, producing a loss of 1.5 billion of dollars. Even in one of the most famous scandal in financial field in were involved derivatives, when Bernard Madoff’s hedge fund, Ascot Partners, caused a hole of 50 billion of dollars. He used a classical Ponzi’s scheme to raise funds with the promise of a really high return with a volatility barely higher 0%, saying that he took short and long position with derivatives; many managers and companies, knowing how derivates work, believed in his strategy based on derivatives, whereas everything was an immense scam.

One of the most recent and catastrophic example of financial crisis was caused by the securitization, in 2007 and 2008: the origin was in the financial products created from mortgages in United States, but the consequences affected all the world. Through securitizations, US banks sold the mortgages that they had previously closed with privates to SPVs (Special Purpose Vehicles) sponsored by the same banks whose did not like the idea to maintain in their balance sheets assets with high requirement of capital. Actually, banks used to concede mortgages even to those subject that did not have any kind of guarantee the famous NINJAs (No Income, No Job, No Asset), but when the SPV sold ABS (Asset-Backed Security), investors were sure about this kind of investment whilst ABSs were not so sure, because they did not guarantee the payment of interest and principal. The payment of ABSs has a waterfall structure: when the senior tranche is completely paid (the safest with less return), then the Mezzanine tranche (medium risk and medium return) receives its payment and only if the there is enough capital, the Equity tranche will receive its rewards.

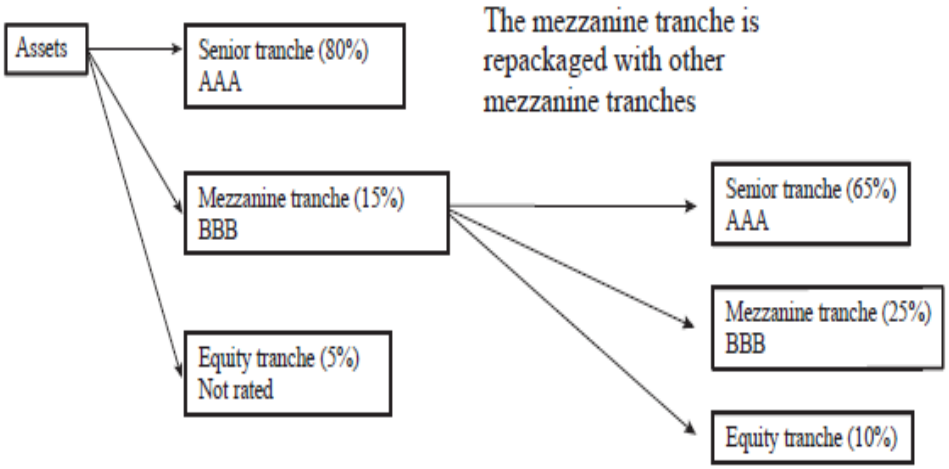


3.1 Figure: Special Purpose Vehicle, extracted from "Options, Futures and other derivatives"

With the data above we can observe how with an only 20% of loss, 2 out of 3 tranches were default, it caused also to rating agencies few difficulties in order to rate these products: usually Senior tranches were rated AAA, Mezzanine tranches were rated BBB and typically Equity tranches were unrated.

There were many investors willing to invest in Senior tranches because they offered interesting returns compared with others AAA rated bonds, but for Mezzanine tranches was much more difficult finding investors so Mezzanine tranches were repacked in other products called ABS CDO (Collateralized Debt

Obligation) with other Senior tranches, Mezzanine tranches and Equity tranches. The rating pattern used to be the same: AAA for Senior tranches, BBB for Mezzanine tranches and unrated Equity tranches.



3.2 Figure: Mezzanine repackaging, extracted from "Options, Futures and other derivatives"

With the example above, it is easier to understand the repacking system of the ABS and the importance of the default and waterfall system: in case the 10% of main assets defaulted, the losses to Senior tranches of ABS CDO would be 0%, but if assets default were at 12%, the losses to Senior tranches ABS CDO were a 17.95%; for a AAA rated product. In case of default of the 20% of the main assets, the worth of the Senior tranches of ABS CDO was simply 0. Financial institutions did not stop at second grade of repacking, but there were third and fourth grade of these products. We can summarize the main reasons of the last financial crisis with few reasons. Firstly, we should remember the uncontrolled concession of mortgages to many NINJA profiles caused by the prosperous economic period that USA was living and the greediness of mortgage brokers. Secondly, the excessive securitization that cause default of many financial products; a kind of leverage on US mortgage markets. Finally, a fundamental element was the unclear definition of the securities: many managements bought many AAA fix income securities which actually were not AAA rating. The definition of AAA by Standard & Poor's is the following: *"AAA an obligation rated 'AAA' has the highest rating assigned by S&P Global Ratings. The obligor's capacity to meet its financial commitment on the obligation is extremely strong"*. We can observe that with only the 20% of default of the main assets, investors could lose everything with a AAA rating, considering only the second-grade securitization. When the US real estate bubble burst, the investment bank Lehman Brothers, one of the best 5 investment banks in the world, went to bankruptcy. They were on of the first firms dealing with mortgage origination and in the last balance sheet (2007), they had a total equity of 22.50 billion of dollars and total asset for 691.07 billion of dollars and consequences of the real-estate bubble burst were clear: many people lost their jobs and consequently could not afford paying back the mortgages and also those NINJAs could not pay back the obligation, Lehman Brothers stopped receiving cash flows from the American families, the bank tried to sell product to everyone trying to saving the firm, the bank went to bankruptcy making a hole of 613 billion of dollars of debt. It was

the beginning of many catastrophic consequences for all the world and seem that only 10 years later the world economy is going out from the deepest crisis of the century.

Today, most large nonfinancial firms use derivatives because they are perfectly suited as efficient tools for hedging and also for speculative purposes. A survey conducted by Bodnar, Graham, Harvey and Marston for the Duke University for the Fuqua School of Business, the 50% of global firms indicated that the market view of the same firm, two out three U.S. firm change the timing and the size of the position in derivative in base the market view on exchange rate and interest rates with hedging purposes. The analysis is based on a sample of 6,896 nonfinancial firms from 47 countries and the results of this study were interesting and surprising homogeneous: the 60.5% uses at least one type of derivative and inside this 60.5%, the 45.5% use Forex derivatives, then there are the interest rate derivatives with a 33.1% and finally the 9.8% in commodity price derivatives.

Due to the undisputable importance of derivatives, in this paper will be explained many different products and how in the practice firms use derivatives for hedging positions or speculate, and we will see also that sometimes firms would like to mix the purpose and it is so important to know, because many companies feel confident with products thinking that they are hedging a position when they are speculating on the same. I say that because I am spending last months at a Spanish bank, working in treasury department issuing and offering to companies Forex derivatives to hedge the position of the firm.

4 METHODOLOGY

The first step for writing this project, was to read books and papers on the subject in order to understand better the mechanism and the characteristic of derivatives; once gathered all the information and the knowledge about the subject, we looked for real cases of hedging and speculation searching them through papers, academic material, official websites of companies and professors world widely known like Aswath Damodaran or John C. Hull, books of well-known owner of hedge funds like Peter Lynch and Warren Buffett, and also through the personal experience in the Treasury Department: Mid Cap Hedging division and Trading desk. For both part of this project, theoretical and practical, we used tools provided by official entities such as the CBOE (Chicago Board Options Exchange) and MEFF (Official Spanish Market of Financial Options and Futures; Mercado Oficial de Opciones Y Futuros Financieros en España) to give strength to our thought, and to drawn strategy charts the main two source have been: Sabadell bank and a model built internally, because many of the “hedging strategy” are explained only by words but not with chart in academic papers; thus, we made a model in order to show better the behaviour of the strategies along the price variation. The price charts have been found and analysed from different websites which use as principal source (with a

remarkable delay, from 30 minutes to one hour the spot price) Bloomberg, Reuters or directly the principal exchange data like the Chicago Mercantile Exchange (CME), the Intercontinental Exchange (ICE) or London Commodity Exchange (LCE); working always on historical data the delay issue did not affect the ongoing of the project.

5 DERIVATIVES

We have already analysed the definition of derivative in the introduction and we have not analysed which features make so important derivatives in financial systems. One of these element is the time: through derivatives we can choose when the contract will expiry, we can choose the maturity of the product, whilst without derivatives we could buy and sell only at spot maturity. This element allows firms and investors to settle the best strategy in terms for the timing and reduce market risks. The second element which makes derivatives so attractive is leverage: with most derivatives, we can pay at the beginning a little of the total amount of the contract and this could be translated as an optimization of opportunity cost. The leverage effect could be surprising us with very positive returns or total disasters, that is why derivatives are considered the riskiest products in financial markets and now with the following example we explain how: a company is listed, one share value is 10 euros and we would like to buy a call option for 2 euros with the strike price of 10 euros. In case the price at expiration date was 13.5 euros, we would record a profit of 75% with options instead a +35% that we would have in case we invested buying a share. On the other hand, if the price dropped to 9 euros per share, we would record a loss of 100% with options instead a -10% in case we would have bought a share. With this simple example, we can observe how investing 10 euros in options we could have made an extra profit of 114.29% in case the price rose to 13.5, but in case things did not go so well we would have lost everything. This element is maybe the most interesting because allows to most companies and investors to take positions in the market.

With the next sections, we analyse deeper the structure of the most common derivative in order to understand how they work, they main features and subsequently how hedgers and investors can use them for their purposes.

5.1 FUTURE & FORWARD CONTRACTS

Despite they are two different derivatives, we analyse them in the same section because the structures are very similar and we will describe how they differ and for which products are typically used. These contracts are the simplest among the derivatives because they are an agreement to buy (or sell) a certain asset at a certain future date for a determined price. With these products both sides, long and short position, are obliged to make the transaction even if the market at spot price is against the position concorded previously.

Forward contracts are mostly used to hedge the foreign currency risk and its price is composed by demand and supply of the same currency; which depends from the expectations of the market due economic cycle, commercial balance of the interested countries, new policies by the central banks and all those elements that may affect the currency of the country. One empirical case of how exchange rates may variate only for the market consideration, without any intervention of central banks is the Mexican peso after the election of Mr. Trump in US. In Bloomberg, we can observe how the price before the election results was 18.5226 pesos for 1 US dollar and in a couple of days after the surprising result, with the same US dollar we could buy 20.8492; it means a devaluation of 12.56% of the Mexican currency in 2 days, in few months the exchange pair USD: MXN reached 22.0385 and only in the last few weeks with the end of Trump's effect Mexican peso is exchanged at 17.9111.

5.1.1 Chart: USD:MXN, Trump's effect

Futures, as we commented previously, are an agreement of buying and selling an asset at a certain date, at a certain price; the most important difference between forwards and futures is the standardization of these last. Meanwhile forward are private contract between two parties, futures are traded on exchange which means that it easier gets a price for private investor and the same investor does not need to review contract detail due to its standardization. Futures are mainly used for commodities, whose largest exchange is in Chicago, and it happens thanks to a big difference between futures and the spot market. In case an investor would like to hedge its position on oil and he bought $50.000 of the same commodity, the clearing house would send to the address indicated by the investor the commodity bought in spot market. The investor could be interest in the commodity physically, but in case the investor would have liked to hedge his position without any delivery he should have bought a future contract with a maturity that he would consider correct. Once that the investor owns the future at the maturity day it has two different possibilities: sell the contract and having hedged the position only financially or hold the contract and wait the delivery of the commodity.

Talking about futures, we have to explain a little more the specification of a future contract. In the first moment, we have to determine the asset and when the asset is a commodity, we have to determine the quality of the same commodity and the Intercontinental Exchange (CIE) specifies the quality and also the price. In some kind of commodities, there are different range of quality and can be substituted paying a different price. For example, the standard grade of corn is called “N.2 Yellow” and can be substituted with “N. 1 Yellow” or “N.3 Yellow”. The “N.1 Yellow” is a higher quality, so the investor who would like the commodity delivered has to pay $1.5 cent more than “N.2 Yellow” per bushel and in case the corn delivered was the “N.3 Yellow” the price would be lower by $1.5 cent per bushel.

Another element is the contract size, which specifies the amount of the asset that has to be delivered once that the contract expires. This could be a problem if the size is too large, due to the necessities of those investors who are looking for hedging smaller quantities or who wish to take a smaller position. This is a reason why some exchanges introduced “mini contracts” in order to attract smaller investors to this kind of product and give more liquidity to the security.

The delivery arrangements and the delivery months are relevant only for those who wants the commodity in physically. These elements are very important because the delivery arrangements may include huge costs of delivery for a specific location, when the destiny is a specific location the price can be much higher. The delivery months, how it can be easily deducted, indicates the month within is available the delivery of the commodity traded used mainly for seasonal commodities.

Two more elements that may be fundamental for hedgers and speculators: price limits and position limits. The price limit is a covenant thanks whom if the price drops more than prearranged price, the contract is said “limit down” and the price drop would not affect totally, but only until the limit. If it the limit is for a price

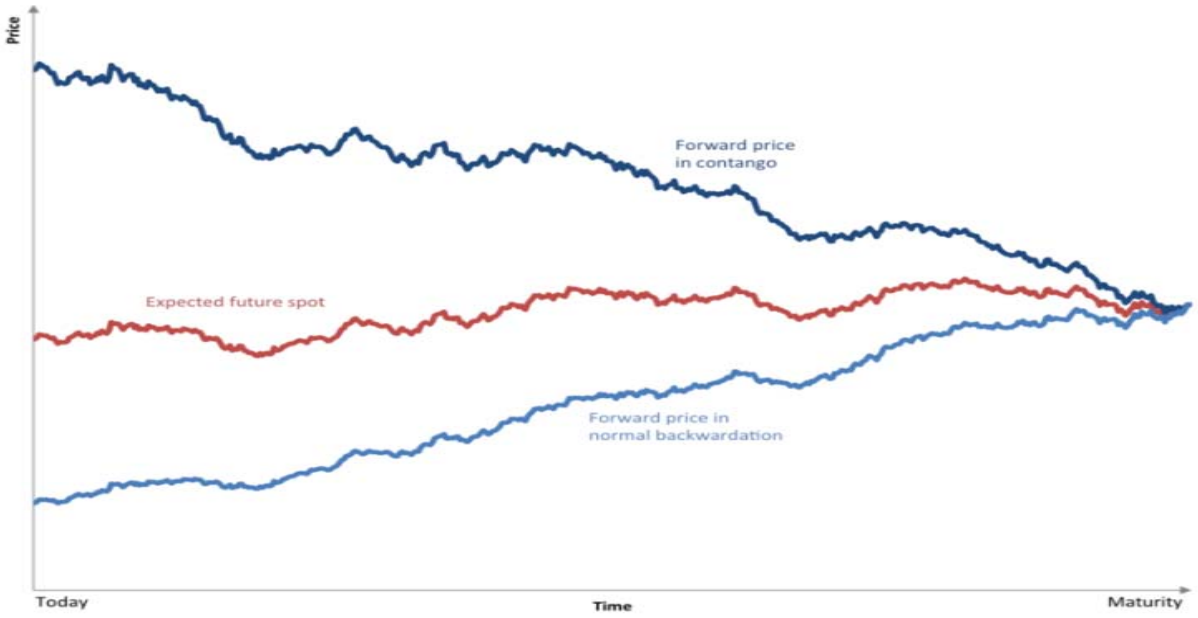
increasing it is called “limit up”. The purpose of this covenant is to prevent sudden and large changes in prices from speculative excesses. Although price limits may appear as a barrier for trading futures, the covenant are actually good for the market in order to set the fair price, spite of it seems fairly controversial. Position limit represents just the maximum number of contracts that an investor may hold, to prevent speculators from an excessive influence on the market and other kind of price manipulation.

Another fundamental difference between forwards and futures is the settle date: with forwards the liquidation of the same, it is settled at the end of contract; whilst with futures the liquidation is daily. With future contracts both parties, buyer and seller, must deposit a determined amount of money, which can variate depending from the underlying asset, to clearing house. Clearing houses manage the daily settlement and in case either buyer or seller had not enough deposit, the same clearing house would call the part for adding more money with the popular term “margin call”. This is the reason for which theoretically there is no credit risk with future contracts, when forwards bear it because of there is nobody who is ruling over the contract, it is just a contract between 2 private parties. With future contracts, in case one of the 2 parties defaulted, the same clear house would take in charge of the missing position in order to do not cause a lack of trust in the future system.

One doubt that an investor could have is if the price of a forward is the same of the price of the future: if the interest rate stays constant within all the duration of the contract, then the price of forward and future contract will be the same, in case the interest change variate then the price of the future will be different because part of the liquidation series would have another discounting rate. Imagine that one on the US one forward contract of silver is quote 15.15 dollars whereas in the spot market is exchanged at 15 US dollars considering that the price in the future will be the same of spot market, because we have applied the FED interest rate 1%, before the last change made by the FED. The price of future contract should have been higher, because all the market was expecting the rising of the interest rate by the FED on the last 14^{th} of June from 1% to 1.25%, it means that we should discount every day the spot price with the interest rate, and when we previously know that it changes we should apply the new interest rate for those days that affect the future contract. Now, with this new data we could calculate the new future price, imagine that the change happened 3 months before the expiration of the contract with duration one year, we should apply 1% for 9 months and 1.25% for the last 3 obtaining a price of 15.1593 dollars per contract.

In any case, when we talk about forward and futures contracts, we have to consider many elements in order to pricing correctly theses derivatives, but the logic view is the same like for other derivatives: the price of the underlying asset in the future. There are 2 main trends in futures and forwards markets: normal backwardation and Contango. Contango are those underlying asset for which the future price has a decreasing slope with the lapse of time, consequently the future price is lower than the spot price: an example of normal backwardation are the derivatives on indices. In future contracts on indices the most

important element which cause a negative trend is the payoff of dividends. In ceteris paribus scenario, the only difference between spot price and the future price is the payment of dividend which affect negatively the share price and this is the first cause of backwardation on indices futures. On the other hand, we have normal backwardation future contracts which are those future contracts that have a higher price respect the spot price. One typical example of contango futures are the future contracts on oil in an expansionistic or recovery stage of macroeconomic scenarios, like which are living nowadays: due to the positive trend of European, American and Chinese economies the demand of oil should increase with time, because of the increasing production of those economies and subsequently increasing prices of the most famous commodity, always in a ceteris paribus scenario.



5.1.2 Chart: Contango, Backwardations and Futures

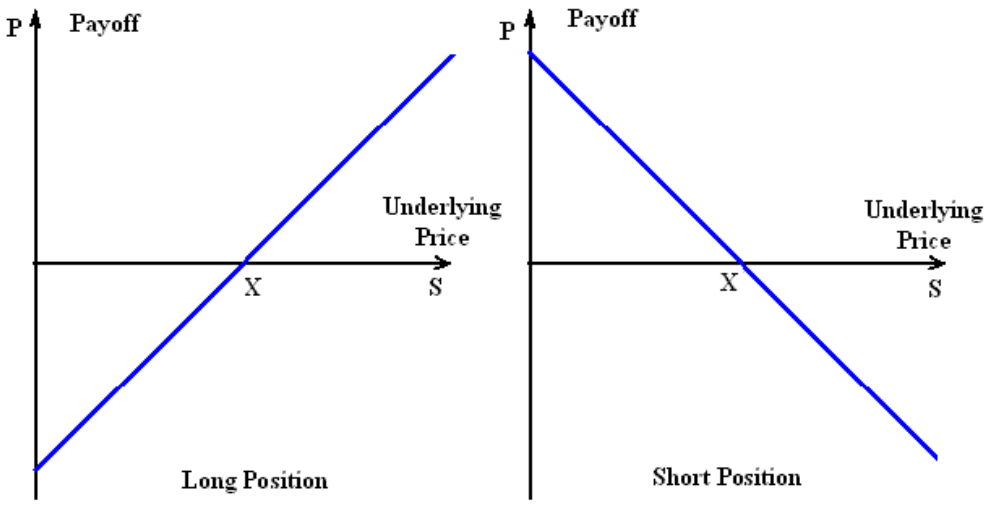
Now that we have analysed the importance trends in forward and future market, we have to observe how interest rates in this market make possible for arbitrageurs to make profit without any kind of risk. The FED set the central interest rate at 1.25% which means that US companies may borrow capital for the central interest rate plus a banking margin on loans, supposing a plus 0.5% from very solid firms. Supposing that on 3rd of July, we could buy a barrel of Brent Crude (ICE) for 49.38 dollars and that the future contract with maturity at 6 months would be traded at 51.45 dollars per barrel. Now, arbitrageurs could borrow 49,380 US dollars for 6 months, buying at spot price 1,000 barrels of Brent, then selling the future contract for 51.450: at maturity date the company would receive the 51.450 us dollars from the sale of Brent, it would pay back the bank for the loan at 6 months (whose interests amount is 491.36 US dollars) and it would have made a profit of 1,578.64 dollars without any risk; only getting advantage from the difference between spot market and future price and the favourable cost of debt. It is possible also to make arbitrage if the future price has a

normal backwardation trend: on 3rd of July the NASDAQ Composite Index was traded at 6,121 points it means 24,484 US Dollars (one ticker is 0.25 point, one ticker is one dollar) and the future contract costed 6,110 points (24,440 USD) with maturity 6 months. A company could sell shorting one title NASDAQ at spot market at 24,484 US dollars, lending this capital at 1.5% which represent the US interest rate and after and buying a future contract at 24,440 US dollars. After six months, the arbitrageur would receive the capital lent 24,466.95 USD, with this resource would pay and buy the title trough the future contract at 24,440 and the arbitrageur would give back the title that had short sold at the beginning of the operation. In this case the arbitrageur would have made a profit of 182.85 without any kind of risk. In these 2 examples, in order to explain the concept and how arbitrageurs work daily in the financial market we omitted costs such as delivery costs or title borrowing costs. As we commented before, in order to price correctly forward and future contracts we should consider the known income: when we know that a share pays a dividend or a bond is a coupon bearing-bond, we should discount it applying the correct interest rate, which one expected when the known income becomes a cash-flow, because it could become another way to arbitrage knowing the yield of the underlying asset and borrowing money buying the same underlying asset and selling the future contract in the way that we analysed in the previous paragraph.

With the following table and charts we describe the main difference between forward and future contracts and relative payoff:

Feature	**FORWARD**	**FUTURE**
Market	Traded in OTC markets	Traded on exchanges
Kind of contract	Not Standardized contract	Standardized contracts
Delivery date	On certain delivery broken date	Range of dates for the delivery
Settlement	At the en of the contract	Daily
Delivery Condition	Usually occurs	Usually closed before to maturity

5.1.3 Table: Forwards vs Futures



5.1.4 Graph: Future payoffs

5.2 OPTION CONTRACTS

Option contracts is one of the most important set of derivatives for its nature and for what it indirectly means. The nature of the contract is an agreement on a determined price of sale or purchase an underlying asset traded both in the over-the-counter market and in exchanges behind a payment of a premium. About the execution of the same contract there are typically 3 kinds of options: American, European and Bermudan. American option can be executed along all the life of the contract, the European can be executed only at maturity date and the Bermudan, this is the less common option, is a hybrid between American and European with a time frame of execution, usually is every month or every fortnight. The European option is the simplest and it is also preferred for empirical economic studies and also for some strategies for its nature regarding the execution date.

Trough options an investor can choose the pricing at which it would be willing to buy or sell buying an option and Chicago Board Option Exchange made an indicator based on option volume, Volatility Index (VIX). With this indicator reflects the market view of future volatility in the S&P 500 options and also the sentiment of the market about the next future of the same. Another sentiment indicator is the Put/Call ratio which indicates the ratio of volume traded of call and put option on the same underlying asset. On this indicator, there are two points of view: the first says that in case the indicator had a higher result (equal bigger than 0.5) we should sell because there many people willing to sell the underlying asset behind a premium and when an asset is massively sold, the price will drop. In case the indicator had a low result (equal smaller than 0.35) we should buy because there are many people willing to buy paying a premium. The other point of view is the preferred one among traders, because following the nature of options many people use these derivatives like a kind of insurance rather than a bet, so if an option is oversold (put/call ratio equal or bigger than 0.5) we should buy because investors are insuring their position in case the negative scenario became

true, on the other hand we should sell when the option is overbought (put/call ratio equal smaller than 0.35) because the sentiment of the market is bearish about the underlying asset and in case the market was bullish the call option would be executed.

As we anticipated before, there are two types of options: call and put. Call options are those option with which the buyer has the right to purchase the underlying asset at a certain price independently the market price and put options are those option with the agreement on the selling price of a certain underlying asset independently the market price. The element that determine the price of the option, called premium, there are many elements and the first of all is the underlying asset price at the moment of the trading, the second element is the strike price of the purchased option, the third is the maturity of the same option and finally the volatility of the underlying asset. The main difference between options and other derivatives is the right to execute a position behind a payment, whilst other derivatives can be summarised easily with a future agreement about a trade. Another characteristic of option contracts is that exists practically an option contract for any kind financial asset: Stock options (option on stocks daily traded), Foreign currency options (European option on a variety of different currency pairs), Index options (European options on indices, usually one contract is to buy or sell 100 times the index at a certain strike price), futures option (usually when an investor trades a future contract, often it is also traded an option contract on the future one. The strike price of the option is usually the future price) and also option on bond futures (the way to invest with options on fix incomes).

A company along its life distributes dividend and makes stock splits and these events may affect the price or the valuation of the option contract on the same underlying asset, here there is the biggest difference between the over-the-counter options and the exchanged-traded options is that the first ones are dividend protected whereas the second ones are not protected. Unless the dividend is not a large cash dividend, there is not any adjustment in option contract terms; this is why sometimes the price of an option is farther due to dividend expectation, it is previously forecasted. On the other hand, the options are completely protected from any kind of stock split or reverse stock split and the reason is because this kind of operation is usually a marketing or psychological manoeuvre in order to give to the market an idea of strong or cheap company in order to improve its price in the market, but the value of the company and its capacity of generating earnings and cash flows has not changed at all. One kind of product not allowed to inexperienced trader is the “naked option” which allows to sell an option on a certain underlying asset without holding it, thus the option seller has to buy by the maturity the underlying assets that will be bought or sold at the moment of option execution. A normal characteristic of options is the leverage of this product: a company listed at 10 euros can sell call option for 2 euros with a strike price at 11 euros; in case the price at maturity was 14 euros, the final result of the operation would be a loss of the 50% respect the positive cash flows earnt by the premium, because the company must sell its underlying asset at 11 when they could be sell it at 14 and with only 2

euros of positive cash-flow per option. Naked option are riskier because the company is not covered by the possession of the underlying asset: using the same data of the previous example, the company sells 25,000 options holding only 10,000: for the 10,000 options covered the company losses 10,000 euros like the previous example, but for the remaining 15,000 options the company must buy at 14 euros per share the underlying asset for selling them at 11; it means a negative cash-flows for buying the uncovered options of 210,000 euros. With this simple example, we saw how could be more dangerous this kind of option and why many investors can't afford a negative scenario.

In order to pricing option there are different methods and criteria, but the most famous and the most used are the Black-Scholes model and the Cox-Ross-Rubinstein, this last well know like the binomial option pricing model which is based on the Black-Scholes model. In order to find the right price of option price we need the following data: Spot price, variance, strike price, time to expiry and risk-free interest rate. Before entering in the mathematical model, we can analyse which are those elements that affect mostly the premium of an option contract: supposing that the spot price and the strike price are the same and a given interest rate, time and volatility are those elements which affect the option price and it makes sense from a logical point of view, later we will analyse the mathematical point of view. Volatility represent the instability of the price of the underlying asset, which increase the price because an issuer does not know how may affect the underlying price the derivative at expiration date. The other element which affect mostly the option price is the time to expiration, because with a longer duration we are giving more changes to the option to go "in the money", we are giving more changes to volatility to do its job of creating instability on the underlying asset price.

The following formula are for calculating the Call and the Put premiums and then the legend of the letters**:**

$$C = SN(d_1) - Xe^{-rt}N(d_2) \qquad P = Xe^{-rt}N(-d_2) - S_0N(-d_1)$$

$$d_1 = \frac{[Ln\left(\frac{S}{X}\right)+\left(r+\frac{6^2}{2}\right)X_t]}{6\sqrt{t}} \qquad d_2 = d_1 - 6\sqrt{t}$$

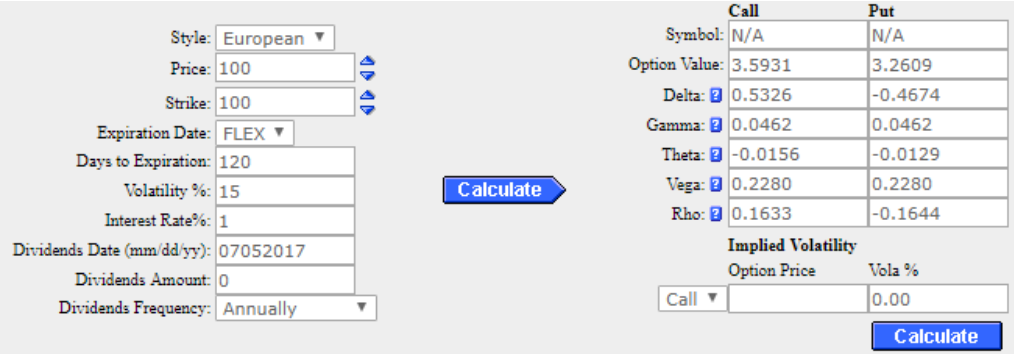
C: Price of a call option **P: Price of a put option** **S: price of the underlying asset**

X: strike price of the option **r: interest rate** **t: time to expiration**

6: Volatility of the asset **N: standard normal distribution with mean 0 and standard deviation 1**

In order to explain what d1 and d2 mean, we preferred to quote Lars Tyge Nielsen director of the Columbia University's Mathematics of Finance MA program from his paper "Understanding N(d1) and N(d2): Risk-Adjusted Probabilities in the Black-Scholes Model": "The formula expresses the call value as the current stock price times a probability factor N(d1), minus the discounted exercise payment times a second probability factor N(d2)". Due to its nature, the put option is equally opposed to call option but the meaning stills the same. This expression is not so intuitive; thus, many financial websites have option calculators and we used

the one offered by the CBOE (Chicago Board Option Exchange) to prove how time and volatility are the most influence variables in option pricing:



			Call	Put
Style:	European	Symbol:	N/A	N/A
Price:	100	Option Value:	3.5931	3.2609
Strike:	100	Delta:	0.5326	-0.4674
Expiration Date:	FLEX	Gamma:	0.0462	0.0462
Days to Expiration:	120	Theta:	-0.0156	-0.0129
Volatility %:	15	Vega:	0.2280	0.2280
Interest Rate%:	1	Rho:	0.1633	-0.1644
Dividends Date (mm/dd/yy):	07052017			
Dividends Amount:	0			
Dividends Frequency:	Annually			

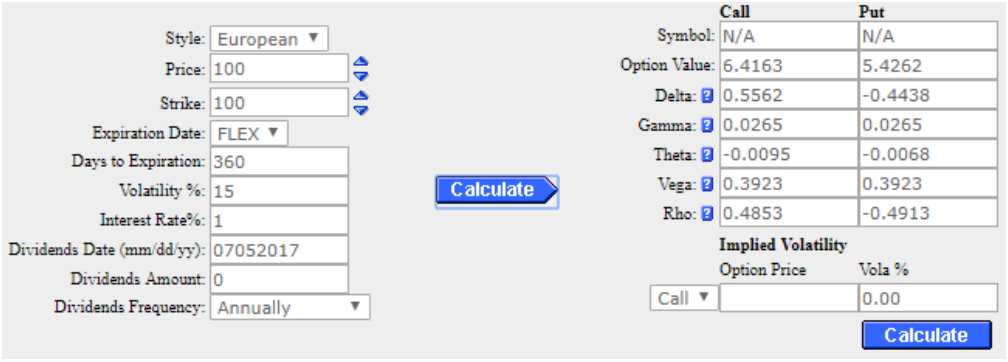
Calculate

Implied Volatility

	Option Price	Vola %
Call		0.00

Calculate

5.2.1 Table: Option pricing, default data



			Call	Put
Style:	European	Symbol:	N/A	N/A
Price:	100	Option Value:	6.4163	5.4262
Strike:	100	Delta:	0.5562	-0.4438
Expiration Date:	FLEX	Gamma:	0.0265	0.0265
Days to Expiration:	360	Theta:	-0.0095	-0.0068
Volatility %:	15	Vega:	0.3923	0.3923
Interest Rate%:	1	Rho:	0.4853	-0.4913
Dividends Date (mm/dd/yy):	07052017			
Dividends Amount:	0			
Dividends Frequency:	Annually			

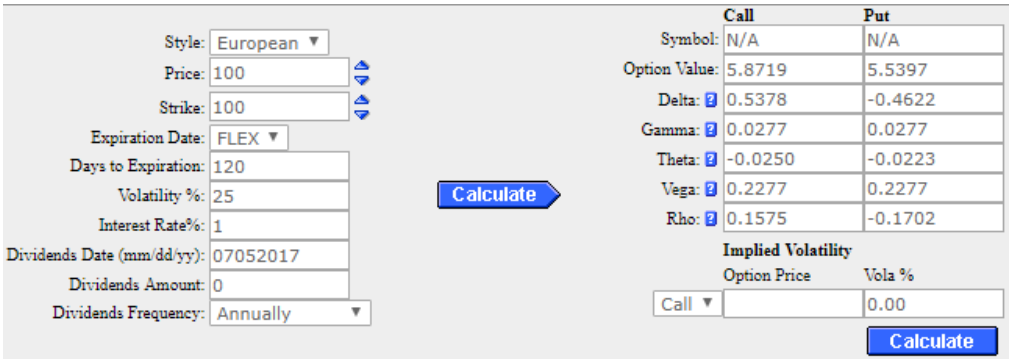
Calculate

Implied Volatility

	Option Price	Vola %
Call		0.00

Calculate

5.2.2 Table: Option pricing, longer Expiration



			Call	Put
Style:	European	Symbol:	N/A	N/A
Price:	100	Option Value:	5.8719	5.5397
Strike:	100	Delta:	0.5378	-0.4622
Expiration Date:	FLEX	Gamma:	0.0277	0.0277
Days to Expiration:	120	Theta:	-0.0250	-0.0223
Volatility %:	25	Vega:	0.2277	0.2277
Interest Rate%:	1	Rho:	0.1575	-0.1702
Dividends Date (mm/dd/yy):	07052017			
Dividends Amount:	0			
Dividends Frequency:	Annually			

Calculate

Implied Volatility

	Option Price	Vola %
Call		0.00

Calculate

5.2.3 Table: Option pricing, higher volatility

We can observe how with these examples how volatility and time to expiry change hugely the option price: from the fist chart, we changed the “Days to expiration” from 120 to 360 and the prices changed from 3.5931 USD for call option and 3.2609 USD for put option to 6.4163 USD for call option and 5.4262 USD for put

option. In the third chart, we changed the volatility from 15% to 25% respect the first chart, maintaining 120 "days to expiration" and the prices changed from 3.5931 USD and 3.2609 US to 5.8719 USD and 5.5397 USD. In this example, we preferred to maintain the spot price and the strike price at the same level in order to show better how volatility and time to expiration affect very similarly both options.

There are also other mathematical indicators of sensitiveness which are useful to understand better how a given option behaves and how we could analyse deeper one single option in order to take the best decision for our purposes: Delta is the indicator which tells us how much variate the price option for one point change in the price of the underlying asset. Gamma is the rate of change of delta when the price of the underlying changes, it is very important because in case the call (or two put) had the same delta, the option with a higher Gamma would be riskier because for the same pricing change it would have a higher change in option price. Theta is the indicator which tells us the rate of change of option price when 1 days passed in a ceteris paribus scenario. Vega represents the sensitiveness of volatility: the percentage variation for 1% variation in volatility. Rho is the indicator which tells us how much an option price would change in case the interest rate changed 1%.

The Cox-Ross-Rubinstein model, also known as binomial option pricing model, is based on the Black-Scholes model and it is mostly used for pricing American and Bermudan options thanks to its characteristic that allows the investor to analyse each frame time instead only one moment. To calculate and explain this model we are assuming that there is a perfect market scenario and without any commission to buy or sell the option, despite it seems obvious we consider that in on period time the underlying asset can only increase or decrease in terms of price, so we have to calculate the probability that in the next frame time the underlying increase or decrease. For finding this value, we have to calculate the up and down factor: multiplying the price by these factors we obtain the future price in case the underlying was bullish and bearish. Before analysing the formula deeper, we have to explain all the variables that we need to create the binomial model.

б: volatility of the underlying asset **r: interest rate**

Δt: the fraction of year that we are analysing (e.g. monthly analysis = 1/12 = 0.0833)

U: Up factor **D: Down factor**

P: probability the underlying increases

$$U = e^{6\sqrt{\Delta t}} \qquad D = \frac{1}{U} = e^{-6\sqrt{\Delta t}} \qquad P = \frac{e^{r\Delta t} - D}{U - D}$$

Now that we have all the elements of the binomial model we can draw our tree and forecast the price of the underlying along the period analysed. Now we show an example using the following data:

б 10%, r 2%, Δt 0.08333, Spot price 10, Strike price 11.

ASSET price

0	1	2	3	4	5	6
10.00	10.29	10.59	10.90	11.22	11.55	11.89
	9.72	10.00	10.29	10.59	10.90	11.22
		9.44	9.72	10.00	10.29	10.59
			9.17	9.44	9.72	10.00
				8.91	9.17	9.44
					8.66	8.91
						8.41

5.2.4 Table: Binomial model, Asset price evolution

Once that we have the complete binomial tree of the asset price, we should create another table with the potential payoff in case we could exercise the option in any period of time; in case we were analysing a call, we should subtract the "Asset price" results with the strike price in order to find the potential payoff; in case we were analysing a we should subtract the strike price with the "asset price" results.

Early exercise PUT

0	1	2	3	4	5	6
1.00	0.71	0.41	0.10	0.00	0.00	0.00
	1.28	1.00	0.71	0.41	0.10	0.00
		1.56	1.28	1.00	0.71	0.41
			1.83	1.56	1.28	1.00
				2.09	1.83	1.56
					2.34	2.09
						2.59

5.2.5 Table: Binomial model, early exercise Put option

We have already exposed the main difference between American and European options and with this model we can observe how the final price can be different and how we should approach this model. To discover the final price of an option we should start from the end, from that payoff that is known in case the option was an American or an European one. In the European option, the only thing that we have to do is discounting the two available possibilities (higher or lower price) by the factor used for finding the probability: $e^{r\Delta t}$; thus, going backward we can obtain the expected value of the future payoff of the option in all the scenario forecastable by the model.

EUROPEAN

0	1	2	3	4	5	6
0.93	0.69	0.46	0.25	0.09	0.00	0.00
	1.20	*0.94	0.68	0,43	0.19	0.00
		1.49	1.23	0,96	0.69	0.41
			1.77	1.52	1.27	1.00
				2.05	1.81	1.56
					2.33	2.09
						2.59

5.2.6 Table: Binomial model, European payoff and price

0.94 = $(1/e^{2\%*0.0833})$(0.68 * 0.5217 + (1-0.5217) * 1.23)

0.5217 is the probability that the underlying goes up.

With American options, we can exercise the option in any period of time, thus we should consider the best scenario between the discounted payoff and the “earlier exercise PUT” results.

AMERICAN

0	1	2	3	4	5	6
1,00	0,72	0,47	0,26	0,09	0,00	0,00
	1,28	1,00	0,71	0,44	0,19	0,00
		1,56	1,28	1,00	0,71	0,41
			1,83	1,56	1,28	1,00
				2,09	1,83	1,56
					2,34	2,09
						2,59

5.2.7 Table: Binomial model, American payoff and price

We can observe how the final price of an American option is 1 dollar rather than 0.93 dollar, it means that the privilege to exercise the option in any time costs a 7.53% more than be obliged to wait the expiration date for the execution. This is a simple example that we used to explain how the binomial model works and how can be consistent the difference between American and European options, but banks and financial managers use model and simulation for pricing the American option, the most famous and used method is the Monte Carlo simulation which allows to make infinite simulation with many observations that an investor would like to use finding always a different result, but always very close the correct fair price.

5.3 SWAP

A SWAP contract is an agreement for exchanging future cash flows between 2 parties, in order to reduce risk or reducing costs. This is an over-the-counter product which means that bears the credit risk; this product has to be defined for the duration, for the variables of cash flows and the frequency of the payments. The main characteristic of most SWAP is that one party assume the obligation to pay a fix quote, on the other hand the other party has to pay a variable cash-flow. The Interest Rate Swap (IRS) is a contract where a party pays a fixed interest rate on a certain nominal and the counterparty pays a floating interest rate for a certain period of years with a fixed frequency. This kind of contract allows those companies which signed a loan with floating interest to change it to a fix rate loan, paying a fix and receiving a floating rate; while the counterparty that has a floating income would change it to a fix income, paying floating and receiving a fix interest rate. Usually the floating interest party takes as reference the LIBOR or other interbank interest rate as EURIBOR more a spread which depends for the kind of contract. Signing this contract, both parties have avoided the interest rate risk and both parties may transform the nature of financial assets and financial liabilities.

For these kind of operation, financial intermediaries play a key rule for non-financial companies which would like a swap for restructuring financial costs: this is the reason why financial intermediaries such as banks are market maker of swap contracts. It is virtually impossible that a non-financial company could find a counterparty for a specific contract with specific conditions and that second company accept all the terms; thus banks, even without having a counterparty, make swap contract to non-financial companies: it means that financial intermediaries have to hedge carefully the risk that they are taking. Sometime swap contract may have a duration of 20 years and in the last 20 years the swap rates dropped terribly, from above 8% to roughly 1%. Then all those companies, or banks, which have preferred paying a floating interest rate instead a fix one, had to pay a lot and probably they closed before the natural expiration the contract paying high closing commissions to the counterparty.

5.3.1 Chart: Libor evolution during the last 30 years

With the chart which represent the evolution of LIBOR during the last 30 years, we can understand better how who signed a contract in 1990 did not want to continue holding the contract, when after few years the floating interest rate was below the half of when he signed it. A characteristic that swaps may have are Cap, Floor and Collar: Cap covenant means that despite the floating measure unit (e.g. EURIBOR) increase more than a certain level, the floating part will pay as max the Cap amount previously established. The Floor covenant has the same meaning than the Cap, but at reverse; in case the floating interest rate dropped below a certain level, the floating rate would be the minimum that the floor covenant establishes. The collar covenant is a mix of the previous two, the floating rate will not never be higher than the cap nor lower than the floor; it may variate inside the target range of the contract. The Forward Rate Agreement (FRA) is other common kind of swap and this is like one observation of the Interest Rate Swap without any difference, only for the pricing of the contract. For pricing a SWAP contract, we should discount all the fix payment by all the risk-free bonds, each one with the same maturity of the payment, to the day of beginning of the contract and the result is the theoretical value of the SWAP and should be the same that the floating interest rate. In case of FRA, it is easier due to its nature of only one observation. When un investor buy a $FRA_{\frac{4}{10}}$, he is buying a FRA which starts in 4 months and ends in 10, it means that the payoff will be the difference between the floating rate and the FRA interest rate multiply by the number of days of contract duration, all discounted by the floating rate for the period of the contract, this case 6 months. Following there is the mathematical formula: $\boldsymbol{FRA\ payoff = Nominal} * \frac{(\boldsymbol{Floating - FRA\ rate}) * \left(\frac{\boldsymbol{Number\ of\ days\ of\ the\ contract}}{\boldsymbol{365*100}}\right)}{\boldsymbol{1+\frac{Floating*Number\ of\ days\ of\ the\ contract}{365*100}}}$

Another popular SWAP among nonfinancial companies is the currency swap, because it is a simple and cheap solution for raising funds in a foreign currency: A US company lends a principal amount in a certain currency, for example US dollars, a British company which borrows the total amount in US dollars, at the same time lends to the first company a principal in a different currency, for example GB Pounds. Now, the first company will receive interest from the loan in US Dollars and will pay interest on the principal in GB Pounds. This is a normal exchange of cash flows with different currencies which occurs, most of the times, with fixed interest rate (also called fixed-for-fixed) because the main purpose of this contract is to change the currency of a borrowing to another currency. It is used because it is more likely than a US company could raise funds in US dollar easier and cheaper than a British one, on the other hand for a British company is easier obtain a loan in Pound compared to an American company. The currency swap can also be viewed as a speculation product for whom thing that a currency goes to be appreciated: imagine that one company can invest 1,000,000 of US Dollars at a yield of 4%, but has the felling that the GB pound will strengthen against the US dollars. The company can swap the 1,000,000 US dollars and get GB pounds at 5%. This kind of currency swap is the most common, but there are different types of currency swap: we can consider also a fixed-for-floating currency rate or floating-for-floating currency rate. Actually, a financial intermediary can make any kind of currency swap whose a company needs. There are different kind of currency swap and one of these could be an alternative to certificates of deposit and fix incomes due to the difference between actual price and future price of the currency: the difference between two currencies is given by the domestic interest rate, for example now the interest rate in USA stablished by the FED is 1.25% whereas the eurozone interest rate is 0.00%; it means that in a ceteris paribus situation if today the forex pair EUR:USD is 1.1400 with lapsing of time the pair would be higher, due to the different evolution of the currencies. Euro will decrease slowly its value in the pair, while US dollar will increase its value in the forex pair; it means that if today the spot price is 1.1400 (7^{th} of July 2017) in six months the pair will be 1.1543; 143 basis points higher. Imagine that a US company has 1,000,000 dollars and signs a swap which obliges the US company to sell today the amount in dollars at 1.1400 for euros and obliges to buy back the dollars in 6 months at 1.1543. The company would receive 877,192.98 euros and after six months they would buy back dollars for 1,010,000 it is a semi-annual 1.25%, or annual 2.52%, with a big advantage compared deposits: the company along these six months can use the euros for their project in the eurozone or for the payment of their importations, whereas with deposit a company delivers the total amount at the beginning and it cannot be used until the end of the deposit contract. Many companies are using this kind of derivative instead fix income asset because of the low profitability of fix income market, even more in the eurozone. The disadvantage of this product is that not all widely companies can use it for the trend of forward points (the basis point at different maturities are called forward point and are the same used for forwards trading), for example an European company which works mainly with USA cannot apply this product instead fix income because it would carry a loss and the solution

would be to sign this contract with other currency with negative forward points such as Swiss Franc; but not all companies have business interest in Switzerland, thus it is a solution that fits only to few companies.

Financial intermediaries do not offer only interest rate or currency SWAP, but also commodities, volatility, credit default and exotic instrument SWAPs, spite of are much less common than the previous two analysed. Commodity SWAP is an agreement with which two parties exchange cash flows that depend on the price of a commodity; the agreement can be of different nature, a series of forward contracts or the spot price at the observation date against the average of the last month or other agreement that both parties sign.

The volatility SWAP behaves exactly like FRA but instead using interest rates, fix versus floating, the parties will use volatility; one side will pay a pre-agreed volatility whilst the other side will pay the historical volatility of the period analysed by the contract terms. It is mainly used by volatility traders for hedging their position for a determined period of time.

The Credit Default SWAPs (CDS) became sadly popular with the 2008 financial crisis for the nature of the contract: a party (buyer) pays a fix quote to the counterparty until the maturity of the contract, the counterparty (seller) does not pay any floating quote but in case the debtor of the buyer can't face its debt and defaults, the seller will have to pay to the buyer a premium more the interest that the debtor should have paying until the maturity of the debt, it seems a sensitive financial tool which works as an a guarantee or an insurance . Many banks and insurances, sure of the solidity of the US economy, signed many CDS when the real estate burst the went into troubles because in few weeks they had to pay back the premium and the interest rate and together the securitization it was the beginning of the hugest financial crisis of the century.

5.4 CONTRACT FOR DIFFERENCE

Contract for difference (CDFs) is the most popular derivative among minor investors because it allows to take position with high level of leverage and with a little amount of money. We CDFs and investor does not buy the asset, but he is buying the position: on 7th of July the stock of General Electric Co. is traded at 26.30 USD per share, an investor who thinks that General Electric will drop in the next few hours can short selling with a stop loss at 28.80. It means that in case the share price rose to 28.80 the investor would loss the entire capital invested, whereas if the analysis was correct and the price dropped to 25 dollars per share, closing the position this investor would have a return of 52% on the capital invested. We made an example of an investor who took a short position, but it is possible operate also with long position the only difference will be the position of the stop loss. Talking about the stop loss, it is not necessary to operate with CFDs but it is highly recommended in order to avoid any kind of mistake.

This kind pf product is very flexible for investors exigencies and allows to make trades in really short time with the chance of create a high return of the investment, on the other hand, the investor can lose his investment very quickly and sometimes rookie investors lose much more than what they had planned for making mistakes with stop loss; for this reason, many regulators indicate CFDs as complex product because the investor may lose more than the deposited. Most private investors invest in equities (only well-known companies with high capitalization), forex and commodities, because are more difficult to manipulate and the broker can't play against the investor, actually in the Financial Conduct Authority (FCA) licence there is a section in which it is analysed the rule of the broker as a pure intermediary or if the firm can operate in the market against the customers.

Banks and financial institutions usually do not work with this kind of product because are offered by brokers, which borrow stocks and then put them in the market of CDF with their own bid-ask prices: they are typically close to the sport market prices but brokers take advantage from it and they offered prices with a little margin for their operativity. A problem with this product are the broking houses that are more than 3,800 only in USA: in a report of the Financial Industry Regulatory Authority only in 2016, 206.2 million of dollars were levied in fines and restitutions, 785 cases referred for fraud and insider trading for prosecution, 26 firms were suspended and 24 firms were expelled. Only in USA in the last 5 years 216 firms were suspended and expelled from the FINRA, so private investor could be in difficulty at the time of choosing a broker house.

5.5 EXOTIC DERIVATIVES

Everyday engineers of investment banks and financial firms, are studying and making derivatives with specific features, unique and different from the standard products; for such reason, it is impossible to explain all the categories and the kind of exotic derivatives available in the market, but we analyse some features that are popular among exotic derivatives and that are widely used in hedging products.

Very often, exotic derivates have some conditions called "barrier" which tell us when a contract becomes active or cease to be active and tell us at which condition. European barriers are all those barriers that become active when at the expiration, or observation date, the spot price of the underlying asset accomplishes with the condition of the barrier. American barriers are all those barriers that become active if in any time the until the expiration, or observation date, the spot price of the underlying asset accomplish with the condition of the barrier. The types of barrier are usually four: up and in, up and out, down and in, down and out. For barriers with "up and in" and "up and out" covenant, the contract will become active or null only if the spot is higher than the "up" condition; on the other hand, for those barriers with "down and

in" and "down and out" covenant, the contract will become active or null only if the spot is lower than the "down" condition.

Another exotic derivative that is important among exotics, it is the Asian option: instead taking one price and comparing it with the strike price, the Asian option takes into account the average of the last month and the difference will be the payoff of the option in case of positive result. For those underlying assets with high volatility Asian option results a cheaper contract for taking position for those investors who does not want to spend too much for buying an American or European option of that underlying.

6 HEDGING AND SPECULATION

The two main reasons for investors to choose derivatives are hedging and speculation, due to the different nature of derivatives that we have previous analysed investors can reduce risk or make an extra profit trough these contracts. The importance of knowing deeply the nature of derivatives is due to the nature of negative-sum game: derivatives in their nature are a zero-sum game, because what a party earn from the contract is paid by the counterparty, but we did not mention earlier the costs of transaction and commissions. Taking into account this new element, we can say that the whole world of derivative is a loss, investors in average are losing money signing these contracts. Investors have to hedge very carefully their position, unless they did not want to cover their speculation policies through hedging positions. Many investors cover their position thinking that they are hedging whereas they are speculating and in order to explain this kind of "camouflage" and theoretical concept we make a real example of it with a couple of assumptions: absence of any intermediary costs and commissions, the neutrality for short-term variation of a share price. This second assumption is given by the point of view of recognized financial managers and entrepreneurs like Peter Lynch and Warren Buffett: a long-term investor does not take care if for one year or two the stock price variates negatively its price, because the long-term investor is focused in making profit in the next 8/10 years and is looking for a five or ten bagger. They are not academic, but we take in consideration their ideas due to their undisputable success in investing.

For this example, we took in consideration Telefonica, the biggest Spanish company and whose business is worldwide. On the 7th of August 2015 Telefonica shares were traded at 14 euros per share and the return yield was 5.98%, it means that the theoretical dividend should have been 0.837 euros per share, but instead that the company distributed a dividend of 0.75 euros per share. Using the option calculator gently provided by MEFF (Official Spanish Market of Financial Options and Futures; Mercado Oficial de Opciones Y Futuros Financieros en España), applying the Black-Scholes model, the price of one put option with strike price at 10 euros and with 432 days of maturity (30th of September 2016) the price is 0.16 euros. We suppose that the

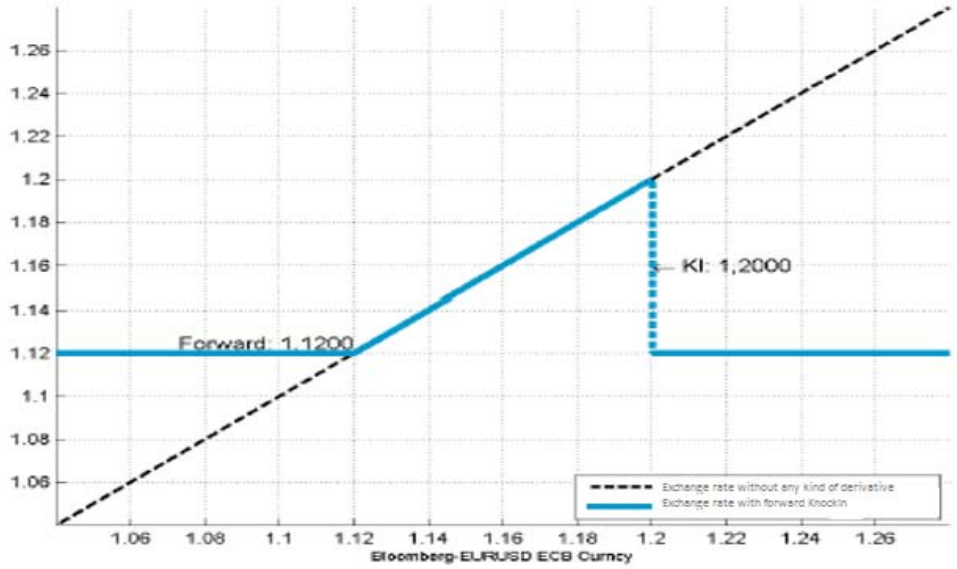
investor had a package of 500 shares and it used the dividend of 300 the shares for hedging (speculating) on the possibility of a sharply drop in share price, buying 1,500 options. A global stock exchange dropped and Telefonica even more due to its investments in Venezuela and the strong devaluation of Venezuelan Bolivar, and the price of the Spanish firm on the 30th of September 2016 was 9.02 euros per share. Per each option bought the long-term investor recorded a net income of 0.82 euros, in percentage +412.5%. the investor would have got an extra-income of 2.46 euros investing only 0.75 of dividend, thus we could calculate the final position of this operation: The initial position of 7,000 euros (500 shares multiplied by the price of 14 euros), the share position on the 30th of September of 4,510 euros (500 shares multiplied by 9.02 euros), the costs of options 240 euros (1,500 options multiplied by 0.16 euros), the dividend received and not invested in options 150 euros (500 multiplied by 200) and the option payoff at maturity 1,230 euros (0.82 euros multiplied by 1,500). The final loss after this operation is of 1,350 euros instead of 2,490, it was like if the share price dropped only until 11.30 euros instead 9.02, a difference of 2.70 euros per share. As we commented earlier, the long-term investor should take care of one year variation if it believes on its analysis and on the company chosen, even more in the recent era that we lived the financial crisis, general panic and economic stagnation cycle; that is why this kind of hedging operation are also evaluated like speculative ones. In case the long-term investor did not want to continue holding a long position in the telecommunication company, he could have sold few months later when the stock was traded at 10.60 euros; instead recording a loss of 24.29% (percentage obtained from the initial scenario against 10.60 euros) it could have recorded a loss of only the 5%.

6.1 HEDGING

Hedging is commonly defined as “a risk management strategy used in limiting or offsetting the probability of loss from fluctuation in the prices of commodities, currencies, or securities…”. Following this definition, found in many us legal attorney web sites focused in finance, we should consider only spot market, forward and future; because it is not considered the possibility of losing money. Theoretically, in order to hedge the position an investor should check which is the best price between the spot price and the future price and take the position, a nonfinancial company would have its commercial margin and whatever happens it would have assured its business. What happens daily is different, many nonfinancial companies are looking to hedge their positions and in the same time they do not want to lose the opportunity to take an eventual disadvantage respect the market price; it brings about the consequence of taking a little risk to earn better prices; thus, in the definition of hedging we should also add that the hedger knows which is the worst scenario. Due to my personal experience, to the importance of currencies for many company and for the

derivatives use by the companies, most of the examples of hedging products and strategy will be referred at the FOREX market.

We have to introduce a new point of view of leverage in order to explain some hedging products: most of investor when hear the word “leverage” the think immediately in investing a smaller amount of money for taking a position and then waiting for the potential payoff of the contract, the most emblematic examples are options and CFDs. With some products, the leverage is referred to the whole nominal of the contract when the market price touches a certain level along the duration of the contract (American barrier) or at the expiration date (European barrier). Usually this leverage is “against” the investor who is willing to “risk” at a certain level obtaining in change a better strike price compared to the same product without leverage.

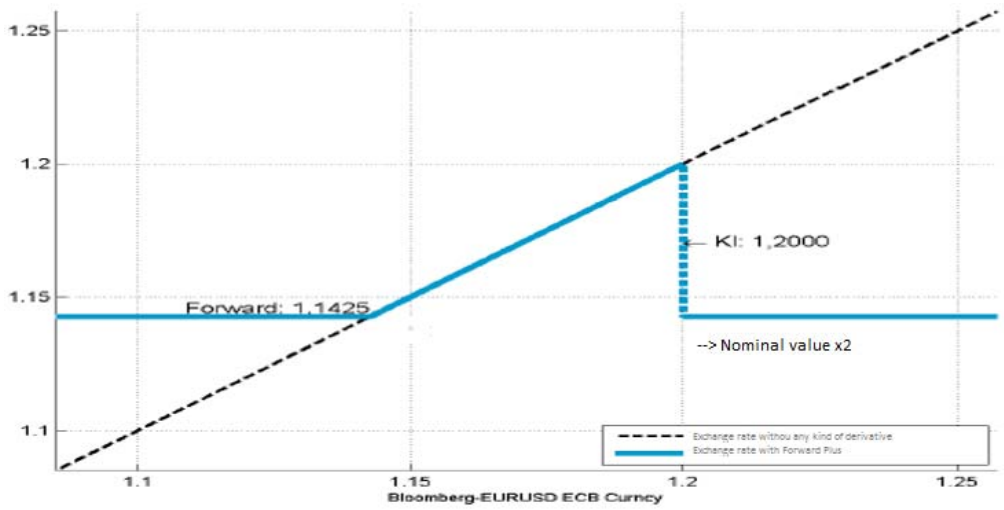


6.1.1 Chart: Forward KI

This is a forward KI (knock in) which allows to the hedger to obtain an exchange rate for the Euro-Dollar at 1.1200; between 1.1200 and 1.2000 the hedger would buy at the spot market price and improving the exchange rate of 1.1200; the worst case happens if the exchange rate was higher than 1.2000 at the observation date, hence the hedger would be force to buy the whole nominal at 1.1200 dollars per 1 euro.

Usually the strike price of a forward KI is worse than strike price of a normal forward, the reason is that with the forward KI the hedger has to possibility to improve the exchange price, until the barrier up and in, while the forward has a strike price and in case the market improved the price, the holder of a forward could not improve its position and it would lose the opportunity cost of not buying at the spot market.

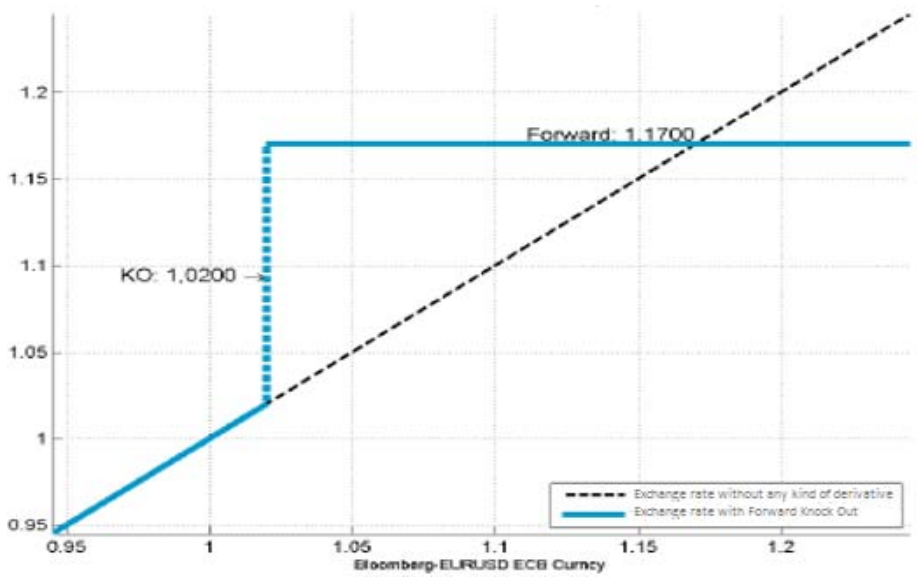
How we anticipated at the beginning of this section, the leverage could be an important element in order to



6.1.2 Chart: Forward plus

plan hedging strategies. With this contract, forward plus, the investor obtains a higher strike price compared to the forward KI, but in case the EUR:USD was higher than 1.2000 the hedger would be force to buy the double of nominal. This kind of product is widely common among nonfinancial companies which manage high amounts of foreign currency, because it guarantees a high strike price, the possibility to improve the strike price in case the spot price was higher than the strike price at expiration date and the probability of entering into the leverage side is improbable; in the example shown in the chart XXX (Number of chart) the leverage starts from EUR:USD 1.200 and in the last two years the highest level touched, in only one day on the 14th of August of 2015, was 1.1714; thus, many companies are not concerned about this leverage and they are willing to afford it to have a better strike price. The leverage usually is twice the nominal value, but does not exist any limit on it; if a company would like to sign a contract with a leverage side which multiply by 3 the nominal, it can be signed and in change at this “new risk” that the company can afford, the strike could be higher, the barrier up and in could have a higher level or a mix of both.

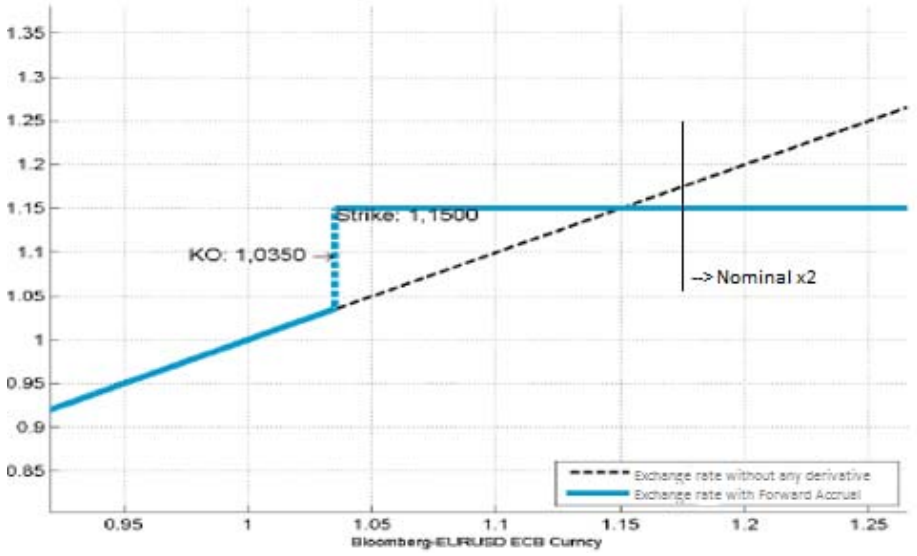
Another product which may be guarantee a better strike price compared to the forward is the forward knock out; this product turns null when the price is lower than 1.02 at the expiration date.



6.1.3 Chart: Forward KO

This product cannot be considered as a hedging product because we are not sure that the hegde will be active at the expiration date, but it is important to know because some strategies are possible thanks to this kind of product mixing with other contract which assures the hedging of the position.

The mix of the Forward knock out and knock in is known as forward KIKO, the barrier “in” can be leveraged or not, and cannot guarantee to hedgers the position due to its knock out side. This kind of product can guarantee a better strike price or better levels of the barriers, but for this reason many prefer product like the Forward accrual which is a series of forward KO with a barrier of leverage on the other side.



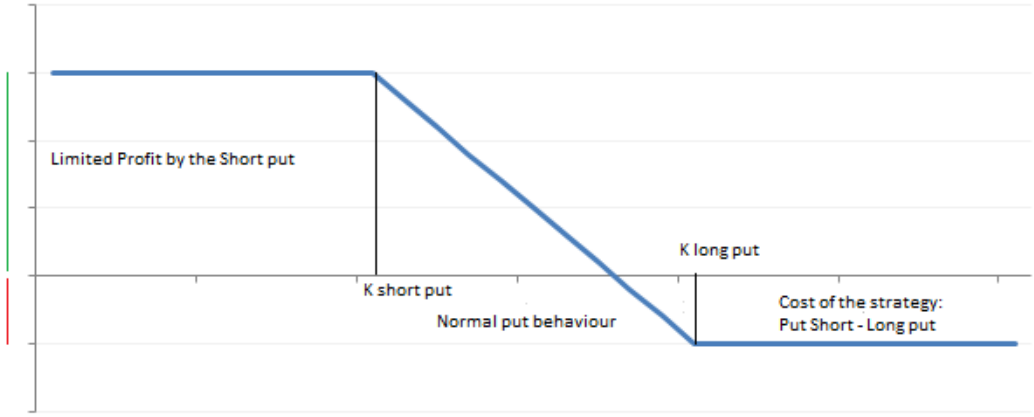
6.1.4 Chart: Forward KIKO

This chart represents the one observation of the forward accrual. With this contract with a certain frequency, daily, weekly, fortnightly or monthly), the spot price will be observed and in case the spot price will be below the KO barrier, nothing happens; in case the spot price was between the KO barrier and the KI barrier (it is a barrier up and in as strike price the same strike price of the forward KO), and in case the spot price was higher than the KI barrier the amount would be doubled. The importance of this product is crucial, because it allows the company to not depend from only one observation and due to the nature of the product the strike prices are usually higher than the product that we have analysed before.

At the moment, we have analysed some products use for hedging purpose in case the company needed to buy US dollar against Euros, obviously are available the same product for selling US dollar that are exactly equal opposed and not all of them are products which can completely hedge a position, or at least do not assure of which the worst scenario would be. For this reason, many companies in order to obtain better strikes and barriers are willing to purchase other products that have a speculative nature. For example, a company needs to buy US dollars and is looking for exchange rate of 1.1850, but the best strike price that the company could obtain with a leveraged Forward KIKO was 1.1775 with Knock out barrier at 1.055 and leverage at 1.1950. The company could buy a forward KIKO for selling US dollars with the barriers very close: Knock out barrier at 1.0500, strike price at 1.0400 and leverage at 1.0350. This second part is very aggressive because the company should sell dollars at 1.0400 in case the exchange rate was lower than 1.0500 and it should be sell the double at 1.0400 if the exchange rate was lower than 1.0350; the barriers are very close and there is a barely margin of making profit with this leg. On the other hand, for assuming such risk the company know could ask for buying US dollars at 1.1850, with a leverage at 1.2000 and with a knock out barrier at 1.0475. With this kind of restructuration, the company would know its worst scenario: selling the doubled nominal of US dollars at 1.0400 when the spot market is lower than 1.0350. It is classic scenario of speculation “camouflaged” like hedging, in this case the company is obtain better results than other classic derivatives and to obtain that is willing to speculate on the unlikely event, such as a US dollar lower than 1.0350 and it happens only once in all the history the 2nd of January of 2017 which minimum recorded was 1.0340.

All the derivatives that we have analysed in the last section can be built with options, with barriers, and options are mostly used for the hedging strategies; depending from the objective of the investor there are more or less aggressive strategies. The easiest product that a company may buy is a put option, once that the company establishes its minimum level for the underlying asset they could buy put options with such strike price and they have hedged the position. Buying only a put option has a couple of disadvantages that not all companies are willing to bear: the cost of the premium and the rigidity of the strategy (it works only from the strike price). For this reason, there are other strategies preferred and variation of the most known

in order to reduce the price of the hedging or in order to do not have such a rigid position like the purchase of a put option. A strategy which allows to the hedger to reduce the cost of the put option is the Bear Put Spread: it is the purchase of a put option and the selling of another put option, with the strike of short position option lower than the long position strike.



6.1.5 Chart: Bear Put Spread strategy

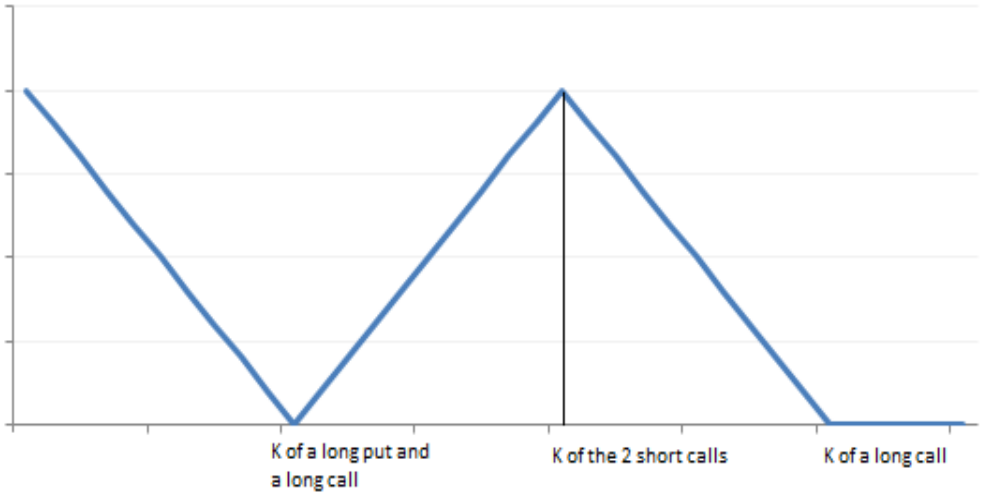
Depending from the distance between the long and the short, the strategy could be less or more expensive and there will be more margin for allowing to the same strategy to behave like a normal put. As we can observe in this chart, from the strike price of the short position the benefit will be limited to the difference between the premium received, the profit obtained until that price from the long punt minus the premium of the long position.

There are companies which want to hedge a position without any cost, hence they have to leverage in order to cover a position until a certain point, since the same company will start losing money with the hedging strategy; an example is a Bear put spread with another short put. Applying this strategy, the hedger could choose at which level the strategy would become losing value, if like a strangle or straddle strategy.

6.1.6 Chart: Bear Put Spread + Short Strangle and Bear Put Spread + Short Straddle

The difference between these two strategies is considerable due to the level since the strategy starts losing value: supposing that the Spot price is higher than all the strike prices, the premiums received in the Bear Put Spread + Short Straddle are higher due to the higher strike price, thus it allows the company to take a less degree of leverage in case it did not want pay for the strategy or ,maintaining the same degree of leverage that the Bear Put Spread + short strangle, it could obtain a higher strike price of the long put reducing the rigidity of the strategy and hedging a wider price range like a normal put option. The strategy that we have analysed, we have built them buying and selling put option; something that is important to know is that we could have built mixing call options with put; apart from the leverage side in case the price dropped drastically, we could have sold a call option with the lower strike and purchased another one with a higher strike price. From a graphic and practical point of view it would have been the same, but talking about hedging in case of price fallen we thought that would be more appropriate using option because of their characteristic: paying the long position in case the prices fell.

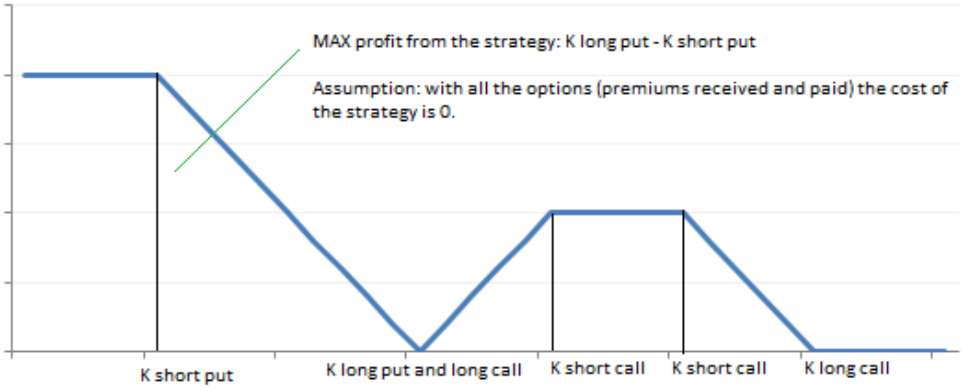
Another strategy used by hedgers in order to reduce rigidity and costs is the mix between the long and short straddle more a long call. Once that the company settle the objective price, since it would like to



6.1.7 Chart: Short Straddle + Long put

Hedge the position, hence I would buy a call and a put at the same level in order to be more elastic and hedge also prices close to the objective price. The second step is to sell a couple of call option, in order to reduce remarkably the strategy price, and in the end, it would buy a call in order to stop the loss provoked by the leverage of call selling. One important think about this strategy is the ratio that the hedger should be use between the short calls and the long call with the highest price, the ratio should be 2:1 because if the hedger would use another ratio, for example 3:2, the strategy would record a continuing loss for increasing prices and this is not the objective of this strategy.

Another typical strategy used by hedgers is a mix between a short butterfly and a short strangle with the losses stopped with a long call.



6.1.8 Chart: Short Butterfly + Short Strangle

This strategy is less aggressive than the previous one and allow the hedger to improve the position only until a certain level which and in this case the difference is between the long put strike price and the short put strike. This strategy is used by those companies that have a clear and precise price since the would like hedge, but at the same time are looking to improve their position in case the market did not fall as much as their price objective.

At the moment, we have analysed hedging strategies only from an absolute point of view: depending from the economical objective of the company, we adapt one or other strategy, but we can also change the Beta of an equity portfolio buying or selling futures on the index of reference. Firstly, we have to define the term "beta": Beta is a measure of volatility respect the market, it says us how much a stock or a portfolio is correlated to the market of reference, when the beta is 1 the portfolio analysed behaves perfectly like the index. When is lower than 1 the portfolio will move slower than the index in both sides when the prices rise and drop. When the beta is higher than 1, then the portfolio will rise and drop faster than the index. For many people, it is not easy understand a value of a negative beta, because it is a volatility measure, thus the existence of products with a negative risk seems impossible. However, the professor of the Stern Business School of New York, Aswath Damodaran, explained how there are products with negative betas known also as "safe havens" like gold. To hedge market risk or high inflation, many investors when the market panics, decide to buy future and products on gold because it is considered a safe product when the market shows signals of regression; it means that when the market falls, the gold price goes up and what happened during the years of the recent financial crisis.

6.1.9 Chart: Gold price during the last 10 years

Nowadays, gold is traded at 42,500-37,500 US dollars per kilo, when the crisis started the same kilo was traded at 25,000 US dollars. Many investors chose to invest in the "safe haven", gold, and in few years the price touched almost 60,000 US dollars per kilo whereas most of listed companies were recording red numbers in their balance sheets. A negative beta does not mean that there is not risk, but that the asset chosen behaves contrary the market.

An investor who wanted to change the beta of its portfolio, should buy or sell a certain number of contract: making an example that one investor had 5,000,000 of dollars invested in one portfolio with a beta of 0.75, when it would prefer a higher beta of 0.95 and the value of a future contract of the index was 100,000 US dollars, he should apply the following formula in order to obtain the desired beta:

$$N\ of\ contracts = \left(\beta_{Desired} - \beta_{Portfolio}\right) * \frac{Portfolio\ Value}{Future\ Value}$$

With the data of the example, the investor should buy 10 future contracts: (0.95-0.75) * 5,000,000/100,000. This is how an investor may change the beta of its own portfolio with futures.

We can affirm, that there are many strategies available thought derivatives and any one of them can fit to the hedger's necessities, but as we commented along this paper, there are only few product and strategies that can be defined purely "hedging strategies" because there is always a speculative leg which allows to improve the prices or costs, in change of assuming a risk that may be even very little, but it still be a risk that a company may be face.

6.2 SPECULATION

Many people have a negative idea about the term “speculation” regard financial markets, whereas every company in the world is speculating on the products or services that they are selling. Speculation is the difference that an investor can generate from the buying price and the selling price. The difference that we see between financial markets and nonfinancial markets is the velocity of execution: while a nonfinancial company to produce its products need a supply chain, a production system and generally a business model which take time to be executed; in financial markets in few minutes we can buy and sell stocks making a profit, assuming the risk of losing money from the transaction; exactly like the entrepreneur bears the risk with its activity. However from what most people thought, speculation bears some positive consequences ignored which are fundamental for the ongoing of the same market. One of these elements is liquidity: in case one long-term investor would like take position the market price is the fairest possible, because in case there were not speculators the difference between bid price and ask price (price at which potential seller would be willing to sell and price at which buyers would be willing to buy) would be wide and in case many holder sold their positions, the price of an asset with low liquidity would decrease very quickly and the same would happen in case many investors would like to buy massively the security with low liquidity. The element of liquidity it is also important for those listed companies which want to increase capital: in case a listed company did not have speculators, who trade with their share, at the moment to make a capital increase the company could not value at the best of their possibility the terms of the same operation. Another important element is the interpretation of the information: nowadays, every week there is a company or a sovereign state which communicate new data, which could be the results of the last semester or the unemployment of the last month. In case there were not speculator, the market could not interpret the data or the consequence would be worse like the example given before. Speculators, take care much more to the information and market sentiment than the real situation of a company, and this could be good for stimulate companies and act faster on some bad news that they had to communicate. When a company publishes bad news, the market punishes it with increasing short positions and to avoid any crisis the company should publish good news soon. It could be seen like the base of the business: an investor buys at a certain price with the idea to sell it at the higher price, making profit and then using that profit to increase its investment of for the consumption; thanks to this point of view (generally in short-term) the long-term investors can increase its position in the portfolio creating wealth and those companies which cannot guarantee this trend, in ceteris paribus scenario, they will be forced to close and make room to profitable companies.

There are principally 2 different kinds of speculators: short-term (from intraday trading to few weeks) and long-term. The firsts, are those speculators that based their strategies on technical analysis and trust on their thoughts; on the other hand, long-term speculators are those speculators who just bet in huge unexpected movement spending a little and earning a lot in case the unexpected scenario became true.

The long-term speculators are those who in a sort way gamble and try to make a huge profit it was possible in the last few years with Brent (Crude Oil).

6.2.1 Chart: Oil price 2014-2015

On the 23th of June of 2014, a barrel of Brent was traded at 115 US dollar after six months of lateral trend and the volatility of Brent on that date was barely higher than 14%. A put option with a strike price of 95 dollars with an expiration of six months (23th of January of 2015), cost 0.0825 US dollars, now supposing that a long-term investor had bought 10,000 contracts, it would have spent 825 dollars and then it would have forgotten about it, considering this investment as a sunk cost. After six months, the barrel of Brent was traded at 49 dollars per barrel; it means a payoff of 46 dollars per barrel, a profit of 460,000 US dollars investing only 825; a 55,657.58% of profitability. Despite options are usually used for hedging strategies, they are also used for speculation and this kind of speculation is considered like a bet that when pays off, can literally be impressive. This kind of operation are not the most common and the probability of their success is low, for this reason we named the premium that they paid “the price for hope”.

Other speculators, works mainly with the information published in different market and geographic areas and speculate on the result publishe, we can summarize in few words how the market react in the minutes after the divulgation of information: in case the results are better than the forecasted the market will react with increasing long position and consequently with an increase price, in case the results were worse than expected the price will drop because of those investors who sell the underlying preferring other investments, in case the results were close to the forecasted the price could depend from the press conference in which members of the board, typically the CEO, comment the results and answer to the questions made by

journalist. When we of central bank choices, the press conference is much more important than the releasing data. The reason is that a central bank cannot change its policy suddenly due to its long-term project and data are already analysed by economist and professionals of the sector, but the informal information is the most important because drawn a line for the next future and the most emblematic example is the comment of the president of the European Central Bank, Mario Draghi, saying regarding the new monetary policies for rescuing the Euro “whatever it takes”.

In order to show how much is important today the information realising, we make a real example of what happened to Mattel, the American company manufacturer of toys world widely known like its dolly Barbie.

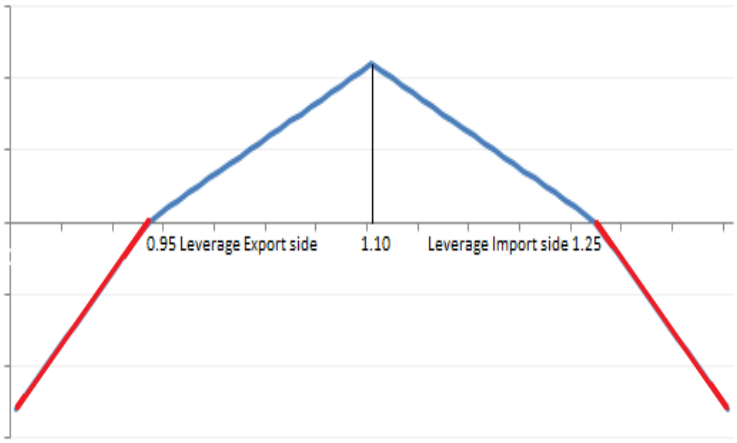
6.2.2 Chart: Price of Mattel 19th and 20th of April of 2017

This is the chart of Mattel the 19th of April of 2017 and 20th of April of the same year. We can observe how in one day the company has lost the 13.50% of its value in few hours, and the reason was the worst data released than the expected and the lack of clear strategy of the future. The data are usually published before the session opens and there is a gap of over 1 dollar between the closing price of the 19th and the opening of the 20th. Speculators in this scenario could have taken a short position with CDFs, only private investors, or with equity forward contracts (they work exactly like normal forwards, but they are on equity assets), assuming a high degree of leverage due to the high probability that the market would have punished this data. In order to give more strength to the importance of information, we also assume that the speculator has chosen to take a short position only during the second 15 minutes, since the second candlestick of the 20th of April and we also suppose that the speculator closes its position during the day 20th of April. In this scenario, the speculator would have obtained a profit of 1 dollar, selling at 22.80 and buying back at 21.80; it would mean a profitability of 4.59% in one day if the investor would have invested in spot market, without any degree of leverage. In case the investor had chosen Equity future contracts, it could have generated a

profitability much higher, because with future contract is asked to deposit from the 5-10% of the contract value, it means a profitability of 45.90% in one day. We did not consider CDFs because the grade of leverage could be even higher, but an investor who takes care to the earning calendar may have a lot of changes of make profit in just few hours.

This kind of information is predictable, but it happens also with other information that does not have a calendar and one example could be Whole Foods Market: it was traded at 35-33 US dollars per share and when the colossus Amazon declared that it was interested in buy it, the share price went up until 42.70 us dollars. In this case the profitability is even higher than the Mattel case and for these reasons there are many controls and investigation about the felony of insider trading.

The strategies that we have analysed in the "Hedging" section with options, can be built also for speculative purposes; the building of these strategies are equals opposed to the hedging strategies obtaining profit from increasing prices and reducing costs assuming risk. Despite the risk taken could be considered the same in hedging strategies as speculative strategies, but speculators (due to their purposes) are more open and willing to assume risk, even increasing the degree of leverage in their strategies. Another contract that speculators, those who trade in Forex, is the Pivot TARF: in this contract, the buyer establishes a certain objective that would like to achieve in absolute value fixing 3 values: Reference value, Export leverage and Import Leverage, then with a fix frequency an exchange rate will be observed and depending from the spot market at the observation, the speculator would earn part of its objective or will have a loss leveraged.



Total nominal	**$10,000,000**
Objective	**$150,000**
Number of observation	**50**
Frequency	**weekly**
Reference rate	**1.1000**
Export leverage 0-10	**0.9500**
Import leverage 0-10	**1.2500**
Export leverage 11-50	**1.1750**
Import leverage 11-50	**1.0250**

6.2.3 Chart & Table: Pivot TARF

With this example, the speculator would be willing to exchange 200,000 US dollars against Euros every week and the possible scenario are 4: if the exchange rate was lower than 0.95 the buyer would sell 400,000 USD at 0.95; if the exchange rate was between 0.95 and 1.10 so the buyer would sell 200,000 USD at 0.95; in case

the exchange rate was between 1.10 and 1.25 the buyer would buy 200,000 at 1.25; and in the end, in case the exchange rate was higher than 1.25 then the buyer would buy 400,000 USD at 1.25. The characteristic of this product is that once the objective is achieved (in this case 150,000 USD), it becomes null and ends giving to the buyer a pure profit. With this data, the worst scenario among the best scenarios would be that the exchange rate would be during the first 10 observations would be higher than 1.1750 and lower than 1.0250; levels never touched during the last 2 years and half. In case the objective had not been achieved with the first 10 observation, then the leverage levels would be much closer and the risk of having leveraged loss along all the duration of the contract would be more probable. Another problem regarding pivot TARF is that is not affordable by everyone, but only by those investors who hold high amount of currency and are willing to hold this kind of position.

7 CONCLUSION

With this End of Master Project, we had the possibility to understand better the whole and complex world of derivatives and their fundamental importance for everyone by different reasons. We started this paper analysing some bankruptcies due to a bad management of derivatives and the reasons of the worst financial crisis of this century which started with the end of one of the most important investment banks in the world, Lehman Brothers. The main reason of the financial crisis was the excessive leverage of the bank on derivative on the US real-estate market which was living a bubble phase; when the bubble burst, Lehman Brothers had to recur to the chapter 11 (bankruptcy liquidation) leaving behind its a hole of 613 billion of dollars of debt. We analysed how the whole set of derivatives is a negative-sum game, due to the commission and fees that investors have to pay when they take a position in the market when the pure structure of derivatives are a zero-sum game. We also analysed that the pricing of derivative why the price of can be lower or higher than the spot market, explaining the fundamental difference between backwardations and contango, fundamental concept for those who want hedging or speculating through futures.

Another aspect that we can consider now in the conclusion regarding derivatives, is that all the derivatives can be used for any kind of underlying asset, despite the characteristic of each derivative is unique (e.g. a SWAP cannot behave like an option) and for being possible, there are derivatives on derivatives. Along the study which made possible the writing of this paper, we incurred in derivative of derivative and the most emblematic example was the long-term strategy on Brent: when we explained the strategy of buying an option on Brent totally out of the money, we considered that the option contracts were on the future contracts of Brent and not in the spot market; commodity spot markets are for those who need to sell or buy

the commodity physically when we were explaining one strategy used by speculators that are not interested in holding or delivering the commodity.

One concept that we analysed deeply, was the concept of hedging mixed to speculation. We observed how there are only few products and strategy that can be defined “purely hedging” and how companies prefer mix products of hedging with speculative for reducing costs or obtaining better prices. We also analysed how companies which operate in Forex market, the market where companies operate mainly, are willing to sign leveraged contracts with exotic barriers to obtain better conditions. At the beginning of the section “5. Hedging and Speculation”, we observed how sometime the hedgers use hedging strategies with speculative purposes, betting on the negative scenario. This concept of “camouflage” depends from the purpose of the investors, if it is a long-term investor, a short-term investor or a speculator; the same strategy may have different interpretations depending from the objective of the investor.

In the end, we evaluated the concept of speculation, which always is associate to a negative thing, whereas is fundamental in many cases in order to avoid big changes in prices and give a fair price to the long-term investors. We observed with true cases, how information is crucial for the short-term investors and how derivatives may generate extra-profits to those that are willing to assume a leveraged position. The long-term speculator is willing to invest small amount of money and consider them like a loss, “gambling” on the improbable scenario, “paying for hope” and generate unbelievable earnings in the case a crisis or an incredible increase hits the underlying asset in which the investor put its “bet”.

In the end, we can assure that derivatives are complex and must be managed carefully because are much riskier than spot market; on the other hands, derivatives allow to make great thing that would be impossible if existed only the spot market: they allow to hedge risk, they can allow to take position with little money and allow you to take positions completely out of the money and also out of the market. The most important thing regarding derivatives is that if you are investing in them, although it does not seem, you are losing money because of its negative-sum game; thus, everyone should know properly the properties of them before creating a new bankruptcy.

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