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Derivative instruments and their role in economic history: causes and implications of the 2008 sub-prime crisis.

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INTRODUCTION

The complexity of the economic system is a matter that has been deeply studied during the course of history and financial instruments are some of the most up-to-date tools at man's disposal in order to shape the modern economy and change the way we do business. The way in which new instruments are used to protect our interests and speculate on new markets is constantly evolving, and has been ever since it was invented; the aim of this paper is to explore the origins of these financial instruments and their evolution during the course of history. Derivative instruments have marked some relevant events in economic history that we can trace back to the 17th century, we can take reference from these events to better understand the irrational exuberance that constitutes human behaviour in economic crises. Exploring the complexity of these instruments is of paramount importance in order to comprehend the way the economy behaves during a financial collapse. The first part of this paper will go in depth with the historical overview regarding the rudimentary applications of financial derivatives, its initial forms and uses, then stemming into their first speculative use, and finally overviewing some important financial crises in history. The second part will focus briefly on some economic theories regarding basic derivative instruments with an outline on options and future contracts. The focus of the paper will gradually shift towards the 2008 subprime crisis; it is important to understand the complexity of the instruments involved in the episode in order to appreciate the scale of such event. Securitization is a fundamental element of the subprime crisis, its implication and extent will be thoroughly analysed in the third chapter. In light of empirical evidence and theories explained in the first part of the paper, it is interesting to make some considerations on the latest financial crisis outlining its main causes and how securitization played such an important role in it, culminating in a comparison between the Dutch tulip crisis and the subprime crisis.

CHAPTER I: HISTORICAL OVERVIEW

1.1- RUDIMENTARY APPLICATIONS AND DEVELOPMENT OF DERIVATIVE INSTRUMENTS

"Three kurru of barley, in the seah-measure of Shamash, the mesheque measure, in storage, Anum-pisha and Namran-sharur, the sons of Siniddianam, have received from the naditupriestess Iltani, the King's daughter. At harvest time they will return the three gur of barley in the seah-measure of Shamash, the mesheque measure, to the storage container from which they took it. Before (two witnesses whose names are listed). Month Ulul, 19th day, year in which King Abieshuh completed the statue of Entemena as god."[1]

This tablet from 1700 BC[2] where two farmers received a certain amount of barley and had to return it at harvest time, is one of the first tangible demonstrations of a derivative contract. The two brothers probably used the barley as seed stock for planting a field, and the transaction may be viewed either as a commodity loan or as a short-selling operation in which the brothers borrowed barley to plant the crop and then return it after the harvest. Unlike modern financial economics textbooks would suggest, the world of derivatives goes far back in time. The emergence of contracts for future delivery managed to enhance the efficiency of agricultural markets in Mesopotamia and also were a prerequisite for the expansion of long-distance trade. Subsequently we can encounter the rudimentary use of derivative instruments during Greek civilization in 1000 BC[3], although it is more difficult to account for the use of these documents than for Mesopotamia since Greek civilization was less interested in, furthermore they did not utilize clay tablets to conduct business contracts. Greek law tended to favour spot transactions rather than long distance trade, but this does not mean they did not mean that the latter type of contracts did not take place; as a matter of fact it happened over the counter as many Greek laws were against derivatives, although Athens allowed contracts for future delivery in sea-borne trade since it depended very much on grain imported from Egypt. Indeed, Hellenistic Egypt is another period in history where commercial contracts managed to survive thanks to the use of a very durable material: papyrus, said to be almost as durable as earlier day clay tablets. The Romans, who were very much inspired by Greek culture, initially adopted the same restrictions on contracts for future delivery, but soon had to catch up with the

[1] Swan, Edward J. *Building the Global Market: a 4000 Year History of Derivatives*. Hague: Kluwer Law International, 2000.
[2] Swan, Edward J. *Building the Global Market: a 4000 Year History of Derivatives*. Hague: Kluwer Law International, 2000.
[3] Swan, Edward J. *Building the Global Market: a 4000 Year History of Derivatives*. Hague: Kluwer Law International, 2000.

commercial realities among the empire which were in contrast with their legislation; reason for which Roman law adapted to the necessities of the empire allowing for these kind of contracts during the third century BC. According to Sextus Pomponius (lawyer during the second century AD)[4], there existed two kinds of contracts: **vendito re speratae** and **vendito spei**. The former provided insurance against crop loss and potential hazards of long distance trade, and was void if the seller did not have the goods at delivery date; the latter was a contract that did not provide for any kind of mercy to the seller in case he was unable to deliver the goods. Roman law also upheld the principle of privity of contract, this meant that a contract was non-transferable because a third party would have been unable to enforce it. These kinds of rudimentary derivative contracts differ in some way to modern financial instruments, but they also resemble them in many ways, evolving throughout the centuries, shaping the world economy and changing the way people perceive the idea of trade itself. Up until now, we have seen how primary forms of contracts for future delivery have emerged during various historic periods; it is during the ***Renaissance*** though, where the first security markets began to take shape, between the fourteenth and the seventeenth century[5]. Along the course of this period of great innovation and progress, the most economically advanced regions in Europe were the Italian city states, which early on in the twelfth century began to issue so-called ***monti shares***. By the thirteenth century these shares had become negotiable, making them tradable in secondary markets. Monti shares were effectively the first securities to be traded on secondary markets, followed later on by ***bills of exchange***[6]: they provided means of exchange in long distance trade between the fifteenth and twentieth century and could pass through many hands since they were freely transferable. During the course of the sixteenth century merchants began to realize that there was no need to settle forward contracts by necessarily delivering the underlying asset, but it was sufficient that the losing party compensated the winning party for the difference between the delivery price and the spot price at the time of settlement. Among the various trading centres in northern Europe, Antwerp was the first where the above described ***contracts for differences*** where used on a large scale. These kinds of contracts were the precursors of modern futures contracts; likewise future contracts are usually settled by paying the difference between delivery price and spot price of the underlying asset but futures have some kind of safeguard. In a futures contract both

[4] Swan, Edward J. *Building the Global Market: a 4000 Year History of Derivatives*. Hague: Kluwer Law International, 2000.

[5] Swan, Edward J. *Building the Global Market: a 4000 Year History of Derivatives*. Hague: Kluwer Law International, 2000.

[6] The buyer of some commodity accepted a bill of exchange and passed it to the payee instead of sending gold or silver coins. The payee either held on to the bill until maturity or he sold it to a third party. The holder of a bill earned interest because bills were traded at a discount that gradually diminished until maturity. The domestic currency price of foreign bills of exchange was the exchange rate.

parties must maintain a ***margin account***[7]where some money has to be paid upfront. The use of margin accounts reduces the risk of futures contracts because daily price changes are smaller than cumulated price changes over long periods of time. Contracts for differences were much less secure because they were settled by a single, potentially much larger cash flow at a distant date. The concept of a "derivative contract" has become known to the common persons only recently, after the 2008 financial crisis, when the economic disaster brought to everyone's attention the consequences of an inadequate management of the financial system. It is in that period that words like "sub-prime" mortgages and "derivatives" became known and talked about by the public. One would tend to think that the financial world, and more specifically the world of derivatives is an invention born in the more recent years; as a matter of fact it is false, since during the seventeenth century the ancestors of modern day ***options*** and ***futures*** were circulating on the Amsterdam stock exchange, one of the first examples of a proper financial market. The financial needs of maritime trade created a supply of forward contracts and securities, which included bills of exchange and shares of joint-stock companies. Investor's interest was mainly dedicated to the ***Dutch East India Company*** and the Dutch ***West India Company***[8], insurance on the risk of ships not returning from their various trips was important, as was investing in the company's shares continuously growing in value. A peculiarity of the Amsterdam exchange was that most of the shares were traded on term; indeed, the use of term sales was very common with wheat and herring, therefore many forward contracts on shares were settled as contracts for differences[9]. The enthusiasm in the Company was soon slowed down by its lagging development; it was then that entrepreneur Isaac Le Maire conducted what was maybe one of the first ***short-selling*** operations in financial history[10]. The man took advantage of the underperforming East India Company, he borrowed shares and then sold them profiting from the fact that he could return them later on buying them at a lower price. Contracts for difference are not so different from short selling after all: in the former, the expected profit depends on the difference between the expected future spot price and the delivery price, while in the latter profit is determined by the difference between expected future spot price and current spot price. Short selling attracts disregard from the public when prices are falling, the reason is that it creates an excess supply of the asset that amplifies the depression in prices. Short selling was banned in Amsterdam in 1610[11], even though restriction on the matter were very difficult to

[7] A margin account is a brokerage account in which the broker lends the customer cash to purchase stocks or other financial products. The loan in the account is collateralized by the securities purchased and cash, and comes with a periodic interest rate.
[8] "The World Standard in Knowledge since 1768." Encyclopædia Britannica. Encyclopædia Britannica, inc. https://www.britannica.com/.
[9] Dillen, J. G. van. *Isaac Le Maire Et Le Commerce Des Actions De La Compagnie Des Indes Orientales*. Paris, 1935.
[10] Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.
[11] Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.

enforce. It was very impractical to determine whether a seller effectively owned an asset or if it was instead borrowed, reason for which the ban was ineffective.

1.2- FIRST SIGNS OF SPECULATIVE BUBBLES AND RECESSIONS

After the development of proper financial markets like the one in Amsterdam, speculation and trade developed in parallel with the market. Trade volumes grew more and more every year and also speculation along with it. Between 1636 and 1637 a speculative frenzy occurred in the Holland[12], it is known as the first major financial bubble in history and it is still today a model for the general cycle of a bubble. The so-called ***tulipmania*** is a period where investors began to wildly purchase tulips, pushing their prices to exceptional highs. The price of a tulip could often exceed the value of a house; investors behaved irrationally during this period and there was certainly space for speculation during the process, done through the use of ***contracts for differences***[13] and possibly options. Psychological biases led to an enormous upswing in the price of tulips, followed by positive feedback and a consequent inflation of prices. Collapse of the market was inevitable when investors began to realize the actual value of the asset they were holding. Although contracts for differences were outlawed in Antwerp already in 1541[14], Amsterdam realized it was inefficient to completely ban them, but rather it was more useful to make them unenforceable courts. This however did not prevent the use of contracts for differences during the tulipmania; derivative markets continued to function because investors valued their credit and reputation a great deal more than they valued their possibility to win in court. The failure to honour a contract would have made a speculator an outcast, excluding him from future transactions or dealings, derivative trading was mainly based on reputation. The consequence of the absence of legal enforcement of derivative contracts was of course that they were traded over-the-counter; the default risk of the aforementioned was characteristic, because it depended on how much an investor valued his peace of mind. The absence of legal enforcement of these contracts can explain why the tulipmania did not in the end lead to a strong economic recession; since holders of long forward contracts had the right to deny their validity, there weren't any major bankruptcies when the price of tulips collapsed in '37. England's financial system had a lot to learn from the Dutch's achievements and relied mainly on the same administrative, scientific and commercial accomplishments; in the 1560s ***The Royal Exchange*** was born[15]. The establishment of the Bank of England in 1694 introduced

[12] Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.
[13] By the time of the tulipmania, contracts for differences had been used in Holland for about a century.
[14] Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.
[15] Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.

Exchequer Bills[16], which the bank discounted together with bills of exchange; by buying Exchequer Bills, the bank monetized public debt and gave rise to a money market where these bills and bills of exchange were traded. The next major bubble in history occurred after the creation of the ***South Sea Company***[17]: it relied on the exclusive right to trade with South America, although this right turned out to be illusory because Spain restricted the trade between South America and Britain to one ship per year. Instead, the Company became a mean to consolidate and reduce the cost of national debt; it bought long-term government bonds and issued shares. The initial enthusiasm for the possible success of the Company drove the prices to a rise and the shares sold well, but the hopes were certainly too high seen that the restrictions to one ship per year and the taxes on the slave trade did not allow for such high earnings. These over-expectations led to the so-called ***South Sea bubble*** in 1719[18]; prices were overestimated and irrational behaviour together with speculation led to their inflation. During the bubble, the main tools for speculation were ***call*** and ***put*** options, where the former were called "refusals". In addition, there also was an innovative instrument: the Company issued partially paid shares that investors could buy by making several instalment payments, if the share price fell below a certain value one could refuse to make the next payment, forfeiting the option on the shares. Certainly, the economic repercussion of the South Sea bubble was more severe than the one seen after the tulipmania; unlike the latter, speculators could not abandon a contract easily, there was a more rigorous enforcement of financial contracts and this led to a greater number of bankruptcies when the bubble burst. The South Sea bubble was the first financial crisis with an international scope; a similar matter occurred in Paris with the ***Compagnie des Indes*** some months before what happened in England[19], this suggests that panic spread from France to England and other parts of Europe.

1.3- THE RISE OF DERIVATIVES IN THE TWENTIETH CENTURY

The 1990s, in which several remarkable international financial crises were experienced around the world can be defined as the international financial instability and financial crises era of the history of political economy. Derivative instruments had a fundamental role in the international financial crises experienced around the world since 1990 such as the Mexican crisis of 1994, the South East

16 British short-time bill of credit or promissory note issued by governmental authority and bearing interest, also known as a modern day treasury bond.
17 British joint-stock company founded in 1711.
18 Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.
19 Weber, Ernst Juerg. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*, 2008.

Asian crisis of 1997 and the Russian crisis of 1998[20]. It is argued that derivatives, designed to hedge currency risks and thus to prevent financial instability after the collapse of the ***Bretton-Woods***[21] system, exposed developing economies to remarkable risks and financial instabilities in the 1990s and they played a much greater role than previously estimated in the international financial crises. The restructuring of the world economy since the 1980s went through a period of policies of liberalization, deregulation of financial markets and globalization; the latter had a three-sided structure, which consisted in liberalization of trade policies, multinational companies' operations and liberalization of financial markets. All tariffs, quotas that obstruct free trade, had been banned within the ***GATT*** [22]and the ***WTO***[23], thus liberalization of international trade was tried to be realised. In addition to this, with the help of regional organisations such as the ***EU*** and ***NAFTA***[24], economic integration among countries was tried to be maintained. The most significant results were obtained thanks to financial liberalization, especially for developing countries: in this regard many of these countries underwent complete and rapid liberalization in order to open up their financial markets to both greater capital flows and a wider array of capital vehicles. This resulted in greater volatilities in interest rates and exchange rates since these instruments were relatively new in developing countries both for investors and authorities. Derivative markets were poorly structured and improperly regulated; the result was that derivatives were open to be used for economically harmful purposes, they were used for taking high risks and escaping from regulations. Therefore, although these instruments were designed to build financial stability thanks to their potential economic benefits such as risk shifting, they caused financial instabilities and market failures such as moral hazard, which come from the asymmetric information problems that can be commonly seen in financial markets, leading to financial crises by triggering the massive and rapid capital outflows. Financial crisis occurs when serious economic problems happen due to very large fluctuations in foreign exchange markets or Stock Exchange and also due to significant increases in defaults of bank credits. The financial crises of the 1990s in developing countries were experienced under fixed exchange rate systems with highly liberalised and weak financial markets where huge foreign exchange and credit risks were seen, together with high leveraged positions being taken through the use of derivatives. The main problem with developing countries was that speculators took large positions against pegged exchange rates as short in local currency in derivative markets either forward, ***swap***, futures or put options. These positions created liability for dealers in term of foreign

[20] "Financial Stability and Financial Crises: The Role of ...". https://www.boeckler.de/pdf/v_2007_10_26_sarialioglu-hayali.pdf.
[21] Fixed exchange rate system established in 1944.
[22] General Agreement on Tariffs and Trade: Agreement to eliminate and reduce trade barriers.
[23] World Trade Organization: intergovernmental organization concerned with the regulation of international trade.
[24] North American Free Trade Agreement: Trade bloc consisting of Canada, Mexico and U.S.

exchange in the future. Since everybody in the weak currency market was short in local currency, synthetic forwards or swaps were created to offset this. Consequently, the dealers borrowed in local currency now and created local currency liability for the future, they bought foreign exchange with local currency in the spot market and invested this amount in foreign exchange assets. In a short amount of time, forward rates started to constitute a signal for devaluation, then everybody went short for local currency, and finally exchange rate systems collapsed creating self-fulfilling expectations and thus, a self-fulfilling crisis.

1.4- The collapse of LTCM

LTCM was a ***hedge fund*** created with means of speculative investment and directed by Nobel Prize winners, professors, former ***Fed*** (central bank of the United States of America) governors and high-profile technicians. It was a company founded in early 1994 and based in Connecticut[25]. The LTCM fund was a hedge fund, i.e. an investment fund that is not subject to the constraints typical of traditional funds in implementing its strategy; it can therefore operate in all markets and with all financial instruments and in particular it can: sell short, operate without any limit with derivative instruments, use ***leverage*** without any limit; this particular hedge fund used convergence trading, a strategy that generally uses bonds and derivatives for hedging purposes. The groundwork for Long-Term Capital Management began when ***John Meriwether*** joined the investment bank ***Salomon Brothers*** in 1974[26]. After his forced resignation, Meriwether went on to build his own fund with the intention to keep on doing what he did so well during his time at Salomon Brothers. Meriwether set up his own hedge fund for arbitrage using mathematical models to predict prices. Composed of industry veterans and respected academics, the firm launched in 1994 with $1.25 billion in capital. Meriwether set a whole new standard for hedge funds in that period: his goal was to raise a capital of $2.5 billion, the asking fees would be 25 percent of profits in addition to an annual two percent charge on assets. Investors were also required to keep their capital in for a minimum of three years; very uncommon standards for a hedge fund[27]. To give credibility to the fund and justify these standards, Meriwether recruited some faces that would provide such believability, which included ***Robert C. Merton***, ***Myron Scholes*** (future Nobel prize winners in 1997) and ***David Mullins*** (vice

[25] "Il Caso Del Long Term Capital Management (Ltcm)." PT> Il caso del long term capital management (ltcm).
[26] Bottarelli, Mauro. "Business Insider Italia." Business Insider. Business Insider.
[27] Amadeo, Kimberly. "How a 1998 Bailout Led to the 2008 Financial Crisis." The Balance.

president of the Federal Reserve). Despite the multiple rejections from investors like Warren Buffet, LTCM managed to launch in 1994 with an enormous amount of funding of $1.25 billion[28]. Long-Term Capital Management was a fund which assumed that there are inefficiencies in the market that will disappear in the long term. The manager relies on these anomalies, hoping for a process of convergence of values, and the difference between the values is small and offers a limited gain. That is why managers using this strategy make considerable use of leverage to increase returns. The LTCM used a financial model, derived from the most up-to-date scientific research, which made it possible to track market interest rate curves and identify assets that differed from the theoretical values expressed by the curves in an extraordinarily realistic way. This financial "monster" handled a large amount of money from the main American and European financial institutions, and also from pension funds. It had capital of $2.2 billion, but loans from banks worth $125 billion, a leverage of 55 times. With such leverage, a 2% adverse movement was enough to lose 100% of the capital. Despite the movement of this large capital, the securities market remained very much tied to risk, fluctuations and the unpredictability of things. The strategy of the fund was to keep a highly probable small gain against a large, highly unlikely loss[29]. But things didn't go exactly as planned. The first bump took place in 1997 after the fall of the Asian markets, when investor sentiment came to a change. Banks began to withdraw from more risky investments; amid global panic, people moved to treasury bonds causing the spreads to widen. Volatility rose in the U.S market and LTCM was losing on every bet they made. The apex of the problem came when in 1998, Russia announced it was devaluing its currency and later defaulted on its debt; markets around the world started sinking. Investors pulled out wherever they could, the whole world was going down. LTCM lost half a billion dollars in one day (fifteen percent of its capital), in one month it had lost nearly $2 billion. Leading representatives of the banking world were urgently summoned on September 23rd 1998 to the Federal Reserve in New York to contemplate the multi-billion dollar hole caused by the failure of Long Term Capital Management. The linear logic of finance at that point prospected two alternatives: either leave LTCM to itself, risking the financial world would implode suddenly under a chain reaction of insolvencies, or keep it afloat with a robust injection of money from a consortium of banks. Despite the raging liquidity crisis, the fourteen banks conveniently chose to "survive". They agreed among themselves to take over LTCM by contributing $3.75 billion together[30].

[28] Amadeo, Kimberly. “How a 1998 Bailout Led to the 2008 Financial Crisis.” The Balance.
[29] Amadeo, Kimberly. “How a 1998 Bailout Led to the 2008 Financial Crisis.” The Balance.
[30] Amadeo, Kimberly. “How a 1998 Bailout Led to the 2008 Financial Crisis.” The Balance.

The huge bubble of fictitious capital that dominated world markets had to be rejected or refinanced, but this financing was facing an unprecedented hyperinflation. In fact, two weeks later the Fed had to decide on an inevitable reduction in interest rates. The LTCM, as mentioned above, brought together important people in the Wall Street financial services industry, bankers with experience in the financial control system and the best brains in mathematics: together they had developed one of the most formidable betting systems imaginable, capable of grinding profits to billions of dollars. The fund had capital above the 100-billion-dollar threshold, and according to some estimates up to 400. By "betting" the capital raked in as collateral, the hedge fund could engage in derivative transactions worth over a trillion dollars. According to The New York Times, inspectors examining LTCM's accounts found that investors' deposits, $4.75 billion worth of capital, had been used as collateral to buy $125 billion worth of securities, and then use those securities as collateral to participate in exotic financial transactions worth $1250 billion[31].

The fund had bet on the fact that in the long term there would be a convergence of the interest rates of the main industrialized nations, according to the parameters defined by the mathematical model of Merton and Scholes. Behind this reasoning is the theoretical assumption that what happened in the recent past defines what will happen in the future, a logic underlying almost all computerized models of world finance. Reality, unlike computer logic, is not linear. Computer models that take into account all analyses of financial data from the past cannot predict the reality that exists outside their linear and statistical universe. In practice, LTCM's financial models were unable to predict the systemic shocks that occurred in Asia and Russia, which caused the financial world to panic and triggered the race for savers to invest in German and US Treasury bonds. Unfortunately, government leaders did not learn from this mistake. The LTCM crisis was an early warning symptom of the same disease that occurred within the 2008 global financial crisis.

[31] Amadeo, Kimberly. "How a 1998 Bailout Led to the 2008 Financial Crisis." The Balance.

CHAPTER II: DERIVATIVE PRICING MODELS

SEC.1- BASIC DERIVATIVE INSTRUMENTS

2.1- KEY CONCEPTS ON OPTIONS

An ***option*** is a financial contract that gives the buyer the right (but not the obligation), against payment of a premium, to buy or sell a certain quantity of an underlying asset at a fixed strike price at a future date. This future date, also called expiration date, coincides with the expiration date of the contract in the case of a European type option, while if the option is American type, the expiration date is the date by which the option right can be exercised. Before moving on to the dynamics and opportunities offered by options, it is appropriate to consider what specifically these instruments are and what the basic mechanisms are. Options are derivative instruments, i.e. their value depends on the value of an underlying asset, which may be real or financial in nature. Options are therefore functions of a certain asset and their yield depends on the value of the underlying security. The ***premium***, is the price that the buyer pays to acquire the option right, while the price at which the option will be exercisable, is also called the ***strike price***. The premium is the only certain disbursement for the buyer and the only insured income for the seller at the time the contract is concluded. This point, as will be seen below, is a very relevant discriminating factor. When choosing the financial instrument to invest in, for example, is it more convenient to choose the option that has a share as its underlying, or to invest in the share itself? Both choices have pros and cons. Options are called asymmetric derivatives, by virtue of the fact that only the seller is obliged by the contract. The buyer is only buying the right to decide whether or not to exercise the option he acquires under the contract. The characteristics and flexibility of options give the possibility to implement different strategies, also depending on the aim pursued by the operator. There are basically three types of operators operating in the market:

- ***Speculators***: those who seek profit in the price changes of the options themselves, taking advantage of the fact that with a single option, and a reduced investment, you control a much higher number of units of the underlying (usually the ratio is 1:100). In addition, with the help of leverage it is possible to increase profits and losses proportionally.
- ***Hedgers***: those who use options as a hedge, to insure their investments from unfavourable market fluctuations.

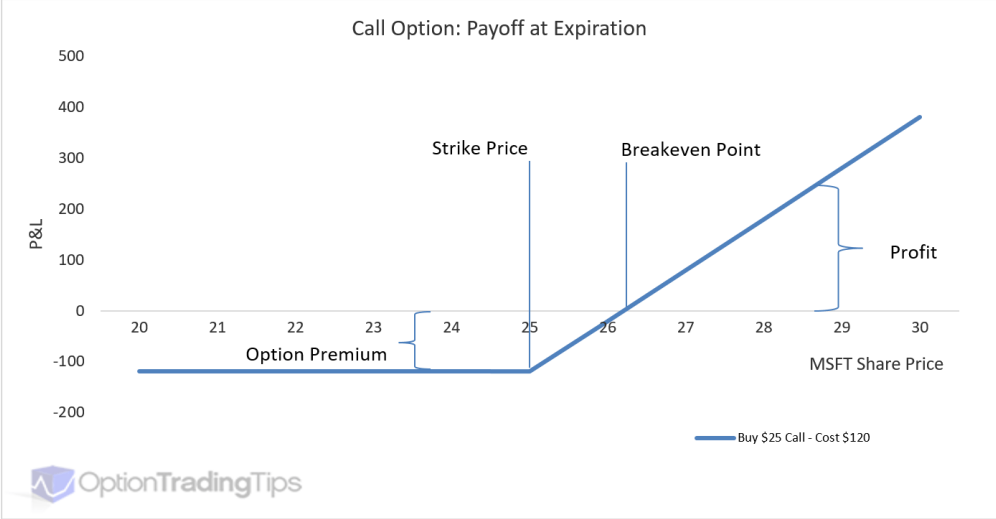
- ***Arbitrageurs***: those who seek to profit from price asymmetries between different markets, guaranteeing zero risk gains.

As has been pointed out, the option right may consist of the right to buy or sell the underlying asset, depending on the type of option chosen: Call or Put.[32]

2.2- CALL AND PUT OPTIONS

Depending on the requirements, an investor will buy, or sell, a call option or a put option.

- The ***Call*** option guarantees the buyer of the option the right to buy the underlying asset. If the option relates to an index, of which it is clearly not possible to receive the underlying asset, only a cash consideration will be obtained. Of course, the exercise of the call option right will only be advantageous if the strike price, added to the premium, is lower than the spot market price, thus making a profit equal to the difference between the value of the option and the total price paid, as can be seen from the figure below[33].



From a speculative point of view, the call allows you to enjoy the rise of a large number of units of the underlying asset, without having to subscribe to them and therefore avoiding the related and costly outlay, but only paying the price for the option. If, on the other hand, you buy the call for hedging purposes, it allows you to insure yourself against any losses resulting from a rise in the value of the underlying asset. This is the case if the investor has

FIGURE 1

[32] Hull, John C. 2018. *Options, Futures, and Other Derivatives*. Harlow Etc.: Pearson Educational Limited.

[33] Figure from McPhee, Peter. 2017. "Understanding Option Payoff Charts." Optiontradingtips.Com. 2017.

another open position in which he or she is betting on the downside of the security in question.

- The ***Put*** type guarantees the buyer of the option the right to sell the underlying asset. The opposite rule applies here: the put option will be advantageous if, when the option right is exercised, the price paid by paying premium and strike price is higher than the spot market price. As shown in figure 2[34].

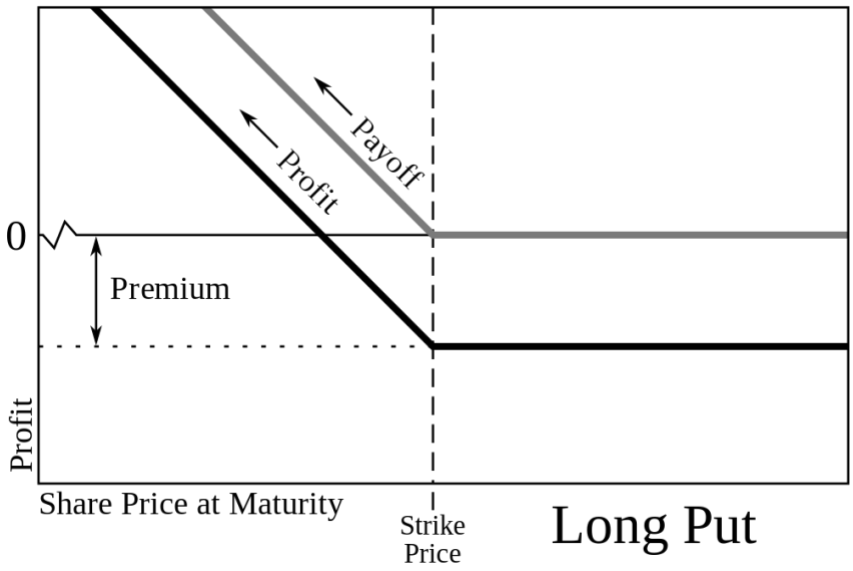


FIGURE 2

In essence, choosing a put option is the same as betting on the loss of value of the underlying asset, allowing you to profit with the market falling. Buying a put for speculative purposes, allows you to bet on the decline of an asset by taking much less risk than a short sale, because if the potential loss of a short sale is infinite, the purchase of a put limits this loss to the premium. A purchase for hedging purposes, on the other hand, insures the investor against price reductions in the underlying asset he owns. In this case, a fall in the value of the security below the strike price would be offset by the gain in the put.

34 Figure from "Put Option." 2020. Wikipedia. May 23, 2020.

In summary, the buyer of an option takes a ***long position***, while the seller of the option takes a ***short position***. We can therefore highlight four possible positions on options:

- Long on a call (right to buy);
- Short on a call (obligation to sell on demand);
- Long on a put (right to sell);
- Short on a put (obligation to buy on demand).

These types of options are so-called ***plain vanilla***, in the sense they are standard, they are the simplest form of options there exist.[35]

2.3- FUTURE CONTRACTS

Futures are financial derivative contracts in which the two parties agree to exchange a certain amount of an asset (financial or real) on maturity at a fixed price. They are standardised contracts and are mostly traded on stock exchanges. Thanks to this, they have a zero-counterparty risk, as the clearing house positions itself as the counterparty for all transactions.
In economic terms, futures, like all derivatives, can be used as a means of hedging, taking speculative positions, arbitrage or professional trading. Risks are hedged by entering into futures contracts so as to offset possible losses on the position of the underlying value against the economic results of the contract. It is, for example, possible to sterilise currency risks by means of currency futures: a debtor in euro resident in the United States may hedge the risk of devaluation of the dollar by purchasing contracts in euros, since a possible depreciation of the dollar against the euro results in the revaluation of the trader's futures position, offsetting it, in whole or in part, for the loss suffered by the principal position. In other words, futures are effective means of hedging the risk of undesirable changes in the value of a principal consisting of real assets (by executing commodity futures) or financial assets (by executing financial futures). A purely speculative objective is pursued when futures contracts are traded without an upstream position exposed to risk, or when the position taken on the derivative instrument increases the overall risk, rather than reducing it.
Arbitrage is, strictly speaking, the search for contracts that are mispriced against the spot market prices of the underlying products, or against the prices of other derivative products, or against the prices of the same product for different maturities. Such research should result in zero gain if markets are efficient and complete. The formula used to price a future, in the absence of arbitrage opportunities and at constant interest rates is:

$$F = Se^{rt}$$

35 Hull, John C. 2018. *Options, Futures, and Other Derivatives*. Harlow Etc.: Pearson Educational Limited.

Where ***F***: future price; ***S***: spot price of the underlying asset; ***e***: capitalisation factor; ***r***: interest rate (constant between conclusion and maturity of the contract); ***t***: duration of the contract. Futures are available on the main world markets and are available on commodities (commodity futures), financial products (financial futures), probabilities or events. ***Commodity futures*** cover all commodities, industrial and non-industrial. For agricultural commodities, precious goods and metals is a market of great importance for hedging risk and providing liquidity. For energy commodities (oil above all) it is an important indicator of future spot price trends, although in the period 2007-09 this forecasting capacity weakened. The share of these contracts traded off-market (***OTC***) is increasingly important and growing. ***Financial futures*** are written on any financial asset, such as currency futures, interest rate futures, stock index futures, equity futures, bond futures, Treasury Bond Futures, Treasury Bill Futures. ***Event Futures*** bet on the probability of an event, such as a creditor default, or the probability of rain (Weather future) affecting agricultural production[36].

SEC.2- PRICING THEORIES AND THE MODELS

2.4- PRICING THEORIES OVERVIEW

Historically, the assessment of options was entrusted to the intuition of investors. The road to the creation of an objective valuation model began in 1877, when the scholar ***Charles Castelli*** published the book "The Theory of Options in Stocks and Shares", in which some concepts began to be glimpsed, albeit at a distance. A first analytical approach took place at the beginning of the following century with the work of ***Louis Bachelier***: "Theorie de la Spéculation". However, it was not until 1955, more than half a century later, that the fruits of Bachelier's studies were collected by Professor ***Paul Samuelson*** of MIT, who in that year wrote an article entitled "Brownian Motion in the Stock Market". Soon afterwards, new studies focused in that direction and in 1962 ***A. James Boness*** wrote "A Theory and Measurement of Stock Option Value", proposing a very innovative valuation model. In the meantime, investors continued to operate in options based primarily on their intuition. In the early 1970s, however, the development of a new calculation model put an end to this era of intuitive valuation. In 1973, Samuelson, ***Fischer Black*** and ***Myron Scholes*** found the differential equation that served as the basis for the model formula. At the same time, the US economist ***Robert Merton*** published an article in which he came to essentially identical conclusions, albeit with a more general and not CAPM-based approach[37]. This model attributed

36 Hull, John C. 2018. *Options, Futures, and Other Derivatives*. Harlow Etc.: Pearson Educational Limited.

37 Weber, Ernst Juerg. 2008. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*.

value to options based on assumptions about share price developments. The underlying idea was that, if the underlying is traded on the market, the linked derivative security would implicitly already be priced. This led to various applications, from the theorization of a risk-neutral portfolio (hedging) to the construction of a portfolio that replicates the value of the derivative security. More specifically, the possibility of constructing an equivalent portfolio with the underlying asset and a free risk asset that replicates the same cash flows as the option under consideration was considered. This, taking into account that, in the simplified model, the price of an asset could, in each period, be only one of two values. Merton and Scholes received the Nobel Prize for economics in 1997, when Black had been dead for two years. Possessing a universally recognised valuation method, however, gave a great boost to the options market. At the same time, it stimulated the development of new theoretical elaborations and the search for alternative methods that could overcome the limits of the B&S model. In this sense, already around the middle of the century studies began on some complex computational methods: The Monte Carlo method. Its origins can be traced back to the early 1940s, when its fathers, ***Enrico Fermi***, ***John von Neumann*** and ***Stanisław Ulam***, concentrated their studies on the ***Manhattan project***. In 1979, moreover, the method known as the Binomial Model was born from a work by Cox, Ross and Rubinstein. The model still remains one of the most effective methods for the evaluation of options[38].

2.5- THE BSM MODEL

The most famous and most general option pricing model was developed in the early 1970s by Fisher Black and Myron Scholes (1973). Originally this model was developed to price European-style financial options (i.e. they cannot be liquidated before expiry) and since the first version it has contributed to and influenced all subsequent pricing models. An important contribution to the defined development of the Black and Scholes model undoubtedly goes to Merton who, on the basis of the 1973 version, has made changes and improvements. In the Black & Scholes model, as in the ***binomial model***, the basic assumption is that it is possible to create a portfolio equivalent to the option, consisting partly of units of the underlying asset and partly of risk-free bonds. The main difference with the binomial model is that in this case the assumption is that the returns are distributed among infinite states of nature according to a normal distribution. The Black and Scholes model allows to define and evaluate an option from the knowledge of fundamental variables that are:

S = Value of the underlying asset

38 Weber, Ernst Juerg. 2008. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*.

K= strike price of the option

t = option expiration

r= risk-free interest rate corresponding to the life of the option = volatility of the underlying

Given these values, Black and Scholes demonstrate that, in the presence of a geometric Brownian stochastic process (the stochastic process that corresponds to the hypothesis of lognormality of the instantaneous distributions of the reference variable), the value of the option can be obtained[39]. The Black and Scholes' method is based on the replicating portfolio idea. As there is no arbitrage possibility in an efficient market, this portfolio must have the same value as the option given by a combination of credit and debt assets and the risk-free underlying asset. The model assumes: that the price development of the underlying asset can be approximated by a log-normal process; that there is a perfectly efficient and frictionless market (including the absence of taxes and transaction costs); that the market interest rate is the same for deposits and loans and is constant over the life of the option; that the variance of the underlying asset is constant over the life of the option. If the market responds to these characteristics, the model under review provides a rigorous basis for calculating the value and risk characteristics of an option. The fundamental factor for this calculation is the variations in the price of the security. Financial theory has made several refinements to the Black and Scholes formula. In 1973 Robert Merton loosened the assumption of non-distribution of dividends in the period of exercise of the option. In 1976 ***Jonathan Ingerson*** loosened the constraint of the absence of taxes and transaction costs and Robert Merton removed the constraint of a constant interest rate. Several adjustments were also made to extend the formula to currency options, bonds, futures and interest rate options (caps; floors, etc.). Empirical adaptations have also been made to evaluate American options (which, unlike European options, give the holder the option to exercise early with respect to maturity). Several interesting conclusions can be found from the model, including the following:

1. The variable that most affects the assessment of the option is the volatility. The value of an option in fact does not depend on the speed with which the underlying asset grows. This allows two investors to look at an option in the same way, while having different opinions on the estimation of the underlying asset.
2. The price of a European option on a security (which does not pay dividends during its life) depends on five factors:
    a. Spot price of the underlying asset;
    b. Strike price of the option;

[39] Hull, John C. 2018. *Options, Futures, and Other Derivatives*. Harlow Etc.: Pearson Educational Limited.

c. Expiry date of the option;
d. Volatility of the underlying asset;
e. Risk-free interest rate.

3. It is never optimal to redeem an American call option before the expiration date, if no dividend is expected. This means that in the absence of dividends, the American option is on par with an identical European one. Conversely, if the underlying asset were to pay dividends, it could result in profit to redeem the call option prematurely. In this case, the American call would be worth more than the European equivalent. As far as the put options, however, it is possible that the premature exercise of it is preferable even when no dividends are expected. It follows that an American put is always worth more than a European type put[40].

In the absence of dividends, therefore, an American call will probably not be exercised before the deadline, this is due to two factors. First, the option protects the buyer from the possible growth of the underlying asset for the remaining life of the option, so as to insure the owner. Secondly, the exercise involves the payment of the strike price. Reasoning on the time value of money, the hypothesis that the investor decides to deprive himself of his funds in advance, is to be discarded. The most important difference, compared with the binomial model is that in the B & S model, the distribution of yields between the infinite states of the nature is assumed, according to normal statistical law. The B&S model is therefore the limit in the continuous binomial pattern, which, as you'll see shortly, is discreet.

In a nutshell, the B&S formula can be summarized as follows:

$$C_E(S,t) = N(d_1)S - N(d_2)Ke^{-rT}$$[41][42]

The formula gives the value of European call options for a non-dividend-paying stock. The factors going into the formula are S = price of security, T = date of expiration, t = current date, K = exercise price, r = risk-free interest rate and σ = volatility (standard deviation of the underlying asset). The function N(・) represents the cumulative distribution function for a normal (Gaussian) distribution and may be thought of as 'the probability that a random variable is less or equal to its input (i.e. d_1 and d_2) for a normal distribution'[43]. Where d_1 and d_2 are given by:

40 "Black-Scholes-Merton Model - Overview, Equation, Assumptions." n.d. Corporate Finance Institute.

41 Veisdal, Jørgen. 2020. "The Black-Scholes Formula, Explained." Medium. March 29, 2020.

42 Kenton, Will. 2019. "How the Black Scholes Price Model Works." Investopedia. 2019.

43 Veisdal, Jørgen. 2020. "The Black-Scholes Formula, Explained." Medium. March 29, 2020.

$$d_1, d_2 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}$$ [44]

In short, the terms in the sum of the B&S formula may be thought as the current stock price weighted by the probability that the option will be exercised minus the discounted price of exercising the option weighted by the probability of exercising the option. Even simpler: "what you are going to get" minus what you are going to pay".

The formula for a European put option has an equivalent form to the one for a call option[45]:

$$P_E(S,t) = N(-d_2)Ke^{-r(T-t)} - SN(-d_1)$$

2.6- THE BINOMIAL MODEL

The Binomial model proposed in a first version by Cox, Ross and Rubinstein in 1979 in "Option pricing a simplified approach", revised and completed by Cox and Rubinstein in 1985 in "Option Market", is one of the most effective methods to estimate an option's value. This model is based on a discrete approach, in which the time remaining until the option expires is divided into periods, within which the price of the underlying security can take only two alternative values, one that is favourable (***up*** state) and one that is unfavourable (***down*** state). The model logic is similar to that adopted by Black and Scholes with the difference that the binomial model is discrete. The binomial model uses discrete time and variables, modelling time as a series of points in which the uncertainty of the previous period is resolved and new decisions are made, making it useful to evaluate and price U.S options which can be exercised at any point during their lifetime. Uncertainty in variables is modelled by distinguishing only two different future states: up (u) and down (d) states. Each state occurs with a certain probability. At each moment in time, the price can go either up or down by a given percentage. When the stock price follows such a process and when there exists a risk-free asset, options written on the stock are easy to price. Furthermore, given appropriate limiting conditions, the binomial process converges to a lognormal price process and the binomial pricing formula converges to the Black-Scholes formula[46]. Comprehending the binomial model is much easier through an example:

Consider a stock whose price today is $50. Suppose that over the next year, the stock price can go either up by 10% or down by -3%, so that the stock price at the end of the year is either $55 or $48.50. If there also exists a call on the stock with exercise price K ± 50, then these three assets will have the following payoff patterns:

[44] Veisdal, Jørgen. 2020. "The Black-Scholes Formula, Explained." Medium. March 29, 2020.
[45] Veisdal, Jørgen. 2020. "The Black-Scholes Formula, Explained." Medium. March 29, 2020.

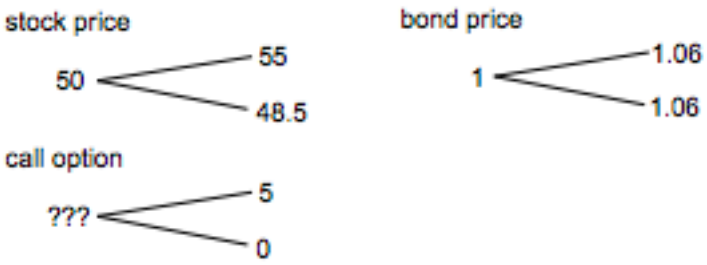


FIGURE 3

In this case the option payoffs can be replicated by a linear combination of the stock and the bond. This combination defines its price uniquely. To see this, denote by A the number of shares and by B the number of bonds which exactly replicate the option's payoffs. This gives the following system of linear equations to solve:

$$55A + 1.06B = 5$$
$$48.5A + 1.06B = 0$$

This system of equations solves to give A = 0.769231, B = -35.1959. Thus purchasing 0.77 of a share of the stock and borrowing $35.20 at 6% for one period will give payoffs of $5 if the stock price goes up and $0 if the stock price goes down—the payoffs of the call option. It follows that the price of the option must be equal to the cost of replicating its payoffs, i.e., call option price ± 0.7692 ` $50 ª $35.1959 ± $3.2656. This logic is called "pricing by arbitrage": If two assets or sets of assets (in our case—the call option and the portfolio of 0.77 of the stock and -$35.20 of the bonds) have the same payoffs, they must have the same market price.[47]

[47] Benninga, Simon, and Zvi Wiener. 1997. "The binomial option pricing model." *Mathematica in Education and Research* 6.

CHAPTER III- INSTRUMENTS INVOLVED IN THE 2008 FINANCIAL CRISIS

3.1- SECURITIZATION

Securitisation of loans is a very complex financial operation involving several actors. Despite its complexity, it generally takes place according to a standardised scheme. Securitization allows a company, known as an ***Originator***, to sell a portfolio of monetary loans by converting them into marketable securities. The latter (bonds) are debt securities that give their holder the right, at maturity, to repayment of the capital lent to the issuer plus interest on this sum. Securitization has grown dramatically in its use in the years before the crisis in 2007-2008, both in America and in Europe. The main actors in a securitisation transaction are:

- The ***bank*** assigning the loans to be securitised, the original creditor, known as the Originator.
- The ***assignee***, the vehicle company (***SPV***) that creates the negotiable securities.
- The ***investors*** who subscribe to the security.
- The ***rating agencies*** for the analysis of the securities resulting from the securitisation.
- The ***credit enhancer*** that issues special guarantees.

Banks have several securitization structures at their disposal***: traditional securitisation, synthetic, revolving, conduit and repackaging***. The underlying mechanism is quite simple, as the Originator bank sells a portfolio of non-negotiable credit to a specially created company which will convert these receivables into negotiable securities[48].

3.2- SYNTHETIC SECURITIZATION

The most important type of securitization after the traditional one is ***synthetic*** securitization. The main difference that can be noted is the synthetic nature of the transaction and the use of credit derivatives. As a matter of fact, unlike traditional securitization, the assets taken into account in the process remain property of the Originator and their economic effect is transferred through credit derivatives, i.e. the credit risk associated with the asset pool is passed on to investors as was also the

48 Pallini, Relatore, and Davide Loreti. 2016. "La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche."

case with the traditional process. As with traditional securitisation, the transaction is carried out through the use of a special purpose vehicle (SPV). The liabilities of the SPV, following a synthetic securitization transaction, but also other types of securitization, are mainly composed of ***credit linked notes*** (CLN)[49], divided into:

- CLN senior.
- CLN mezzanine notes.
- CLN junior.

These instruments are subscribed, as far as senior and mezzanine CLNs are concerned, by investors following a rating given by specific companies. In the case of junior CLNs, on the other hand, since they are subordinate and therefore riskier, they are subscribed by the originator bank itself. Synthetic securitization allows the credit risk of a portfolio of assets to be transferred but not the transfer of ownership. The transfer of risk takes place through credit derivatives, such as:

- Credit default swap (CDS): a derivative instrument under which a protection seller, against payment of a periodic premium, undertakes to pay another protection buyer a payment if, by a certain date, a third party becomes insolvent. Therefore, CDSs are instruments that protect against the credit risk present in a single asset or in a pool of assets held in the portfolio. There are different types of credit events that can be considered as default: non-payment; bankruptcy; declaration of insolvency; insolvency proceedings or debt restructuring. An agreement may be put in place between the parties where the protection seller's obligation is due as a result of a credit event only if a certain amount of loss is exceeded. There are two ways of liquidating the swap in the event of insolvency: cash, which provides for a payment to the counterparty equal to the difference between the initial and final value of the reference bond; physical, which instead provides for the purchase by the protection seller, at a previously determined price, of the reference bond in question.
- Total return swap (TRS): this contract provides for the exchange of the rate of return on a specific reference asset by the protection buyer with another type of cash flow that usually corresponds to the ***Libor***[50] plus a spread paid by the protection seller. The total rate of return includes the interest and principal payments provided for in the contract and, in addition, the appreciation of the reference asset during the life of the swap. The protection seller, on the other hand, corresponds to payments usually linked to the Libor plus a spread plus any depreciation of the reference asset.

[49] "Sharper Insight. Smarter Investing." 2019. Investopedia. 2019.
[50] The London Interbank Offered Rate (LIBOR) is a benchmark interest rate at which major global banks lend to one another in the international interbank market for short-term loans.

- Credit-linked note (CLN): is an instrument linked to the credit risk of a reference entity whose performance, with reference to any deterioration in credit quality or default, depends on the amount of interest payments on the notes and their repayment at maturity. These notes are issued by the protection buyer and subscribed by the protection seller. In the event that the credit event does not occur, the protection buyer reimburses the notes at par. If one of the credit events occurs, the protection buyer simply reduces the amount due to the protection seller by an amount equal to the impairment loss suffered by the reference entity as a result of the reduction in its performance.

Therefore, SPVs hold a pool of credit derivatives related to assets still owned by the Originator. This type of securitisation has a number of practical advantages for the Originator:

- This securitization process allows limits to be exceeded in some jurisdictions regarding the transfer of ownership of certain assets, due to the fact that only the credit risk is transferred and not the ownership of the assets taken into consideration. These legal limits are likely to make the transaction impracticable or to slow down the execution time, also leading to an increase in costs;
- There is the possibility to build securitization schemes more easily;
- As there is no actual sale of the asset, it is possible to securitise a wide variety of assets as long as they incorporate credit risk and regardless of the asset's availability and liquidity.

Compared to traditional securitization, synthetic securitization not only offers operational advantages but also economic advantages:

- Synthetic securitization is less costly than traditional securitization;
- This operation makes it possible not to jeopardise the relationship with the client since he is not informed of the assignment of the credit risk relating to his debt. This advantage is fundamental for a bank as it has long-term relationships with customers with the possibility of offering them additional financial services.[51]

51 Pallini, Relatore, and Davide Loreti. 2016. “La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche.

3.3- REPACKAGING SECURITIZATION

Repackaging securitization, also called resecuritization, is a particular transaction in which the portfolio of assets is also made up of structured finance products (ABS). The spread of this type of instrument is due to the increasing use of securitization transactions and therefore the existence of an increasing number of tranches that constitute collateral. This securitization is also defined as two-layer securitization, since it is an operation whose underlying is made up of the securities generated by a previous securitization operation. Thanks to resecuritisation, it is possible to form a highly diversified pool of assets made up of structured financial products, thus offering the highest degree of customization of the instruments issued. The redemption of this type of securitization is usually "bullet" type, which can increase the potential market given the simplification from the investor's point of view. On such securities there is the possibility to apply higher spreads than traditional securitization. A higher spread is a symptom of the presence of a premium required by investors due to:

- Greater complexity of the financial product;
- Structure that incorporates double leverage;
- Greater exposure to systematic risk;
- Limited development of a large secondary market for repackaging.

3.4- INSTRUMENTS OF SECURITIZATION

When mentioning securities issued to finance a traditional securitisation transaction, we can talk ***about asset-backed securities*** (ABS). As a matter of fact they can be distinguished in ***mortgage-backed securities*** (MBS) and asset-backed securities (ABS), which are distinguished by the underlying asset; in particular, the MBS refers to mortgage loans and ABS to all other loans. But in reality, there is a huge number of instruments issued by SPVs against a wide range of assets that make up the collateral for the operation. ABS are subject to credit tranching. This term refers to the subdivision of the issuance of ABS securities in two or more classes characterized by a different level of seniority, i.e. they differ depending on the level of payment priority. In this way each of the tranches is characterized by a different profile of risk/return[52]. The classic version of tranching usually occurs with the creation of three tranches:

[52] "SECURITIZATION." n.d. www.Bankpedia.Org

- ***Senior tranche*** (class A) characterised by the highest level of rating, the highest priority in the payment of cash flows and therefore gives a lower return than the other tranches.
- ***Mezzanine tranches*** (class B) characterised by an intermediate level of subordination and therefore a lower yield than the other tranches. Rather high rating, therefore characterised by an average risk/return level.
- ***Junior tranche or equity*** (class C) characterised by a high level of subordination. Moreover, the payment of this tranche will only be made if the payments of the other tranches have been reimbursed in full, so if there's any remaining availability. They are burdened with all possible losses and late payments. Rating agencies usually do not assign a rating to such tranches. The originator usually subscribes such tranches in full, in order to signal the quality of the securitized assets and also as an incentive to monitor the credit worthiness of the underlying assets over time. Given their subordinated nature and therefore their high level of risk, they present also a higher yield than all the other tranches.

Instruments issued by SPVs in general must meet the following characteristics:

- They must be negotiable, i.e. there must be the possibility of marketing, legally speaking, and there must also be an organised market where the exchange can take place.
- They must also have a level of quality that allows them to be marketed, or rather, a level that meets the needs of consumers.

A classification that can be made with regard to securitized assets is in relation to duration:

a. Securities with short-term maturity such as ***asset-backed commercial papers*** (ABCP) which are usually guaranteed by a pool of assets that are also short-term.
b. Securities with long-term maturity, these in turn can be divided into two types:

- Asset-backed securities (ABS), if the portfolio sold is homogeneous. ABS are guaranteed by a broad and homogeneous collateral and the assets that comprise them can be considered independent in terms of risk exposure.
- ***Collateralized debt obligations*** (CDOs), if the underlying asset is mixed. CDOs are backed by a pool of assets consisting of a low number of high amount, non-standardised loans rarely granted on particular occasions. These securities are used to set up pools made up of

heterogeneous assets in order to obtain a benefit through diversification and thus reduce the volatility of expected returns.

Despite the considerable existence of a large class of securities, it was found that the volume of securitisation of residential mortgages, i.e. **RMBS**, was the highest in the years before the financial crisis[53].

3.5- ASSET-BACKED SECURITIES (ABS)

ABS holders will receive periodic payment of a series of coupons during the life of the financial instrument, determined by fixed or variable interest rates. What distinguishes ABS from common bonds is the limited recourse clause. This clause allows the issuer to pay the interest and the return of the capital to investors in relation to the cash flows received from the assigned receivables. Therefore, the issuer is liable to the investor only within the limits of the securitised portfolio. The riskiness of an ABS does not depend, as in normal bonds, on the core business of the issuer but depends solely on the quality of the receivables assigned to it[54]. Theoretically, a portfolio of assets can be formed by any activity involving payment flows, those most commonly used are:

- Mortgage-backed securities (MBS). The mortgage loans that form the underlying portfolio can be of two types: prime and sub-prime, depending on merit. These types of underlying assets are the most widely used and also those with the lowest risk of insolvency due to the presence of the collateral provided by the mortgage on the property.
- Credit card receivable-backed securities. The guarantees for these kinds of ABS are credits related to the use of a credit card for an amount exceeding the current account availability within the credit limits granted by the bank Unlike other kinds of securities there is no material asset underlying the stock, but a simple promise of debt repayment
- Loans for the purchase of the car: such securities are "auto-loan-backed securities (auto-ABS)". The subscribers of securitized assets with underlying loans for the purchase of cars are less subject to the risk of early repayment with respect to MBS. This is mainly due to the fact that a loan for the purchase of a car has a shorter life span than a mortgage loan and therefore there is less probability that the debtor will pay off the loan before it matures.

53 Pallini, Relatore, and Davide Loreti. 2016. “La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche.

54 “ASSET-BACKED SECURITY (ABS).” n.d. www.Bankpedia.Org

- Student loans.
- Loans granted to companies.
- Receivables from leasing contracts.

3.6- MORTGAGE-BACKED SECURITIES (MBS)

MBS are securities issued by a specialized intermediary against a "package" of mortgages of which he has made himself transferee by the lender. In American practice, mortgage loans are taken out to finance or re-finance the purchase of a residential home or other kinds of real estate and have a fairly long duration, generally from 15 to 30 years, during which the borrower repays the debt in monthly instalments including principal and interest. To increase turnover, the lending institutions (mostly small regional banks) refinance themselves by selling groups of mortgages with similar characteristics to specialised institutions, mainly the ***Federal National Mortgage Association*** (FNMA), the ***Government National Mortgage Association*** (GNMA) and the ***Federal Home Loan Mortgage Association*** (FHMLC). These group mortgages into packages against which they issue mortgage backed securities that they guarantee, and which are sold to the public. Together, these agents and these transactions form the secondary mortgage market. The interest and principal repayments on the loans sold are intended to pay interest and repay the MBS. MBS appeared in the United States in the early 1970s as an impulse from the government to create a secondary market for mortgages and housing financing. Two organizations were set up, by act of Congress, to create a secondary market for mortgages through securitization: GNMA (which was responsible for the first securitization of mortgages in 1970) and FHLMC. Another organisation that is attached to the Federal Government and active in the securitisation of mortgages is the FNMA, set up as a government agency in 1938 and now converted into a private law company. Whoever buys an MBS indirectly finances the purchase of houses or the financial needs of companies. MBS are a means for small US regional banks to grant loans to clients without using their own funding. A distinction is made between residential mortgage backed securities (RMBS), intended for the purchase of private residential homes, and commercial mortgage backed securities (CMBS) reserved for financing the construction or purchase of real estate for commercial use such as condos, shops, restaurants, showrooms, supermarkets, etc.. MBSs can be offered directly, or grouped together in other securities called real estate mortgage investment conduit (REMIC), or form the basis of financial derivatives called stripped mortgage backed securities (SMBS)[55][56].

[55] "MORTGAGE-BACKED SECURITIES." n.d. www.Bankpedia.Org
[56] Pallini, Relatore, and Davide Loreti. 2016. "La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche.

3.4- Valuation of mortgage securities (rating)

A rating agency is a company responsible for providing an impartial assessment of the quality of ABS and for assigning a rating to the securities issued in connection with the securitization transaction. The rating must comply with certain criteria, it must be a synthetic, relative, and comparable; of course, this assessment is an estimate, expressed by an external and independent entity such as the agency, of the issuer's ability to cope with the timely payment of principal and interest. For those who are about to invest, rating is an essential information for evaluating the better than the quality and risk inherent in the title. The bonds issued by SPVs following a securitization transaction of ABS and MBS are guaranteed by the cash flows generated by the assets involved in the sale. Investors, however, are unable to readily obtain exhaustive information about the level of risk, with particular reference to the risk of insolvency, of the companies that issued the bonds. However, the rating agencies do not merely assess credit risk but also analyze the payment structure, the legal structure, the risk associated with the various participants in the securitization and also assist the originator in structuring the transaction. The rating agencies do not limit themselves to evaluating the securities only at the time of issue, but continue to closely monitor the performance of the entire transaction in order to verify the impact on the initial creditworthiness of each significant event, possibly modifying the assigned score. Therefore, small investors who, unlike large bondholders, traders and portfolio managers, are unable to assess the risk of default of the securities themselves by investigating the solvency of the issuer, rely on the bond ratings provided by the agencies. The two largest rating agencies are: ***Moody's*** and ***Standard & Poor's***. Both operate in the same way, assessing the credit risk of the issuing company and assigning a rating represented by a conventional acronym. The acronyms that the agencies use for issues with a lower risk of default or with high credit standing are: Aaa for Moody's and AAA for Standard & Poor's. Bonds subject to these ratings usually lead to interest margins that are lower than government bonds with similar maturities, while bonds, which have a lower rating and therefore a higher risk of default, generally increase the interest margin compared to government bonds with similar maturities. The acronyms used to indicate bonds with a high yield but an equally high risk of default are classified with Baa for Moody's and BBB for Standard & Poor's[57]. The credit enhancement figure is very important for the security rating resulting from the securitization transaction, especially with regard to achieving a positive rating. This entity intervenes to cover the

57 Cicuto, Michele. 2016. ““Le asimmetrie informative nelle cartolarizzazioni: analisi empirica del loro manifestarsi e possibili soluzioni per evitarle.”

credit risk inherent in the security, i.e. it intervenes if the debtor is no longer able to pay. The guarantees offered by the credit enhancement are of two types (although they are usually used together):

- Internal: if they are put in place by the same Originator that sold the package of assets subject to the securitization;
- External: if these guarantees are put in place by third parties who differ from the Originator.

However, the investor must pay attention to the illusion of rating; in fact, the rating must not be the only criterion to base investment choices. Although a AAA or Aaa rating may induce an investor to invest, it must be considered that this reflects only certain aspects of the risk inherent in securities issued in connection with a securitization transaction, thus leading to unexpected losses on the investor's part[58].

3.7- CREDIT RISK AND CREDIT DERIVATIVES

The credit risk component represents an important source of risk for financial institutions together with market risk, interest rate risk, exchange rate risk, operational risk and others. Financial institutions devote a large part of their resources to quantifying and consequently containing credit risk, which is determined by the possibility that the debtor may fail to meet its contractual commitments in a timely manner. Such behaviour can have a dual effect:

- First, it may be a default, where the party cannot meet its commitments due to temporary difficulties.
- Secondly, it could be an insolvency, where the person, unlike in the case of default, is unable to perform his obligations on a permanent basis.

There are various ways of managing credit risk, for example, through the use of ***credit derivatives***. These instruments represent contracts whose value does not depend on commodities, currencies or rates, but on the creditworthiness of one or more reference entities, be they issuing companies or states. The underlying asset is therefore represented by the entity to which a credit exposure exists. The valuation of this contract takes into account both the risk of default of the entity and the deterioration in creditworthiness, which therefore affects credit quality. Credit derivatives therefore allow for the negotiation and treatment of credit risks, just as financial derivatives are used to negotiate market risks. The emergence of such derivatives is linked to the need to protect financial intermediaries, such as banks, from credit risk arising from loans granted to states or companies.

[58] Pallini, Relatore, and Davide Loreti. 2016. "La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche.

The use of the term credit derivative dates back to 1992 at the conference of the ISDA, International Swap and Derivatives Association. The exponential development of these instruments took place mainly in the late 1990s and early 2000s when banks persistently used these instruments to transfer credit risk from their loans to others, thus transforming the modus operandi of the financial markets. The traditional activity that banks carry out is to lend money and thus to assume the credit risk arising from the possible insolvency of borrowers. Since this risk may pose a threat to the banks themselves, they tend to remove loans from their balance sheets. This reversal of behaviour is mainly due to the strict rules imposed by supervisory authorities. The main characteristics of a credit derivative can be summarised as follows:

a. It is a product characterised by elastic demand with respect to price, this means that the percentage change in the quantity requested is greater than the percentage change in price.
b. The period in which the outstanding positions are held is relatively short and does not necessarily end when the contract expires. The duration can vary from case to case and usually includes a period of time ranging from 1 to 10 years.
c. The management of these instruments is based on methods used within the company thanks to widely used software and models.
d. It allows the credit risk of the legal instrument from which it originates (whether a bond or a loan) to be separated so that this asset can be easily transferred.
e. It is a product that makes it possible, through the transfer of credit risk, to make positions that would otherwise be illiquid negotiable.

Credit derivatives are instruments that allow the management of credit risk and require for the payment of a premium. Unlike other credit transfer instruments, such as securitization, the risk is transferred to the counterparty while the underlying asset remains in the possession of the buyer. Created with the aim of protecting Banks from a counterparty's credit risk, these instruments have developed considerably because of their innovative nature, favouring the hedging of positions characterised by high credit risk[59]. Today, banks can diversify their portfolios by maintaining exposure to certain risks on the one hand, and by using credit derivatives to seek protection from other risks on the other. Credit derivatives are the result of the encounter between two main components:

a. ***Credit risk***, which is the main purpose of the contract;
b. The ***derivative contract***, the value of which depends on an underlying asset.

59 Chen, James. n.d. “Credit Derivatives: How Banks Protect Themselves If You Default.” Investope

The contract involves two counterparties:

- The "***protection buyer***" who sells his credit risk in exchange for protection.
- The "***protection seller***" who assumes the credit risk transferred by the buyer.

In a nutshell, this contract consists of the possibility offered to the protection buyer to transfer only the credit risk to the protection seller, while retaining the underlying asset. If the debtor does not honour its commitments, the protection seller is obliged to pay the buyer the repayment; this causes the extinction of the existing contract, which is declining. If the insolvency event occurs, the amount to be paid may assume a threefold nature:

- ***Physical settlement***: delivery of the asset against payment of the face value.
- ***Cash settlement***: payment of the difference between the face value and the market value of the underlying asset. In this case, no delivery of the asset remains with the insured person.
- ***Binary pay-out***: in this particular case, the protection seller, at the time the event occurs, undertakes to pay the buyer a predetermined amount at the time the contract is concluded.

Credit derivatives can be divided in two categories: on the one hand, ***singlename*** contracts and, on the other, ***multiname*** contracts. The former consist of contracts whose underlying asset is represented by a single security. An example of such contracts is the ***credit default swap*** (CDS). The latter, on the other hand, consist of contracts involving several assets. An example of such contracts is the ***collateralized debt obligation*** (CDO); in such contract a portfolio of credits is defined, where the payments are directed to the investors according to a precise normative structure[60].

3.8- COLLATERALIZED DEBT OBLIGATIONS (CDO)

CDOs are securities guaranteed by a pool of loans issued by the SPVs, which hold the assets pledged as collateral. These securities are guaranteed by a diversified portfolio, as opposed to ABS. This portfolio is usually composed of loans, bonds and ***credit default swaps***, which in turn are divided into tranches according to their repayment priority. As with ABS, the payment of interest and repayment of capital is proportioned to the flows generated by the securitised assets. CDOs offer more opportunities for risk transfer than ABS securities. CDOs are more complex transactions than traditional ABS and therefore more difficult to assess. The difficulty in their valuation lies in the presence of numerous variants and also due to the plurality of assets underlying the security[61].

60 Greenberger, Michael. 2010. “The Role of Derivatives in the Financial Crisis.”. University of Maryland

61 “Collateralized debt obligations.” n.d. www.Bankpedia.Org

No less difficult to assess is the complexity of the transaction, which can accentuate the possibility of creating various conflicts of interest. There are different types of CDOs that differ based on:

- the nature of the transaction, the main economic purpose for which they are entered into.
- the way the collateral is managed, as well as the relationship that exists between it and the CDOs issued, in terms of capital flows and interest.
- The structure through which the transaction is carried out.

Like ABS, CDOs are also distinguished according to the underlying securitised asset, and they are divided:

- ***Collateralised loan obligation*** (CLO): the underlying of which is made up of loans granted by banks to businesses.
- ***Collateralised bond obligation*** (CBO): the underlying of which is made up of a portfolio of bonds issued by both the government and businesses.
- ***Collateralised mortgage obligation*** (CMO): the underlying of which is made up of a portfolio of mortgage loans. CMOs divide investors into classes: each class has different settlement regarding cash flow payment, maturity and risk level[62].

3.9- CREDIT DEFAULT SWAPS (CDS)

The credit derivatives market is characterised by continuous financial innovation and flexibility, which can be traced back to the technical structure of the contracts. These instruments are traded in the over the counter market, where contracts are not subject to precise standardisation rules. Credit derivatives can be defined as second-generation instruments as they arise from the evolution of first-generation instruments ("***plain vanilla*** products") to meet the needs of market participants. Among the simplest and most widespread forms of credit derivatives are ***Credit Default Swaps*** and ***Total Return Swaps***. The former are used for the risk of a loss of capital invested in a credit transaction while the latter are used for the risk of an "unexpected" change in the return compared to the expected return, both of which relate to a given asset over a certain period of time. For the sake of this thesis we will focus specifically on the first instrument cited above. The mechanism of a CDS contract can be explained in a few simple words: it is a contract through which the protection seller undertakes to pay the protection buyer a sum of money, upon payment of a periodic sum by the latter, in the event of a specific event (called credit event) connected with a given financial activity. The contract can be compared to an "insurance contract" in which the seller, in the event of insolvency of a specific issuer (reference entity), undertakes to pay a certain

[62] Pallini, Relatore, and Davide Loreti. 2016. “La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche.

amount, determined or determinable, to the buyer. However, it is not a real insurance contract from which it differs for some characteristics that will be described later[63]. The CDS contract covers certain risks associated with certain specific events, called credit events, specified in the contract. The ***ISDA*** (International Swaps and Derivatives Association) has provided a classification of credit events. These events are as follows:

- ***Bankruptcy***: Represents the most catastrophic event that can involve a reference entity. It requires a legal declaration of the debtor's inability to meet its obligations to creditors. This is the event most likely to occur in a CDS contract.
- ***Moratorium*** or ***Repudiation***: This is an event at which the issuer (reference entity) disputes or questions the validity of the obligation or other debt issued. This event usually involves sovereign issuers.
- ***Failure to pay***: This event is also known as "unexecuted payment" and is determined when the issuer has not honoured a debt at its natural maturity after a grace period (usually 30 days) has elapsed. The most common event is, for example, a failure to pay a coupon on a bond determined by the inability to repay it when the contract expires. The failure to pay precedes the bankruptcy event but still represents an event that gives rise to the obligations of the protection seller.
- ***Obligation Acceleration***: This event refers to the possibility that one or more bonds may be redeemable before maturity as a result of events that may cause the issuer to default. As is also the case with failure to pay, there is a minimum amount that triggers the credit event.
- ***Restructuring***: It takes place whenever there is a change in the bond loan. Changes may, for example, relate to duration, coupons, reduction in principal or premium payable, reduction in the rate or amount of interest payable. Debt restructuring results in less favourable economic and financial conditions for creditors.

A credit default swap contract consists of the following components:

- ***Notional capital***, against which the payments due by the protection buyer are calculated.
- Amount of individual ***payments*** due.
- ***Periodicity*** of the related payments.
- ***Expiry*** of the contract.

63 Dell'osbel, Michela. 2016. "Analisi Del Mercato Dei Credit Default Swap.". Università Cà Foscari Venezia.

- ***Credit events***, i.e. events such as the insolvency, deterioration or improvement of the rating of a particular reference entity[64].

A CDS is a bilateral contract involving two parties, the protection seller and the protection buyer. It offers protection against the risk of insolvency of a specific issuer (reference entity). It was anticipated that the CDS contract on the one hand has similar characteristics to an insurance contract while on the other hand it differs for other reasons. Although there may appear to be similarities between a CDS and an insurance contract, there are substantial differences between them. An insurance contract offers protection against the risk of loss on assets you own. In a credit default swap contract, it is not necessary to hold the underlying asset in order to take a long position. Contracts with such characteristics are referred to as ***naked CDSs***, which have come under a lot of criticism because they are responsible for the increasing insolvency of global markets. If the underlying asset of a Credit Default Swap is characterised by a given bond issue, the maturity of the contract will coincide with the residual life of the bond; consequently the amount of payments due by the protection buyer will be closely linked to the credit spread (the difference between the implicit yield in the bond issue and the yield of the risk free security). In other words, the riskier the security, the higher the fixed rate required to offer hedging. CDSs are synthetic instruments that can perform the function of indicating the riskiness of the underlying asset and allow the operators involved to isolate the credit risk because there is a correspondence between the exchange of certain flows and the conditional payment upon the occurrence of a given event (credit event). The protection seller bears the risk of possible bankruptcy upon payment of a premium by the protection buyer. Such an instrument is useful when aiming to diversify the credit risk of a portfolio of assets. It may be that an intermediary concentrates a large part of its credit activity on well-known sectors; therefore, a possible solution to the problems could fall on protection through credit default swaps. The use of such instruments has increased especially in recent decades, years marked by the impending financial crisis, as they represent a valid alternative for institutional investors who want to delegate the risk inherent in certain activities to others. This makes it much easier for them to monitor the performance of their activities.

64 Dell'osbel, Michela. 2016. "Analisi Del Mercato Dei Credit Default Swap.". Università Cà Foscari Venezia.

CHAPTER IV- CAUSES AND CONSIDERATIONS ON THE 2008 FINANCIAL CRISIS

4.1- THE 2007-2009 MORTGAGE CRISIS AND DEBT SECURITIZATION

"People aren't as impressed by homes anymore after they saw how they collapsed in price with the financial crisis."- Robert J. Shiller

Technically, debt securitization is a process by which one or more undivided and illiquid financial assets capable of generating cash flows, such as a bank's receivables, are "transformed" into divisible and saleable assets, i.e. asset-backed securities (***ABS***). Depending on the underlying asset that is securitised, we can speak, for example, of ***MBS*** (mortgage backed securities, the underlying of which are mortgages), ***CDO*** (collateralised debt obligation, the underlying of which are public or private bonds), ***ABCP*** (asset backed commercial paper), the underlying of which is represented by short-term loans. Securitizations, specifically those involving mortgages, played a considerable role in the disastrous crisis that exploded in the financial markets of the United States in 2007 and rapidly spread to the economy of other countries, causing the bankruptcy of several financial institutions and forcing several states to intervene to save others. In the previous chapter we have examined the main mechanisms of ABS; the focus for the current chapter is to see how securitisations fit into the overall picture that led to the disaster. Let us start with the example of a simple ABS: it divides investors into several tranches, which are given a ranking by the agencies (e.g. AAA for the highest end, downwards). The ABS remuneration system then gives rise to what is known as a waterfall effect, a cascade, as the remuneration flows pass from the best ranked tranche subscribers and then to the investors of the lowest or unrated tranches. From the point of view of losses, it can therefore be said that they are first absorbed by the lower end of the range and then gradually rise to the higher end of the range, when the loss borne by the previous tranche is at its highest. For this reason, if high-rated ABS were not difficult to place, the same cannot be said for medium-risk ABS. This problem was circumvented by the creation of the ABS CDOs, composed of medium-ranking (BBB) ABS tranches. Each CDO, created by definition with middle-ranking ABS, was then divided into new tranches. The highest of these new tranches was then rated AAA, attracting more investors. A high tranche ABS is profitable only if losses on the underlying assets are limited to a certain percentage, then a high tranche CDO is profitable only if the losses do not exceed a lower percentage. This also makes a well valued CDO quite risky. Banks have always financed loans and mortgages with deposits. At the beginning of the second half of the last century, however, demand for loans in the USA exceeded deposits. Thus, the banks developed a system that would allow them to continue lending loans: mortgage-backed bonds, MBS. This gave rise to portfolios of mortgages whose payments were grouped into securities placed with investors. In

1968, the ***GNMA*** (Government National Mortgage Association) was founded with the task of creating these securities. It also had the task of guaranteeing the MBS, i.e. protecting investors from the risk of default on mortgages (these investors, however, continued to bear the risk of advance payments, which resulted in lower rates of return). After mortgage securitisations, securitisations on car loans, corporate loans and sub-prime mortgages emerged and, always more often, investors in these new forms of securitisation were not covered by GNMA[65]. Under the same system as before, several tranches were created and valued on subprime mortgages, and on those tranches, others were created and valued as we have seen. In the early 2000s, the rigour of banks' checks on the reliability of mortgage applicants had decreased, which had given many households, which would not have been granted a mortgage before, access to it. Banks counted on the fact that the risk of subprime mortgages would then be discharged through securitisations. The objective of the banks was to take out the loans and sell the securitizations, while the buyer paid attention only to the ***FICO*** credit score (which defined the quality of the lender) and the ***loan-to-value ratio*** (i.e. the ratio between the amount of the loan and the value of the property), which in many cases were inflated by the experts under pressure from the banks themselves. The illusion was that the real estate market could continue to grow. What happened was that several subprime borrowers began to be unable to pay, their homes went into foreclosure or auction, and the value of the properties fell, causing other borrowers to find themselves with a higher mortgage value than the house they were buying. In America, moreover, on several mortgages, borrowers enjoy a ***put option*** that allows them to sell the house to the bank at any time in exchange for the remaining debt. For banks, the exercise of the option by the borrower can also become very expensive, and while for many struggling families, giving up the house was a last resort, for speculators, it was a convenient choice. Houses foreclosed and resold at auction resulted in banks falling well short of the value of the loans granted and in 2008/2009 losses in this respect were on average 75% of the nominal value of the loans. Those who had invested in ABS CDOs on subprime loans had lost 100% of their value by mid-2009, while the original ABS tranches from which they were created had lost around 97%[66]. In this way, the real estate market bubble, which exploded as a subprime mortgage crisis, became a huge banking and financial crisis due to the mechanisms behind the securitizations analysed above, and quickly spread to the real economy. The banks became much more risk-averse, triggering a credit crisis that penalised credit-worthy individuals and further blocked the economy already in recession. Large financial institutions suffered huge losses, some were bailed out with public funds,

65 Bajracharya, Sugat. 2009. “Are Derivatives the Cause of a Financial Crisis?”

66 Hull, John C. 2018. *Options, Futures, and Other Derivatives*. Harlow Etc.: Pearson Educational Limited.

others (e.g. Lehman Brothers) were allowed to fail. World stock exchanges plunged into chaos and the effects were felt throughout the economic and financial system. The crisis infested Europe, where a few years later it brought the sovereign debt crisis to light, with which institutions are still struggling today.

4.2- CAUSES OF THE SUBPRIME CRISIS

The 2008 bubble in the United States led to one of the most dramatic recessions in history since the Great Depression of 1929. It should be noted, first of all, that the sub-prime mortgage crisis has shown some weaknesses of the capitalist system that have both economic and social roots. The origin of the downward phase of the crisis can be placed temporally in the summer of 2007 for the United States; from that period and location the crisis spread rapidly until it contaminated the entire globe and many sectors of the economy. Clearly, however, the roots of the bubble date back to a previous period and can be traced to a specific sector of the market: the real estate market, and more precisely that of the so-called "sub-prime" mortgages. It is worth pointing out immediately, however, that although in 2006 sub-prime mortgages accounted for about 20% of the mortgages in the real estate market[67], the crisis in this sector ended up devastating the American mortgage market and therefore the American economic system and international markets. In order to understand the evolution of the crisis, first of all it is necessary to analyse the fluctuation in real estate prices since the beginning of the 20th century. During this period there were basically two phases in which the cost of housing increased rapidly. The first significant increase occurred in 1940 and the motivation is simple: during the Second World War resources were used for supplies and armaments and the construction of houses was reduced. As soldiers returned from the conflict, new families were formed and as supply remained low, the sudden increase in demand caused prices to skyrocket. Compared to the rise in house prices in the first decade of this century, however, what happened in 1940 appears to be a small phenomenon. What is even more surprising is the fact that in that second historical period there was no valid motivation for price increases. In fact, on the one hand, construction costs were falling, on the other hand, population growth was proceeding at a steady

67 Gramlich, Edward M, Robert D Reischauer, and Urban Institute. 2012. *Subprime Mortgages : America's Latest Boom and Bust*. Urban Institute Press.

pace, so that neither the demand nor the supply side could show any underlying reason for a substantial increase in prices. To have a comparative meter of the gravity of the events that occurred in recent years, one can compare it with what happened on October 19, 1987, the so-called "Black Monday", in which Wall Street recorded a percentage decrease of twenty points in a single day. Although equities make up on average 20% of total household wealth in the United States, this did not affect consumption or GDP growth in the country[68]. So much so that in 1988, the country grew by 4% one point more than the previous year.

In light of this experience, there was also hope in 2006 that the financial system would be able to withstand the collapse in house prices and the negative effects that would result from it. This was not the case, however. The estimated loss of world output due to the crisis was enormous. It is estimated that the total cost was one hundred times higher than the loss suffered by speculation on mortgage loans[69], considering that the effects of the bubble touched many countries as well as the United States. It is essential to understand, then, why house prices began to rise in the early 2000s and why their collapse had such dramatic consequences. Often the phase of euphoria preceding a crisis is the result of irrational behaviour on the part of a more or less numerous group of subjects. The initial rise in prices was partly fuelled by the fact that mortgage interest rates were particularly low at the time, making it seemingly very advantageous to buy a property, especially in the expectation that house prices would continue to rise. In fact, interest rates were kept specifically low, given the equally low inflation, by one of the most important bodies for the US economic and financial system, the FED. Moreover, house prices were not included in the index count to calculate inflation, or at least were not directly included in it: for this purpose, only property rents were included in the basket, which did not increase proportionally or quickly enough to influence the consumer price index significantly. If, on the other hand, house prices had been included in the FED's calculations, their growth would have caused inflation to rise, and this would have sounded a wake-up call, presumably leading the FED to raise interest rates, and perhaps the bubble would not have reached such severity and size. Another reason why it was particularly convenient for households to buy property was a legislative change in the process of mortgage valuation and lending by banks, as a result of which the restrictions became less rigorous. The consequence of this facilitation was to grant loans to households with a higher risk of debt repayment, i.e. the creation of a category of debtors/clients called "sub-prime".

[68] Gramlich, Edward M, Robert D Reischauer, and Urban Institute. 2012. *Subprime Mortgages : America's Latest Boom and Bust*. Urban Institute Press.

[69] Gramlich, Edward M, Robert D Reischauer, and Urban Institute. 2012. *Subprime Mortgages : America's Latest Boom and Bust*. Urban Institute Press.

The banks took on this risk indirectly, or at least differently than in the past. Previously, banks, when granting a loan, were obliged to keep it on their balance sheet until it was repaid in full. The ultimate purpose of this obligation was in the legislator's intention to encourage the financial institution to keep the client under control and ensure that the loan was repaid. In the new millennium, US banks were able to grant a large number of mortgage loans and finance them by bundling them into a single financial instrument and then selling it to other investors. The savers who invested in these securities, given the huge number of mortgages involved, were unable to assess the risks and trusted that the banks would make a proper assessment before granting the loan. In addition, until the 1970s, banks in the United States could not expand beyond state borders and therefore, given the federal structure of the United States, limited to the state of incorporation: in other words, they could only collect the savings of local households and businesses. In this way, the banks, concentrating their activities exclusively on a certain type of client base, were weak: they were particularly prone to negative shocks affecting specific areas of the country. By way of example, during the 1980s, when there was a sudden drop in oil prices, states such as Texas, where the economic system was based mainly on the oil sector, went into recession. Texas banks, in those years, only lent and did business with local customers and when they found it difficult to repay their debts, some of them went bankrupt. Also, as a result of this episode at the end of the 1980s some measures were taken, two in particular, to make the banks operating on US soil more solid and efficient. First of all, financial institutions were allowed to operate beyond state borders, with the direct consequence that the smaller banks were taken over by the more solid and larger banks: for example, the Bank of America, originally operating in California, opened branches throughout the United States.

The second measure concerned the emergence of new financial products, which allowed banks to diversify their risk further without the need to operate outside a state, the same products we have mentioned in the previous chapter. Instruments that transformed certain assets, such as mortgages, into securities that were then issued on the market (CDOs, MBSs, and other forms of securitisation). Although the purpose of this type of financial instrument was to protect banks, this could only happen if the securitisation process was carried out properly: banks should never lose control over their clients' financial conditions. In order to limit the risks, banks could have been allowed to sell only part of the loan granted, so that they would remain exposed to credit risk and would therefore be induced to check their customers' creditworthiness. Efficient regulation was the FED's task, but this intention was not fully pursued[70].

[70] “The 2007-08 Financial Crisis in Review.” 2019. Investopedia. 2019.

The crisis is therefore also the result of a lack of adequate financial legislation and not just the use of new products on the market. The FED and the market regulators, on the other hand, could not impose certain regulations, because they were under pressure from the government, whose intention in the 2000s was to increase the number of people owning a house. In the particular case where banks are not careful enough to grant mortgage loans (as it was the case in this period), as long as real estate prices rise, they manage to perceive large profit margins; however, when the cost of houses starts to fall, a problem arises: if the value of the house becomes lower than the amount of the mortgage, it becomes more convenient for borrowers to leave the house and not to pay the debt avoiding to pay the remaining instalments. On the other hand, the bank has no choice but to take over the house or put it up for auction trying to get as much as possible out of it, even though the value is still lower than the loan and as a result, a loss has to be recorded in the balance sheet. However, this is not the only explanation for what happened. In fact, most borrowers did not leave the house because of the loss of value, but many of them were unable to pay their mortgage instalments, thus defaulting. Even though banks incurred large losses due to defaulted loans, this still does not explain why the US financial system almost collapsed. Indeed, in addition to the collapse in prices and the reduction in household consumption, there were other mechanisms and factors that amplified the crisis.

4.3- THE ROLE OF INTERMEDIARIES, LEVERAGE AND SECURITIES

It is important to focus on the role of the banks as financial intermediaries, i.e. as the intermediaries between savers and borrowers. Three mechanisms were found to be of great importance for the development of the crisis: leverage, product complexity and liquidity. The leverage ratio defines the proportion within a financial institution or company between debt and equity. Banks and other financial institutions may decide, to the extent permitted by law, to take on a high or low degree of leverage. As is easy to imagine, in times of economic development it becomes convenient for banks to maintain a high leverage ratio, as this allows them to achieve a higher profit margin. High leverage, however, can be risky: a reduction in the value of assets could lead to an insolvency of the financial institution. In the case of the sub-prime crisis, until house prices rose, banks experienced a period of particular economic comfort and had their balance sheets inflated by these operations. On the other hand, as already noted, supervisory institutions did not intervene because of political

pressure to facilitate the purchase of real estate for American households through affordable mortgages. Highly leveraged banks were allowed to continue lending, not by using equity capital, but capital made available to them by investors. As a result of these transactions, senior bank executives received rich rewards from their companies, which were linked to their profits and therefore had an incentive to enter into further transactions, albeit at increasing risk. Over time, the example of the banks was imitated by other financial institutions (financial companies, hedge funds, etc.), and so the overall value of the financial exposure and the resulting risk increased disproportionately.

Banks with a high asset-capital ratio were the first to go bankrupt and, as a result, were no longer able to lend. Even the most solid banks began to have to take measures: to survive the fall in house prices they had to use a large part of their capital. For example, some insurance companies, due to the issue of credit default swaps, had invested a large amount of money in the real estate market, so when the value of real estate fell, they could not recoup their losses with the remaining capital.

In such situations, financial institutions can strengthen their position in three ways. Firstly, by trying to raise more capital, but in a time of financial crisis, it is not easy for banks to attract investors. Alternatively, they can reduce the number of loans granted to businesses and households. Finally, they can sell their liquid assets, in particular the shares and bonds they have in their portfolio. However, due to the assumption of such countermeasures by major operators, credit is blocked and the price of securities on the stock market falls sharply. These are the three main processes that have turned the financial crisis into a real economic crisis. The collapse of the stock market together with the real estate market, had reduced the wealth of households, consequently reducing overall consumption.

The complexity of securities is the second mechanism that contributed to the amplification of the extent of the crisis. Securitisation in itself is an appropriate tool and, as mentioned previously, there are significant advantages to using this form of credit management. However, such transactions create additional risks. Rating agencies, which are called upon to assess derivatives, have had difficulties or misjudged the risks associated with them because of the assumption that the underlying loans had become uncollectible, both for MBS and CDOs. It is precisely for this reason that these financial products took the name of "toxic" or "junk" securities. Once the bubble burst, they lost all interest in the same investors, who, in order not to take risks, became reluctant to lend money even to the institutions that held them.

The latest cause of the spread of the crisis concerns the liquidity of banks. From the 1990s to the last decade, new sources of funding for banks have emerged, in addition to the traditional collection of savings from customers. Banks, in fact, have been allowed to finance their own management and

investments also thanks to short-term loans that are granted from one bank to another, thus giving flexibility to the amount of loans that the recipient can grant from time to time. This system has a cost, which became apparent during the crisis: if financial institutions and investors lose their trust in banks, they may find themselves in a situation of shortage of funds and therefore be forced to sell their assets in order to remain liquid.

Thus, during the crisis, banks began to sell their portfolio of securities en masse, which soon made it difficult to carry out these activities, with the result that in many cases the securities they held were sold at very low prices. On the other hand, as lending by third parties decreased, the only remaining possibility for banks to rebalance their financial statements was to put the most liquid financial assets on the market.

When, however, on September 15th 2008, Lehman Brothers Bank declared bankruptcy, in addition to the dismay of investors, the banks reacted with strong fears and consequently raised interest on loans to other banks. Due to the simultaneous intervention of the crisis propagation mechanisms described above, in the second half of 2008 the US financial system was effectively paralysed, banks no longer had resources from which to draw credit and the stock market collapsed. This led to a shift from a financial crisis to an economic crisis that directly affected most American citizens.

4.4- SUBPRIME VS TULIPS: A COMPARISON BETWEEN TWO ERAS

During the course of this paper we have talked about two financial crises that have marked the history of the economy for different reasons: the tulip crisis of 1637 in the Netherlands, which is considered the first financial crisis in history, and the speculative bubble that erupted in the United States in 2008, which is the most recent crisis and has had serious effects on the financial markets and also on the real economy of many countries around the world. In this last part, we will try to identify some similarities between the two phenomena, despite the almost four centuries that elapse between the two events, without forgetting, however, the important differences and, first of all, those concerning the historical and geographical context. The capitalist economic system has always been accompanied by financial crises, with often serious effects for many categories of people and operators and sometimes for entire economic systems; the evolution in prudential matters has certainly helped to control them, but without succeeding in eliminating them completely, as the crisis of 2008 demonstrates. The study of the economic-financial crises of the past is therefore indispensable to reach a full awareness of the behavioural dynamics in order to verify the assumption of the rationality of the market and its operators, to understand the complexity of the financial phenomena and, if possible, to introduce corrective measures or mechanisms that can reduce the risk of crisis, limit its size, its propagation, the subjects involved

and, in general, the damage to the economic system as a whole. The two phenomena have occurred at a considerable distance over time. It is interesting to compare the two crises first of all because of the time aspect, since the first one opens the history of modern financial crises, and the second is the most recent: this makes it possible to verify the extent to which economic, technological and cultural progress has changed the development, effects and consequences of financial crises. The tulip bubble took place in the Protestant Netherlands in 1600, in the period coinciding with the birth of the financial markets, which were therefore not fully regulated at the time. Holland was a small country that had just gained independence, where most of the occupation was given by traditional jobs, such as that of the craftsman, the labourer, the sailor and the farmer[71]. The sub-prime crisis, on the other hand, developed during 2008 in a nation like the United States, an industrialised country, one of the world leaders in terms of output and the centre of financial markets around the globe, now regulated for a long time by extensive legislation and subject to supervision by competent authorities to prevent abuse. Nevertheless, investor behaviour during the crisis does not seem to have changed much, particularly in view of the risk attitude of certain investments. Analysing exclusively the price trends of the assets subject to the two crises, on the one hand the tulip and on the other the real estate and securities issued to finance their purchase, the trend of the two phenomena is very similar.

Although the contexts were profoundly different, the behaviour of market agents (in the first case mainly individual investors and in the second the banks) is similar, as it is evident that at the origin of the bubble there is the intention to exploit a new investment opportunity trying to obtain high economic returns. In fact, in the years preceding both crises, a socially evident euphoria within the economic system had developed, due to the widespread perception of easy short-term gains. What differs, instead, is the object of speculation, the event that initiates the downward phase, and clearly the social and cultural contexts also change. We go from the Dutch seventeenth century, when it took years, at the time of digitization, to reach commercial destinations like the Indies; this could make the two eras seem like real "different worlds" and as such not comparable or lacking significant common elements. Yet what the two crises have in common is not so much the nature of their causes as their morphology. In order to fully understand the events, it is necessary to analyse the psychology of the individuals who are the protagonists; in this perspective, the behaviour of investors is substantially in line in both cases both in the euphoric phase and in the subsequent ones after the disruption.

71 “Tulip Mania – and the Economic Bubbles – Scientific Scribbles.” 2017. The University of Melbourne. October 14, 2017.

The lessons that can be learned from comparing the two crises are numerous. The typical common factors are various, starting with the underestimation of the risks of financial instruments, especially in the initial phase of euphoria, on the prospects for earnings. However, there is a marked discrepancy between the tulip bubble and the subprime mortgage crisis in two respects: the different complexity of the investment object, and therefore, the different level of information asymmetry, and the level of interconnection of markets with other countries (relatively low in the first case when compared to the 2008 crisis). In the first case, the investment was clearly related to real assets, recently launched on the market and characterized by a certain variety, but substantially well known to investors. In the second case, mortgage-linked securities had been built by banks and financial institutions by assembling a multiplicity of debt categories. Although the securities were apparently secured by real estate, their articulation and regulation was very complex. The second aspect is perhaps the most profound difference between the two crises. Technological development and globalization have exponentially increased the number and speed of exchanges between countries today. Interconnection, however, is not merely a material component: money investments in shares, foreign bonds and derivative securities are made every day. The network of links that existed in 17th century Holland with other markets is in no way comparable with the one that characterizes the contemporary world and this is mainly the reason why the first crisis remained within national borders, while in the second case the crisis infected many other countries. Although there are countless differences from a geographical, temporal and economic point of view, there remain and will remain, however, elements that are endogenous to the capitalist system and that cannot change.

CONCLUSION

The problem of the causes, dynamics, consequences and possible countermeasures of financial crises, more than 400 years after the first tulip crisis, is still an extremely topical issue. Prudential supervision plays a central role in the prevention of crises nowadays and through some interventions that have been implemented for the monitoring of the balance sheets of companies operating in the financial market, an attempt is being made to improve the economic system so as not to be exposed to crises like the one that began in 2007. Although the analysis of the crises has been limited to certain aspects, it has shown limits and potential weaknesses of the financial system, whose trend is not by chance characterized by recurring crises that are an integral part of the different economic phases. As mentioned above, the most recent crisis shares some characteristics with what historians define as the very first, although there are clearly some distinctive aspects, linked in particular, but not only, to the historical-geographical and socio-economic context. Like the previous ones, moreover, the bubble of 2007 confirmed once again the cyclicality of the economic system, characterized by an ascending and descending phase. At present, financial crises are regarded by industrialised countries as a known phenomenon, which is therefore better managed than in the past. Several recommendations are useful to prevent, contain, limit or reduce the effects of financial crises, such as the regulation of leverage or the introduction of rules to ensure greater disclosure on the risks of certain financial products, but what is certain is that even today there is no system in which banks and other operators in the financial system cannot fail or a period of economic crisis that cannot arise within systems characterised by a free market economy. Regulations must, therefore, evolve over time along with market conditions and need change, at least trying to avoid catastrophic phenomena.

Bibliography

Ali, Paul Usman. 2001. “Review of ‘Building the Global Market: A 4000 Year History of Derivatives’ by E J Swan (2000).” *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.288719.

“ASSET-BACKED SECURITY (ABS).” n.d. Www.Bankpedia.Org. Accessed June 12, 2020. http://www.bankpedia.org/index.php/it/86-italian/a/18435-asset-backed-security.

Bajracharya, Sugat. 2009. “Are Derivatives the Cause of a Financial Crisis?”

“Black-Scholes-Merton Model - Overview, Equation, Assumptions.” n.d. Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/black-scholes-merton-model/.

Chen, James. n.d. “Credit Derivatives: How Banks Protect Themselves If You Default.” Investopedia. Accessed June 12, 2020. https://www.investopedia.com/terms/c/creditderivative.asp#:~:text=A%20credit%20derivative%20is%20a.

Cicuto, Michele. 2016. ““LE ASIMMETRIE INFORMATIVE NELLE CARTOLARIZZAZIONI: ANALISI EMPIRICA DEL LORO MANIFESTARSI E POSSIBILI SOLUZIONI PER EVITARLE.” http://tesi.cab.unipd.it/53846/1/Cicuto_Michele.pdf.

“COLLATERALIZED DEBT OBLIGATIONS.” n.d. Www.Bankpedia.Org. http://www.bankpedia.org/index.php/it/90-italian/c/19197-collateralized-debt-obligations?highlight=WyJjZG8iXQ==.

Dell’osbel, Michela. 2016. “Università Cà Foscari Venezia Analisi Del Mercato Dei Credit Default Swap.” http://dspace.unive.it/bitstream/handle/10579/8991/832126-1193579.pdf?sequence=2.

Dillen, Van. 1935. *Isaac Le Maire et Le Commerce Des Actions de La Compagnie Des Indes Orientales.* Paris.

“Encyclopedia Britannica.” n.d. Encyclopedia Britannica. https://www.britannica.com/.

Gramlich, Edward M, Robert D Reischauer, and Urban Institute. 2012. *Subprime Mortgages : America's Latest Boom and Bust*. Urban Institute Press.

Greenberger, Michael. 2010. "The Role of Derivatives in the Financial Crisis." https://fcic-static.law.stanford.edu/cdn_media/fcic-testimony/2010-0630-Greenberger.pdf.

Kimberly, Amadeo. 2019. "How a 1998 Bailout Led to the 2008 Financial Crisis." The Balance. https://www.thebalance.com/long-term-capital-crisis-3306240.

Hull, John C. 2018. *Options, Futures, and Other Derivatives*. Harlow Etc.: Pearson Educational Limited.

Kenton, Will. 2019. "How the Black Scholes Price Model Works." Investopedia. 2019. https://www.investopedia.com/terms/b/blackscholes.asp.

McPhee, Peter. 2017. "Understanding Option Payoff Charts." Optiontradingtips.Com. https://www.optiontradingtips.com/options101/payoff-diagrams.html.

"MORTGAGE-BACKED SECURITIES." n.d. Www.Bankpedia.Org. http://www.bankpedia.org/index.php/it/115-italian/m/21211-mortgage-backed-securities?highlight=WyJtYnMiXQ==.

Pallini, Relatore, and Davide Loreti. 2016. "La Crisi Finanziaria e La Cartolarizzazione: Analisi Critiche." https://tesi.luiss.it/17418/1/181991_LORETI_DAVIDE%20SILVIO.pdf.

Pia Gaudiano, Valentina. 2010. "PROFILI EVOLUTIVI DELLA CARTOLARIZZAZIONE ED EVIDENZE EMPIRICHE." http://www.schermapuglia.it/documents/TESI%20LA%20CARTOLARIZZAZIONE.pdf.

"PT> Il Caso Del Long Term Capital Management (Ltcm)." n.d. Www.Performancetrading.It. https://www.performancetrading.it/Documents/McAnalisi/McA_Long_Term.htm.

"Put Option." 2020. Wikipedia. May 23, 2020. https://en.wikipedia.org/wiki/Put_option.

Sarialioglu-Hayali, Ayca. 2007. "Financial Stability and Financial Crises: The Role of Derivative Instruments in International Financial Crises." https://www.boeckler.de/pdf/v_2007_10_26_sarialioglu-hayali.pdf.

"SECURITIZATION." n.d. Www.Bankpedia.Org.http://www.bankpedia.org/index.php/it/127-italian/s/22346-securitization.

"Sharper Insight. Smarter Investing." 2019. Investopedia. https://www.investopedia.com/.

"The 2007-08 Financial Crisis in Review." 2019. Investopedia. https://www.investopedia.com/articles/economics/09/financial-crisis-review.asp.

"Tulip Mania – and the Economic Bubbles – Scientific Scribbles." 2017. The University of Melbourne. https://blogs.unimelb.edu.au/sciencecommunication/2017/10/14/tulip-mania-and-the-economic-bubbles/.

Veisdal, Jørgen. 2020. "The Black-Scholes Formula, Explained." Medium. https://medium.com/cantors-paradise/the-black-scholes-formula-explained-9e05b7865d8a.

Weber, Ernst Juerg. 2008. "A Short History of Derivative Security Markets." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1141689.