Rating Actions and Market Efficiency: A Case Study on Italian Banks

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ABSTRACT

The “grey” financial crisis of 2008, originated from the collapse of the collateralized debt obligations market in the United States, is probably the worst market failure in the modern era. In the wake of this dramatic economic downturn, many fingers from all over the world were pointed at American rating agencies, indicating them as partially responsible for the disaster. Apparently, the golden era of rating agencies, whose credit scores convinced many Europeans to invest their capital overseas, and which contributed significantly to the American industrial development, was suddenly over. Rating agencies have been repeatedly accused of having underestimated the intrinsic risks carried by CDOs. In some cases, there have also been allegations of collusion between agencies and issuers finalized at assigning investment-grade ratings to extremely risky securities.

Being the modern financial system completely globalized, the crisis was soon exported all over the world, including Europe and thus Italy. European Authorities also acknowledged the role that rating agencies had played in the spreading the crisis and then adopted specific regulatory measures aimed at containing their power and force them to comply.

There is not much literature covering the effect of rating in European markets, and the few papers that do it mostly focus on the effect on Sovereign bonds and the yield-spread among different nations. This thesis aims at bridging this gap and, drawing inspiration from a past study, tries to analyze the impact that rating agencies have on the Italian stock market. The main premise is that the improved European Regulation should have somehow changed the way investors perceive these credit scores. This study intends to investigate the existence and magnitude of this relationship.

In Chapter 1, as a starting point for this empirical study, the efficient market hypothesis will be briefly introduced with its three forms and the main criticisms. Chapter 2 will be dedicated to shedding some light on the rating industry, its main business practices, and the new European regulatory framework. Finally, in Chapter 3 the results of the empirical analysis will be reported, preceded by a description of the event study methodology.
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1. EFFICIENT CAPITAL MARKETS

Many Economic Theories are the result of subjective interpretation. They combine theory and mathematical models to explain complex real-world phenomena like any other “hard science”. Unfortunately, this approach works successfully in the natural sciences but rather poorly in the social and behavioral sciences, which deal with the relationships between human beings. In other words, there are no proven laws in Economics, but rather ideas that try to explain how the market works (Van Bregen, 2004). Such ideas are by definition imperfect, and then subject to a constant re-evaluation and evolution, even though the diffusion of empirical analysis allows a convenient simplification of reality. In this thesis, a cluster of behaviors of the stock market, which is “regulated” by economic laws, will be analyzed. In fact, stock prices follow the law of demand and supply like any other good traded in any other market.

Broadly speaking, financial markets perform the same function like any other market for goods and services. They bring large numbers of buyers and sellers together in the same physical or virtual space, where they can trade financial securities instead of tangible products. Differently from other markets though, in financial markets the need for information transparency is fundamental, given the intrinsic characteristics of the products being traded in (Castaldo & Palla, 2016). Financial products can be described as instruments for managing money, as they do not represent a physical object but rather a contractual position. In turn, the ability to correctly estimate the value of such goods uniquely depends on the amount and quality of information that investors possess. Therefore, it is possible to state that the diffusion of information in capital markets is positive for the choices of single investors and the overall market, resulting in a better allocation\(^1\) of resources.

In the following chapter, a comprehensive view of the Efficient Markets Hypothesis, which is probably the most discussed theory in finance, will be provided. The most relevant literature concerning this topic and its evolution will be examined in detail, including criticisms, opinions and contemporary derivations, such as behavioral finance and the adaptive markets hypothesis.

\(^1\) Allocative Efficiency is basically obtained when there is a transfer of surplus wealth from some industrial sectors to others which are in deficit (Castaldo & Palla, 2016).
1.1 The Efficient Markets Hypothesis

The efficient market hypothesis, also referred to as the hypothesis of informational efficiency\(^1\) in markets, is one of the pillars of Financial Economics. It evolves directly from the theory of random walks\(^2\) (Fama, 1965), which essentially claims that future movements of a stock’s price cannot be predicted because they happen randomly. Eugene Fama, one of the pioneers of this theory, describes an efficient capital market as a market in which securities’ prices always “fully reflect” all available information (Fama, 1970). Although disaffections and criticisms against this theory are nowadays significant, most of the American academic financial theory, including the event study methodology and the CAPM\(^3\), is still strongly related with the assumptions stated in the efficient markets hypothesis (referred to from here on as EMH).

The EMH postulates that every investor in a financial market will rationally interpret all the available information and news surrounding a certain security, and then will compete for such security with many other investors in the market. The underlying assumption is that investors, like actors in any other market for goods and services, aim at maximizing their utility and have rational expectations\(^4\) about the profit they can make. In other words, the market aggregates the information coming from many different investors and the resulting security price is the convergence point (or fundamental value FV) of the independent valuation, opinion, and willingness to pay of each of these investors. In addition, the fierce competition among them eliminates all positive-NPV trading and arbitrage opportunities, resulting in securities being sold at their fair price\(^5\) (Berk & DeMarzo, 2011).

Other relevant interpretations of the EMH have been provided over the years by different economists. Paul Samuelson claims that in an efficient market, even though he doesn’t use this

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1. Four different types of market efficiency are often considered in literature: Technical Efficiency, Allocative Efficiency, Valuation Efficiency, and finally Informational Efficiency (Destino, 2016).
2. There is copious literature explaining the contrast between technical analysts and theorists of the random walks that goes back to the early 1960s.
3. The Capital Asset Pricing Model is currently one of the most popular equilibrium models in financial markets.
4. Rational Expectations means that the investor makes decisions after the analysis of all available information.
5. A Fair Price is the reasonable price that a buyer is willing to pay for a security, assuming it has reasonable knowledge of its value.
exact definition, prices behave as martingales\(^1\) (also referred to as “fair games”) as a consequence of the competition among participants, arguing that the only relevant outcome is that one day’s price is the best estimation of the day after’s price (Delcey, 2018). Michael Jensen suggests that the EMH can be also interpreted as a transfer of the zero-profit competitive equilibrium concept, also known as “perfect competition” in microeconomic theory, to the behavior of prices in capital markets under conditions of uncertainty (Jensen, 1978). Burton Malkiel instead, in his book “A Random Walk Down Wall Street” describes the effects of perfect market efficiency like this:

A blindfolded monkey throwing darts at a newspaper's financial pages could select a portfolio that would do just as well as one carefully selected by experts (Malkiel, 1973).

The timing factor also needs to be considered, as it plays a fundamental role in the EMH. In fact, new information capable of affecting capital markets, such as a change of management, a new tariff announcement, or any other event concerning the company’s prospects, gets constantly released every day. Considering that in an efficient market the intrinsic value\(^2\) of securities is supposed to change over time, the result is that new pieces of information disclosed are able to affect the investors’ forecasts and predictions of a company’s future earnings. Every new piece of information is thoroughly processed and then immediately incorporated in the price. Thus, investors should still expect to obtain only a normal rate of return. This means that the price adjusts instantaneously, before the investor has time exploit it (Ross, Westerfield, & Jaffe, 2004). Consequently, trading practices such as arbitrage\(^3\) are not possible in an efficient market.

The only strategy that yields profits under such conditions, does it on the long term and it is the buy-and-hold one, which consists basically of buying and passively holding the market portfolio, obtaining the expected return (Destino, 2016). Nevertheless, in the real world, every new relevant information is processed either with an overreaction, resulting immediately in higher returns

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\(^1\) In probability theory, a **Martingale** is a sequence of random variables (i.e., a stochastic process) for which, at a particular time, the conditional expectation of the next value in the sequence, given all prior values, is equal to the present value.

\(^2\) With **Intrinsic Value**, it is meant a concept developed by “Fundamental Analysts” which consists in the perceived or calculated value of a stock that incorporates all the tangible and intangible factors influencing it.

\(^3\) **Arbitrage** is the simultaneous purchase and sale of an asset traded in different markets at different prices to profit from the imbalance of such prices.
followed by an adjustment of the price or with a delayed response, resulting in returns steadily growing after the announcement, as shown in Figure 1.

![Price Reaction to New Information](image)

**Figure 1 – Price Reaction to New Information.**

Although the EMH can be considered valid in almost any type of financial market, for the purpose of the specific event study which will be described in the following chapters, only the stock market will be considered.

The literature about the EMH also tries to provide an explanation for the frequent price movements around a fundamental value typical of capital markets. Fama describes an efficient market as a situation in which security prices reflect, at any moment in time, a good estimate of their intrinsic value. It is the effects of information based both on events that have already occurred or events which as of now the market expects to take place in the future (Fama, 1965).

Although uncertainty concerning intrinsic value will persist, actual prices will wander randomly about their intrinsic value, and if there is any pricing error it is not systematic. Successive price changes will happen randomly and independently from the outcome of the event.

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1 The main body of empirical research concerning the random walk theory is focused on proving this hypothesis (Fama, 1965)
Disagreements between academics and practitioners are a daily matter in finance when it comes to some controversial theories such as the EMH. In fact, many of its critics (including a significant portion of the academic community) claim that it has little or no practical use in the real world of stock trading. Although, by summarizing all the pertinent facts about the EMH, it is possible to extract one significant practical implication from it:

No-one can profit by trading underpriced or overpriced stocks because, by definition, they do not exist in an efficient market. Moreover, no-one can “beat” the market with respect to time, as new information gets incorporated in the price immediately.

The only way to increase profits in an efficient market is exclusively by purchasing more risky investments. In fact, a strict EMH supporter would claim that investors should only purchase stock indices\(^1\) (S&P 500, NASDAQ, etc.). This would guarantee them the market return on their investments and the minimization of expenses, such as the fees of a hypothetical asset manager or analyst, because “no-one can’t beat the market”.

It is worth mentioning a widely known anecdote about a finance professor and a student who come across a $100 bill lying on the ground. As the student stops to pick it up, the professor stops him, “Don’t bother, if it were a real $100 bill, someone else would have already taken it.” That is basically what efficient markets are about.

The EMH represented a revolutionary concept in financial markets when it was originally formulated. Nevertheless, the amount of evidence in contrast with it has grown up to a considerable size and many papers about the criticism of the EMH from famous economists have been produced since the late ’70s. These incongruences and criticisms will be further elaborated in the following paragraphs.

\(^1\) A **Stock Market Index** is a performance indicator of a specific portion of a stock market or stock exchange. It can be calculated in many different ways, but the most popular one is the weighted average of the stocks traded.
1.1.1 Criticism of Technical and Fundamental Analysis

The EMH, and before that the random walk theory, was formulated in contrast to the very popular and controversial current of technical analysis (referred from now on as TA). The main implication of these theories is that some patterns highlighted in the movements of a security’s past prices tend to recur in the future (Fama, 1965). In fact, the goal of TA is to identify regularities in the time series of prices, by extracting non-linear patterns from it. Although it is necessary to assume that only some price movements are significant, as they give a contribution to the formation of a specific pattern, while other are considered just as “white noise” to be ignored (Lo, Mamsky, & Wang, 2000). In other words, technical analysts (also called “chartists) claim that it is possible to predict a stock’s future movements in price by identifying and analyzing recurring shapes in the past movements and earn excess returns by taking advantage of this recurrence.

The main difference between quantitative finance and TA lies in the fact that the first one is mainly algebraic and numerical, while the second one is geometrical and visual. Some particular examples of these patterns are: “head and shoulders”, shown in Figure 2, “double top/bottom”, “raising wedge” etc.

Figure 2 – Head and Shoulders Pattern (Lo, 2004)
The main criticisms moved to this paradigm is that, if the random walk and/or the EMH are an accurate description of reality, then the “technical” procedures for predicting stock prices are completely without value. If the price changes are essentially random and independent from the past movements, as stated in the assumptions of the EMH, investors cannot use their knowledge of the past prices to obtain excess trading profits. In fact, the methodologies of “pure” technical analysts have always been surrounded by a certain degree of mysticism in the academic community (Fama, 1965), also thanks to the unique extremely complex jargon used by such practitioners which creates a strong language barrier (Lo, Mamaisky, & Wang, 2000). Some scholars have even debated that the difference between other quantitative techniques and TA is not very distant from the difference between astronomy and astrology.

Although the academic community has always been rather skeptical towards this field for more than 100 years, recent studies have shown that with the help of modern and sophisticated algorithmic techniques based on statistical smoothing of noise and advanced pattern recognition TA is able to provide incremental information for some stock markets. This raises the possibility that TA can add value to the investment process (Lo, Mamaisky, & Wang, 2000).

Differently from TA, fundamental analysis (referred from now on as FA) has received a more generous treatment from Fama and other supporters of the EMH. The assumption of this approach is that at any point in time a security has its own intrinsic value, which depends on the earning potential. As shown in Figure 3, such earning potential depends in turn on several fundamental factors like macroeconomic environment, industry outlook, interest rate, capital structure, etc. (Fama, 1965). Through the analysis of these fundamentals, the analyst is supposed to assess if the actual price is above or below the intrinsic value, which is basically an estimate of its future price.

The main criticism of FA by supporters of the EMH mostly lie on its claim that excess returns can be systematically obtained through the superior estimation capabilities of an analyst, who will always be able to identify overpriced and underpriced stocks. Nevertheless, Fama himself contemplates the effectiveness of analysts in the efficient market. He claims that on average, analysts can obtain better returns than the investor who simply applies the buy-and-hold strategy, given that they can identify in time possible discrepancies between the current price and the intrinsic value. The intervention of these many highly skilled analysts is supposed to help the price to adjust instantaneously to new information, which makes in turn the market more efficient.
This last statement may sound confusing at a first sight, but ultimately it fits with the principles of the EMH. In fact, although the gains of these highly competent analysts may be significant, their intervention helps to establish a market in which FA becomes useless both for the average analyst and for the average investor (Fama, 1965).

1.2 Empirical Modeling of Efficient Markets

Given its mostly numerical nature, Finance is the branch of Economics that suits best a mathematical modeling of its theories and processes. This makes the employment of empirical analyses particularly convenient and consequently widespread. Thus, in the paragraphs below, it will be described quantitatively the equilibrium condition of expected returns on securities under the EMH, which has been theoretically introduced in the previous paragraph. Slightly in contrast with what reported in the preceding paragraphs, it is useful to specify that past prices actually have some relevance for the random walk and efficient markets.

Given their random nature, future prices are easily modeled by probability distributions, and the appropriate probability density function to perform such modeling is extracted from the time series (Fama, 1970). In this thesis, for demonstration purposes it is always assumed that prices follow a normal distribution, even though the evidence sometimes points in completely different directions.
The main purpose of this section is to lay out the empirical foundations of prices behavior in the stock market in order to establish a model for a security’s abnormal returns, which will be later used in the event study calculations.

1.2.1 Price Behavior

Before laying out more advanced implication of the EMH, it is fundamental to analyze in detail how prices move in a financial market and the mathematical tools that are used to describe them. For simplicity’s sake, this analysis will be reduced to Fama’s random walk model and to Samuelson’s geometric Brownian motion. This topic is extremely vast and complex, and the purpose of this thesis is only to give a quick review of its basic concepts, that will be employed in the main research body of the paper.

The Random Walk Model:

Fama claims that in a random walk (referred from now on as RW) market, uncertainty makes impossible to predict future prices, which will wander around the intrinsic value of a security in a random fashion (Agwuegbo, Adewole, & Maduegbuna, 2010). This synthetic description provided is particularly helpful to lay out a basic mathematical framework of the RW and then to highlight the differences with the more complex geometric Brownian motion model.

In Figure 4, it is possible to observe the many possible trajectories of a simple random walk starting from an arbitrary value.
In particular, given a stock price $P_0$ at a certain time $0$, the RW model implies that successive $n$ price changes $p_1, p_2, \ldots, p_n$ are independent, identically distributed, random variables which can only move one “step” upwards or one “step” backwards. This basically means, in the simplest form, that the random variable $P_i$ at the time $i$ can either return the value $+1$ or the value $-1$, both with a $50\%$ probability. Therefore, the function that represents the final price $P_n$ after $n$ steps is:

$$P_n = P_0 + \sum_{i=1}^{n} p_i$$

This model has two important limitations. Regardless of the size of the step, it does not conceive more “extreme” price changes in short time-frames (as shown in Figure 4), which are fairly frequent in the stock market. Moreover, stocks have limited liability and their price cannot thus become negative, whereas this very simple model allows this eventuality. The more sophisticated Geometric Brownian Motion model, which also Fama adopted later, provides a solution for these problems.

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1 In the **Random Walk Model**, the step indicates the numerical unit that is added or subtracted to the previous price value. The basic model includes a step of absolute value 1, but this can be easily changed to suit different modeling needs.
The Geometric Brownian Motion Model:

Samuelson introduced this model in 1965, to upgrade the existing Brownian motion model created by Bachelier. It designed it in such a way that the price of a stock is subject to the same multiplicative (or percentage) fluctuation per unit of time, regardless of the absolute value of the stock. The geometric Brownian motion model (GBM) develops in continuous time and it can be related to several primitive assumptions on preferences and returns (LeRoy, 1989). This makes it less restrictive than the random walk model, and therefore a better choice for modeling prices.

\[
P_t = P_0 \exp \left( (\mu - \frac{\sigma^2}{2}) t + \sigma W_t \right)
\]

In this equation \( W_t \) is a Weiner stochastic process and is the only random element. The constants \( \mu \) and \( \sigma \) are respectively called “drift” and “volatility”. Their effect can be clearly observed in Figure 5. \( P_0 \) instead, is an arbitrary value used to determine the starting point of the whole price process. This model became increasingly popular in the 1970s, as it was used to model stock prices in the Black-Scholes derivative pricing model.

Figure 5 – Geometric Brownian Motion (Wikipedia, 2018)
1.2.2 Equilibrium Conditions

The EMH has empirical relevance only within the context of a specific market equilibrium that can somehow describe the effect of information incorporation (Fama, 1970). In fact, market efficiency must be always tested in a joint-hypothesis with market equilibrium. In his later review of the EMH, Fama reformulates this assumption like this:

We can only test whether the information is reflected properly in prices in a pricing model that defines the meaning of “properly” (Fama, 1991).

Most of the relevant literature agrees on the fact that the condition of market equilibrium can be stated in terms of expected return. This means that every security on the market offers a “fair” or “equilibrium” trade-off between risk and return. It is now fundamental to underline that in this thesis the term “risk” will be used as a common reference to the volatility of price, because in literature it is not possible to find a univocal definition of it.

When it comes to describing the EMH with mathematical terms, Jensen’s definition turns particularly useful.

A market is efficient with respect to the information set $\theta_t$\(^1\) if it is impossible to make more than the expected return by trading only on the basis of an information set $\theta_t$ (Jensen, 1978).

Such expected return can be represented with this equation, which represents the equilibrium conditions of an efficient market:

$$E(P_{t+1} | \theta_t) = P_t (1 + r_t) = [1 + E(r_{t+1} | \theta_t)]P_t$$

Where $P$ and $r$ are random variables, $r_t$ is the required return on the asset for the period $t$ and $E(P_{t+1})$ is the expected price\(^2\) at the end of the period $t$. The conditional expectation notation is

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\(^1\)The use of the variable $\theta_t$ to describe a generic concept such as information is a convenient simplification used only for the purpose of modeling.
specifically used to imply that the information set $\theta_t$ is “fully incorporated” in the price, as the theory states.

The consequence of this equilibrium model is that it is not possible to obtain extra profits\(^1\) on the owned securities only thanks to the information contained in $\theta_t$. It can be also extracted that asset prices (after being adjusted for required returns) will behave as martingales\(^2\) with respect to the information set $\theta_t$, which includes the past movements such prices.

This equilibrium condition rejects the existence of trading systems based only on $\theta_t$ that yield profits or returns in excess of the expected ones.

Given the excess profit $\pi_{t+1}$, this can be written as:

$$\pi_{t+1} = P_{t+1} - E(P_{t+1}|\theta_t)$$

That results in:

$$E(\pi_{t+1}|\theta_t) = 0$$

The equilibrium condition can also be expressed in terms of the Abnormal Return $AR_{t+1}$, as a function of the observed return $R_{t+1} = P_{t+1}/P_t$:

$$AR_{t+1} = R_{t+1} - E(R_{t+1}|\theta_t)$$

That results in:

$$E(AR_{t+1}|\theta_t) = 0$$

Finally, this concept can be extended also to a portfolio composed of many different securities. Given a portfolio $V$ and a generic amount of funds $\alpha(\theta_t) = [\alpha_1(\theta_t), \alpha_2(\theta_t), \ldots, \alpha_n(\theta_t)]$ to be invested in $n$ stocks.

It easily verifiable that:

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\(^2\) It is assumed that the investment income is immediately reinvested in the same security, like a compounded rate.

\(^1\) In Economics this is also called **Excess Market Value**, and it corresponds to the difference between the observed price and the expected value of the price projected one time-unit earlier.

\(^2\) In the original form of the **EMH**, Fama argued that prices behave like random walk. Argument that was corrected in the following papers.
\[ V_{t+1} = \sum_{j=1}^{n} \alpha_j(\theta_t)[R_{t+1} - E(R_{t+1}|\theta_t)] \]

That results in:

\[ E(V_{t+1}|\theta_t) = 0 \]

It is also important to highlight that the stochastic processes \( \{AR_t\}, \{\pi_t\}, \text{and} \{V_t\} \) are all martingales with respect to \( \theta_t \).

The equilibrium conditions described above, are then meant at establishing a common ground on which the various forms of market efficiency are jointly tested.

### 1.3 The 3 Forms of Efficient Markets

Before describing the EMH in details, some assumptions must be laid down, in order to ensure that the hypothesis holds.

In an efficient market, it is expected that:

- There are no transaction costs in the trade of securities.
- All relevant information is available for free to market participants.
- Every participant agrees on the implications of current information for the current price and distributions of the future price of each security.

To handle different response rates, researchers separate information into different types: information on past prices, publicly available information and all information. According to Jensen’s definition, these can be defined as three different information sets \( \theta_t \), each one including the other according to their relative strength. As Figure 6 shows, these information sets are contained one inside another, from the weakest to the strongest form.
1.3.1 The Weak Form

Capital markets are said to be weakly efficient or to satisfy weak-form efficiency if they fully incorporate the information in the past stock prices.

The weak form of efficiency can be mathematically expressed with:

\[ P_t = P_{t-1} + E(return) + random\ error_t \]

This equation states that the price at time \( t \) is equal to the sum of the last observed price plus a random variation occurred over the time interval. This implies that the expected return is a function of a security’s risk while the random error is due to new information about the stock issuer.

The weak form rejects the validity of the technical analysis, which states that it is possible to predict the future from the patterns of past price movements. By denying that future market movements can be predicted from past movements, we are denying the profitability of a host of techniques falling under the heading of technical analysis. (Using figures to anticipate stock price movements) I.E: Head & Shoulders. Exploiting cyclical patterns thus would not be possible if the weak efficient market hypothesis held. In conclusion, the weak form of EMH claims that past price movements do not affect stock prices.
1.3.2 The Semi-Strong Form

Capital markets are said to be semi-strongly efficient, or to satisfy semi-strong efficient form, if prices incorporate all publicly available information, such as financial statements and other documents which are required in mandatory corporate disclosures. This is the most widely accepted paradigm and whenever the EMH is generally mentioned, in the striking majority of circumstances it is referred to this specific form. This is because there is more evidence in support of this hypothesis than in support of the strong and the weak forms combined (Ross, Westerfield, & Jaffe, 2004). The semi-strong form of the EMH basically states that, whenever a new piece of relevant information is released, the market incorporates it immediately. Therefore, a delayed response of the market to a given event results in the market itself not being efficient.

The semi-strong form of market efficiency is tested empirically with the event study methodology. Since this econometric methodology is the core subject of this thesis, it will not be described in detail here. A thorough analysis of all the characteristics, as well as the implementation of this technique, can be found in Chapter 3.

1.3.3 The Strong Form

Capital markets are said to be strongly efficient, or to satisfy the strong efficient form if prices incorporate all information, both public and private. This implies that profits exceeding normal returns cannot be realized regardless of the amount of research or insider information investors have access to. This is clearly an extreme form of the EMH, and it has little practical usage. In fact, it is treated by economists mostly as a logical completion of the set of possible hypotheses (Jensen, 1978) and there is widespread skepticism about it. Given these peculiar characteristics, as well as the extreme difficulty of testing it empirically, the strong form of the EMH has been barely covered in financial literature. Especially if compared to the other two forms.
1.4 Beyond the Efficient Markets Hypothesis

The EMH history articulates in three phases. In the 1960s it began the construction of the hypothesis, mainly thanks to the contributions of Fama and Samuelson. In the 1970s, the establishment of an empirical corroboration generated consensus in the economic academia, and since the 1980s the evidence in opposition to the EMH is constantly piling up (Delcey, 2018).

In 1978, when the econometric tools were starting to improve their level of sophistication, Michael Jensen wrote:

There is no other proposition in Economics which has more solid empirical evidence supporting it than the Efficient Markets Hypothesis. Yet, we seem to be entering a stage where incohesive evidence is arising which seem to be inconsistent with the theory (Jensen, 1978).

Since that moment, many economists kept on hypothesizing that occasional departures from a situation of market efficiency situation were not a coincidence, but rather a systematic occurrence. The criticism made by Grossman and Stiglitz in 1980 became immediately popular. They argued that since obtaining information is not costless, prices don’t perfectly reflect all the available information. If they did, investors who spent resources to gather information would receive no compensation (Grossman & Stigliz, 1980). Nowadays, the EMH is partially discredited, as many scandals and proved that markets sometimes can be far from efficient. Although, it remains a good starting point for scholars that aim at understanding the complex dynamics of financial markets.

In the latest decades, the field of behavioral finance has made its appearance in academic environments. It basically studies the influence of the human psychological sphere on the behavior of the actor in financial markets, and then observe the reaction on the market itself. Moreover, in 2004 MIT Sloan’s professor Andrew Lo has condensed all the critics about the EMH and formulated a new qualitative paradigm that argues to explain the behavior of actors in financial markets, based on an evolutionary approach to economic interactions (Lo, 2004).

Even though both these paradigms are still in their embryonal phase, they might one day become the new standard theorems of financial economics and replace definitely the EMH.
1.5 Conclusions

As shown in this chapter, the EMH is nothing more than a convenient simplification of real markets, whose usefulness mostly lies in allowing the mathematical modeling of price movements, market equilibrium, and other elements. It can be argued that markets indeed react to every new relevant information being disclosed, but their reaction can be sometimes far from efficient.

Some scholars even argued that the 2008 financial crisis represents the end of the traditional EMH. Paul Volker, former chairman of the FED said:

it's clear that among the causes of the recent financial crisis was an unjustified faith in rational expectations and market efficiencies.

Despite this harsh criticism, and despite the fact that it cannot be regarded as other stronger economic theories, the EMH can still turn useful under some circumstances. In fact, the efficient market equilibrium model can be referred to as the ideal model of market behavior. It follows that any departure from this equilibrium model signals an anomalous situation, and those anomalies can be then identified and studied.

In the following chapter, a short introduction on rating agencies will be provided. They will be introduced as information intermediaries, and thus entities that can disclose relevant information able to influence the price of rated securities, perturbing the equilibrium model.
2. RATING AGENCIES

The origins of the Rating Industry can be traced back to the industrial development of the United States in the 19th century\(^1\), through the private financing of many infrastructure projects such as bridges, railways, and roads. Up to those years, investors didn’t feel the need for a rating because most of the upstanding obligations were sovereign. Therefore, the full solvency of such securities was always implicitly assumed. After the diffusion of private obligations, small investors were skeptical about the value of the underlying investment projects and the need for an instrument with the purpose of earning their trust started arising (Castaldo & Palla, 2016).

The first credit reporting agency, named Mercantile Agency\(^2\), was established in 1841 by Lewis Teppan and first rating, in the format currently used, ever published was assigned in the United States in 1909 by John Moody, who later gave birth to the homonymous agency: Moody’s. Since that moment, the main characteristics of the industry, as well as the major players, haven’t really changed in more than a century of existence.

As already introduced in Chapter 1, the decision-making process of financial operators, if based on an incorrect information set, is inefficient and can lead to losses. Financial products, being intangible, represent a form of wealth whose value can only be estimated through the analysis of the economic sublayer. It is clear that rating agencies, with their role of intermediaries, play a fundamental role in guaranteeing an efficient flow of resources in financial markets. For this reason, the responsibility of those agencies in the 2008 financial crisis, which generated one of the biggest market failures in history, started a debate worldwide on whether their current role in financial markets and their power should be discussed (Sinclair, 2010).

In the following chapter, a basic analysis of the rating industry will be provided, as well as the characteristics of the three main agencies and the criteria with those ratings are being assigned. Furthermore, there will be also a broad view of the regulatory framework in which these companies operate and how it evolved over the years.

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\(^1\) It is also useful to remember that this period saw the rise of the modern Investment Banking Industry, with the establishment of names such as J.P. Morgan, Lehman Brothers, etc.

\(^2\) Mercantile Agency later changed its name in Dunn & Bradstreet, which operated as an independent rating agency until 1962, when it was acquired by Moody’s.
2.1 Information Asymmetries

Information asymmetries are considered to be the main cause of market failures, as they put an obstacle to the allocative efficiency of resources in the markets themselves (Castaldo & Palla, 2016). There is an information asymmetry when, in a financial transaction, one party possesses more, better, or “earlier-obtained” information than its counterparty. The party in possession of this information can then make a better-informed decision or even take advantage of the counterparty, leading to a zero-sum game.

The consequence of this information gap is a situation in which the future return on securities affected by asymmetries between the buy and the sell sides of a transaction cannot be precisely determined. As a result, the final price does not incorporate every information about the risks related to the security being traded, and thus, the investment will be inefficient.

During the negotiation of a deal, two specific and common information asymmetry situations can be identified. They differ mainly in the timing of the asymmetry:

- **Adverse Selection**: it occurs when one party, during the negotiation phase, has more accurate and different information than the other party regarding its default probabilities, leading to a situation of disadvantage for the less informed party.

- **Moral Hazard**: it occurs when the issuing party provides misleading information about the security and, once the deal has been signed, then changes his behavior to opportunistic when it does not have to face the consequences of the risk it takes.

When making investment decisions, being in possession of accurate information is a necessary condition to make accurate and rational choices (Castaldo & Palla, 2016). Citing Modigliani and Miller’s theorem, if financial markets were perfect (no transaction costs, complete information transparency), the choice of financing sources should not influence investment decision (Ćorić, 2010). Unfortunately, the EMH is only an ideal simplification of how markets really work in the real world. They are systematically characterized by a lack of information that impacts on the relationship among the various operating subjects, leading often to situations of uncertainty.

Since the rise of modern capital markets, the quest for obtaining proper information has always interested every actor in the market and many solutions and proposals have been implemented to bridge the gap and make the, sometimes contrasting, interests of borrowers and savers meet.
2.1.1 Intermediaries and Relationship with Efficient Markets

Corporate disclosure\(^1\) is an example of measures aimed at overcoming information asymmetries, and it is critical for the functioning of an efficient stock market (Healy & Krishna, 2001). Publicly traded firms are required to disclose relevant information through shareholder reports, which include financial statements, footnotes, management discussion, and performance analysis.

Nevertheless, most of the time information about an investment’s riskiness is not so easily available to the average investor, or it is too complex to be effectively interpreted. In fact, in equity markets, the parties involved in a transaction are often generic investors and the firm’s management. The latter, being most of the time in possession of confidential or hidden information, holds the upper hand during negotiations. This leads to the investors being unwilling to lend their money if they fear that insiders may profit at their expense. This, in turn, increases firms’ cost of capital to the extent that the risk in the economy has to be borne by fewer investors (Lambert, Leuz, & Verrecchia, 2012). That is where information intermediaries step in.

Figure 7 – Financial and Information Flow in a Capital Economy (Healy & Krishna, 2001)

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\(^1\) Corporate Disclosure can be defined as a periodical communication between a publicly traded firm and its stockholders about the firm performance, governance changes, and other key issues.
They are external entities, private or governmental, that collect information from firms, analyze it, and then provide it in many different forms to the demand side actors in capital markets. Given that investors tend to prefer more transparent markets, intermediaries are widely recognized to make a positive contribution to the efficiency of the market they operate in, by allowing investors to rationalize their investment choices. This way, both investors and firms benefit from the action of intermediary, which reviews the value of an investment. Since reputation is one of the biggest assets of intermediaries, they have an interest in delivering information as accurate as possible.

Typical information intermediaries are:

- Financial Specialized Press
- Independent Financial Analysts
- Financial News Agencies (Bloomberg, Reuters, …)
- Commercial Banks (Intesa Sanpaolo, UniCredit, …)
- Investment Banks (Mediobanca, Société Générale, …)
- Financial Brokers
- Credit Rating Agencies\(^1\) (Moody’s, Standard & Poor’s, Fitch, …)

Even in the area of publicly traded companies, which are supposed to disclose every piece of information, intermediaries can still provide valuable help. Given that investors are faced with several hundred incoming news stories every day, companies try to exploit this situation by “packaging” bad news into announcements that are longer and less focused on the company itself (Dzieliński, 2017). News agencies take over the task of “unpackaging” company press releases and provide to investors clear and unbiased information about potential negative announcements.

Some recent research also shows evidence of how intermediaries provide several indirect benefits to lenders as well. Firms that have borrowed from the same banker or share an indirect connection through a network of bankers are significantly more likely to enter an alliance (Frattaroli & Herpfer, 2019). Nevertheless, it is important to remember that, even though the benefit provided to market efficiency by information intermediaries cannot be denied, the role that some of them, rating agencies in particular, play in financial markets carries also a significant conflict of interest, whose consequences can sometimes be dramatic.

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\(^1\) There exist also Credit Rating Agencies based in Europe, but their importance and relevance, also in European markets themselves, are negligible compared to their American counterparts.
2.2 Rating Agencies

Because of their intertwining role with financial regulation, and their century-old history, rating agencies are indeed among the most influential intermediaries operating in financial markets. In a nutshell, they can be defined as privately-owned information intermediaries that express opinions about the creditworthiness of given investments through a specific scale of symbols.

Currently, as shown in Figure 8, there are three rating agencies detaining around 90% of the market share: Moody’s, Standard and Poor’s and Fitch. They are usually referred to as the “The Big Three of rating” and they dominate the industry since its early days. Each agency has ratings outstanding on 10 trillion dollars of securities (White, 2010). In fact, high economies of scale, reputation, and artificial barriers to entry make the rating industry a perfect example of oligopoly.

Since the topic of rating agencies and their potential conflict of interest concern with regulation is already broadly covered in literature, this thesis will focus solely on highlighting the key aspects of the rating methodology. The criteria and the business model of the agencies will be shortly described, as well as the new European regulation post-2008 controversies.

This selection has been made to focus solely on the factors that may have changed investors’ perspective towards rating agencies after the crisis, to give the event study a wider interpretation.
2.2.1 The Rating Activity

In the previous paragraphs, it has been established that the purpose of information intermediaries, and rating agencies in particular, is to improve the efficiency of financial markets by providing reliable, correct, and independent information to operators. In fact, this is the only way investors can obtain a return on capital that is correctly proportioned to their risk preferences. According to Standard & Poor’s public manifesto, rating securities help foster the development and smooth functioning of capital markets (Standard & Poor’s, 2014).

In order to dig deeper into the nature of such information and its implications, it is useful to formally state the definition of credit rating:

A rating is a provisional judgment\(^1\), assigned by a specialized agency, on the ability of an issuing entity to meet its financial commitments

(Castaldo & Palla, 2016)

In other words, it represents the creditworthiness assessment of an issuer, assigned to the issuer itself or to one of its outstanding debt obligations. This means that a credit rating expresses an estimate of the probability of default or delayed payment of the security. Such probability is not expressed in absolute terms but rather in relative terms since there are future events and developments which cannot be foreseen. Meaning that a higher rated security is viewed, according to the agency’s criteria, as less likely to default than a lower rated one (Standard & Poor’s, 2014).

It is also worth mentioning that, after the recent controversies following the default of many securitized sub-prime mortgages, rating agencies spent considerable efforts in clarifying that ratings are not recommendations to buy or sell a security, but rather mere opinions.

Ratings are also assigned on short-term and long-term scales, to better profile the different risks arising in different time frames. Among the different types of ratings, credit ratings are the most popular. Although, the main agencies also provide ratings and scores about the financial and operational strength of companies, which are related to different kinds of risk (Fitch, 2019). Moreover, ratings are not static. They are constantly and periodically updated by the rating agencies to align with new developments in the markets, guarantee constant monitoring, and ultimately to

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1 After some bankruptcy trials, every major rating agency agrees on their ratings to be considered “opinions”.
prevent actions driven by moral-hazard\(^1\). Some ratings also include an outlook, indicated with + or - signs, which is basically a prediction on the improvement or deterioration of the rated security.

The success of such instruments can be partly explained by the fact that ratings provide an effective solution to the needs of a complex and globalized financial sector to have complex information distilled by experts into easy-to-use symbols and rankings (Coffee, 2006). On the other hand, investors trust the fact that rating agencies have an insider position, thanks to which they have access to confidential and valuable information about the issuers. Agencies formulate and disseminate rating opinions that are used by investors and other market participants who may consider credit risk in making their investment decisions. In part, because rating agencies are not directly involved in transactions, but they are viewed by both investors and issuers as impartial, independent providers of opinions on credit risk. Also, the rating is often not offered as a standalone opinion. It is usually accompanied by an explanatory analysis and, before being publicly disclosed, it is communicated first to the issuer who can appeal the decision of the agency, in case it is not satisfied (Cantor & Parker, 1995).

<table>
<thead>
<tr>
<th>Moody’s</th>
<th>S&amp;P</th>
<th>Fitch</th>
<th>Default %</th>
<th>Risk</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>AAA</td>
<td>AAA</td>
<td>0.01%</td>
<td>Minimum</td>
<td>Extremely strong capacity to meet financial commitments.</td>
</tr>
<tr>
<td>Aa1</td>
<td>AA+</td>
<td>AA+</td>
<td>0.02%</td>
<td>Moderate</td>
<td>Very strong capacity to meet financial commitments.</td>
</tr>
<tr>
<td>Aa2</td>
<td>AA</td>
<td>AA</td>
<td>0.03%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aa3</td>
<td>AA-</td>
<td>AA-</td>
<td>0.05%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A+</td>
<td>A+</td>
<td>0.05%</td>
<td>Medium-Low</td>
<td>Strong capacity to meet financial commitments, but somewhat susceptible to adverse economic conditions and changes in circumstances.</td>
</tr>
<tr>
<td>A2</td>
<td>A</td>
<td>A</td>
<td>0.07%</td>
<td></td>
<td></td>
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<tr>
<td>A3</td>
<td>A-</td>
<td>A-</td>
<td>0.09%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baa1</td>
<td>BBB+</td>
<td>BBB+</td>
<td>0.13%</td>
<td>Acceptable</td>
<td>Adequate capacity to meet financial commitments, but more subject to adverse economic conditions. Considered the lowest investment-grade by market participants.</td>
</tr>
<tr>
<td>Baa2</td>
<td>BBB</td>
<td>BBB</td>
<td>0.18%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baa3</td>
<td>BBB-</td>
<td>BBB-</td>
<td>0.32%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) If ratings were static, the rated issuer could radically change its policies, undertaking higher risks, and taking advantage of investors, knowing that his rating score would not be changed.
<table>
<thead>
<tr>
<th>Speculative Grade</th>
<th>Ba1</th>
<th>Ba2</th>
<th>Ba3</th>
<th>BB+</th>
<th>BB+</th>
<th>BB+</th>
<th>BB+</th>
<th>Acceptable under Condition</th>
<th>Considered highest speculative-grade by market participants. Less vulnerable in the near-term but faces major ongoing uncertainties to adverse business, financial and economic conditions</th>
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<tr>
<td></td>
<td></td>
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<td></td>
<td>BB</td>
<td>BB</td>
<td>BB</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BB-</td>
<td>BB-</td>
<td>BB-</td>
<td>BB-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speculative Grade</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>Caa1</td>
<td>Caa2</td>
<td>Caa3</td>
<td>Ca</td>
<td>C</td>
<td>Specific Attention and constant monitoring</td>
</tr>
<tr>
<td></td>
<td>B+</td>
<td>B+</td>
<td>B-</td>
<td>CCC</td>
<td>CCC</td>
<td>CCC-</td>
<td>C</td>
<td>CCC</td>
<td>Under Observation</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>B</td>
<td>B-</td>
<td>CCC</td>
<td>CCC</td>
<td>CCC</td>
<td>C</td>
<td>D</td>
<td>Unsustainable</td>
</tr>
<tr>
<td></td>
<td>B-</td>
<td>B-</td>
<td>CCC</td>
<td>CCC</td>
<td>CCC</td>
<td>CCC</td>
<td>D</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CCC</td>
<td>CCC-</td>
<td>CC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>DDD</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CCC</td>
<td>CCC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>DD</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>C</td>
<td>D</td>
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<td>SD</td>
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Figure 9 – Source: (Castaldo & Palla, 2016) (Standard & Poor’s, 2014)

At the dawn of the industry, agencies provided the public rating of securities free of charge and obtained their revenues from the sale and publication of related materials for investors. After 1970, as the publication business did not yield sufficient returns to justify intensive coverage and the demand for faster and more comprehensive rating services increased, rating agencies changed their business model and started charging issuers for rating them (Cantor & Parker, 1995).

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1 There is a strong relationship between rating agencies and the publishing industry. In fact, Standard & Poor’s is owned by McGraw-Hill, and Fitch was initially a financial publisher.

2 The old business model may have also been threatened by the spread of new photocopies machines (White, 2010).
This business model transformation opened the doors to potential conflict of interests issues, but rating agencies’ concern about the reputation as their biggest asset, managed to keep the conflict of interest in check for the first three decades after the change (White, 2010).

Nowadays, it’s general market practice, in order to ensure sufficient liquidity from investors, for debt issuers to be rated by at least one agency. In fact, agencies usually obtain confidential information from issuers and factor this information into their ratings opinion. Thanks to this, issuing companies can reach a favorable cost of capital without disclosing information that may compromise their competitive position. In some cases, being rated is also a mandatory condition to access particular categories of funding, such as pension funds and mutual funds.

![Figure 10 – Steps to obtain a Credit Rating (Standard & Poor's, 2014)](image)

The “Big Three” rating agencies\(^1\) also offer a service called unsolicited rating\(^2\), which consists of assigning ratings to outstanding securities only on the basis of publicly available information and without being requested by the issuer. This practice is widely popular in the United States, while it was authorized in Europe by the European Banking Authority only in 2016. (Congiu, 2016)

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1. **Fitch** started assigning unsolicited rating only after 2000.

2. A lot of controversies are being caused by **unsolicited ratings**. It has been repeatedly alleged that rating agencies use this instrument to force issuers to purchase their services, in order not to undermine their credit reputation.
2.3 Rating Criteria

Until recently, rating agencies have been reluctant to disclose the methodologies used to calculate ratings, making it difficult, if not impossible, for the market to fully understand how they estimate those rankings (Castaldo & Palla, 2016). Moreover, their algorithms were never submitted to the review committee of the Econometric Society. Therefore, it was not even possible to know whether their methodology could have been considered “state-of-the-art” or not.

After the recent streak of defaults, agencies started revealing more and more elements about their methodologies. Although, some of their personalized criteria and the weight assigned to specific factors in the overall analysis still remain unknown (Ferri & Lacitignola, 2014).

When a rating is being assigned, the specific risk factors that are accounted for depending partially on the sector in which the issuer operates. The credit analysis of a corporate issuer typically considers many financial and non-financial factors, including key performance indicators, economic, regulatory, and geopolitical influences, management and corporate governance attributes, and competitive position (Standard&Poor's, 2010). In rating a sovereign government instead, the analysis focuses on fiscal and economic performance, as well as monetary stability and the effectiveness of the government’s institutions.

Rating agencies evaluate separately and using different methodologies, as shown in Figure 1, these two specific risk profiles, namely financial risk profile and business risk profile.

![Figure 11 – S&P Rating Criteria (Standard & Poor's, 2010)](image-url)
The procedure used to assess the **financial risk** of an issuer does not differ much from a traditional valuation analysis (Castaldo & Palla, 2016). The analysis includes most of the traditional financial and accounting ratios, such as EBITDA, ROE, current ratio, liquidity, etc. It is important to specify that rating agencies do not employ just one single financial profiling model. The weight assigned to every financial ratio significantly differs in the overall analysis according to the industry and the size of the issuer\(^1\). Although, the analysis is not a mere assessment of the consolidated balance sheet, but rather aimed at determining the volatility and risks of future cash inflows.

The **business risk** instead, is evaluated after an information set of mostly qualitative nature, whose interpretation is strictly dependent on the subjectivity of the analyst and his ability to understand reality. Agencies using the analyst-driven approach generally evaluate risks related to the competitive environment the firm operates in, such as the barriers to entry, the suppliers and customers’ bargaining power, and the degree of rivalry within the industry itself. Teams of analysts review these elements to assess the issuer’s financial health, operating performance, policies effectiveness, and risk management strategies.

A clear distinction between issuer and issue rating must be done. An **issuer rating** generally refers to the likelihood that an issuer may default with regard to all its financial obligations. An **issue rating** instead, is based on a blend of issuer risk and the priority of a creditor’s claim in the eventuality of a bankruptcy associated with the debt being rated. It is also worth mentioning that so far, no significant difference has been found in the way the Big Three rate securities and issuers. Although, it has been observed that Moody’s and Standard and Poor’s provide systematically lower bond ratings compared to their smaller competitors (Christiansen, Dyer, & Harbord, 2004).

In the following chapter, an event study on banks’ issuer rating changes will be analyzed. Therefore, it must be specified that, rating-wise, banks are different from other industries. In fact, the role that banks play as financial intermediaries and their importance for financial stability determine the degree of external assistance they receive, as well as the risk factors they are exposed to (Packer & Tarashev, 2011). Their creditworthiness also accounts for the degree of support that government and financial institutions can provide in case of distress. For this reason, agencies usually assign a “stand-alone” rating, reflecting the intrinsic financial strength of the bank, and an “all-in” rating, also factoring the likelihood and the magnitude of such external support.

\(^1\) A parameter such as the **liquidity ratio** has a dramatically different importance if the rated issuer is a bank or a financial institution rather than a consumer products manufacturer.
2.4 Controversies and Regulation

The intertwining of rating agencies and regulators started in 1975, when the SEC, the Security and Exchange Commission of the United States, started to treat some rating agencies as the “Nationally Recognized Statistical Rating Organizations” (Karminsky & Peresetsky, 2008). After that moment, various supervisory bodies set rules governing financial activity depending on credit ratings. For instance, the US Federal Reserve has prohibited banks to purchase bonds with rating below investment level. Also, the Basel Committee\(^1\) offers banks to set reserve ratios depending on the rating of the borrowers. The regulatory “protection” of some agencies is the main reason why the number of firms operating in the market is so low despite the very attractive profitability\(^2\).

Nevertheless, today the number of scholars and experts who express concerns about the power of rating agencies is considerable and it keeps growing every year. Conflicts of interest, as well as biases on the part of the rating agencies, have been pointed out on numerous occasions. These concerns primarily involve the issuer-pays model, as it is alleged that issuers may bribe agencies to obtain higher credit scores, and the shady rating criteria make this bribery almost impossible to prove. Some of these concerns are also attributable to the fact that it is quite common for issuers and agencies to establish long-term relationships (Weemaels, 2013). Moreover, following the latest financial crisis, rating agencies have been repeatedly accused to have underestimated the risk of specific derivative financial products (Mayer & Isenbart, 2013). After these developments, it was clear to many legislators that a stricter regulation on rating agencies was indeed needed.

In the European Union, the first provision concerning rating agencies, Regulation No. 1060/2009, was adopted in 2009 and entered into force in 2011. Before that moment, the topic was barely mentioned in few articles of the competition law and market abuse sections of TFEU. This delay in implementing a code of conduct can also be explained by the fact that, before the adoption of a common currency, European obligations markets individually lacked size and bargaining power to impose their will on such powerful entities (Castaldo & Palla, 2016). The main purpose of this new regulation was to establish an initial registration procedure for rating agencies, but actually, it was meant as the first step in the development of a broader regulatory structure (Weemaels, 2013).

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\(^1\) The **Basel Committee on Banking Supervision** is a global standard setter for banking regulation. It was established in 1974 by the central bank governors of the 10 biggest economies.

\(^2\) In 2017, Standard & Poor’s reported on its activity a profit margin ranging around 41%. 
The provisions contained into the newly adopted European regulation can be divided into three main pillars: **Registration**, **Quest for Quality Ratings**, and **Supervision**.

Rating agencies that wish to issue credit ratings in the European Union can opt to apply for **registration** with the ESMA. The registrant must provide information such as organizational structure, ownership structure, rating criteria, compensation arrangements, etc. It must be specified that rating agencies are not obliged to register, in order to operate in the Community. Although, any institution that wishes to use a credit rating is obliged to rely only on those issued by registered agencies. Facing the risk of losing their clients, rating agencies had no choice but to comply with the new regulatory framework, especially since ESMA had established a stricter system to oversee credit opinion from non-Member States.

The **quest for quality ratings** consists of several provisions aimed at fighting conflicts of interest and ensuring maximum transparency. Some of these provisions are:

- Rating models used by agencies must comply to the 2012 ESMA technical standards.
- Agencies must clearly indicate the name and job title of the lead analyst as well as the person primarily responsible for approving the rating.
- Agencies must have a supervisory board, at least one-third of whose members are not involved in credit rating activities.
- Agencies must establish and disclose policies and procedures intended to ensure the independence of their rating activity.
- Agencies are in charge of defining compensation for their analysts. The direct negotiation of salaries between analysts and issuers is prohibited.
- Agencies have civil liability to investors and issuers in case of procedure infringement (Regulation No. 462/2013)

After the modification of the Regulation No. 513/2011, the ESMA was appointed in charge of the **supervision** of rating agencies. The approach used to supervise is risk-based, meaning that ESMA uses a structured approach to identify potential threats at individual supervised entity or industry level. Moreover, it can opt to launch new investigations or market studies, as well as to take ad-hoc supervisory measures when necessary (ESMA, 2019).

The set of rules listed above aims at promoting fair competition and ultimately improving market efficiency. It must be remembered though, that there is still no sufficient evidence in support of the effectiveness of such regulation, and eventual policy updates are still being discussed.
2.5 Conclusions

In conclusion, rating agencies can be defined as powerful and influential information intermediaries, which have the potential to bridge the borrower-lender information gap by disclosing scores on the borrower’s creditworthiness. Although, in this chapter, their role in financial markets has been mainly analyzed with respect to issuers, because obligation issuers need to be rated in order to gain access to certain capital markets, and to institutional investors; those which are only allowed to purchase investment-grade rated securities.

Harder to measure and to understand though, is the importance and relevance that credit ratings have for common investors. In fact, several previous studies have shown that stock price reactions to rating change announcements are quite modest or even statistically insignificant (Linciano, 2004). Furthermore, the small statistically significant impact of such rating actions has been observed only in correspondence of rating downgrades or negative watches change.

Therefore, the purpose of this thesis is to investigate whether the adoption of the new Community Regulations (1060/2009, 513/2011, and 462/2013), aimed at increasing transparency and ensuring compliance to state-of-the-art techniques, has produced a significant change in the way investors perceive credit rating disclosures by the Big Three agencies. In the following chapter, a description of the event-study technique used to investigate this eventual change will be provided, as well as the outcome of the overall analysis.
3. EVENT STUDY AND EMPIRICAL ANALYSIS

In Chapter 1, it has been repeatedly suggested that, according to the EMH, capital markets reflect all available information about firms through their stock prices. Given this premise, it is possible to study how a particular event changes a firm’s prospects by quantifying the impact of the event on the firm’s stock.

In Chapter 2, rating agencies have been introduced as powerful information intermediaries that provide information about the creditworthiness of borrowers by releasing credit scores. Thanks to the regulatory role of their services, these agencies can hence influence markets by disclosing their ratings.

After introducing the concept of efficient markets first and having depicted a basic framework of the operational practices of rating agencies afterwards, in this chapter the impact of rating actions, downgrades in particular, on the efficiency of the Italian stock market will be finally tested. The econometric methodology called “event study” will be used to perform this analysis, to test if the rating has some informational content for the markets or not, and whether it contributes to the overall market efficiency.
3.1 The Event Study Methodology

An event study is formally defined as an econometric analysis performed on financial securities that examines the effect of a catalyst\(^1\) occurrence or a contingent event that it is suspected to have a significant impact on the return of such securities. Examples of events that can influence a security’s value include an announcement of a merger, the result of a company defaulting on its debt obligations or political interventions that can impact on a firm’s business model, and hence on its revenue stream. Although, the most popular event type investigated is the announcement of quarterly earnings, given its regular frequency and predictability. Event studies can shed some light on how a security is likely to react to a given event and therefore help to predict how other securities will react to the same event occurrence.

In fact, in a corporate context, the usefulness of event studies arises from the fact that the magnitude of abnormal performance at the time of an event provides a measure of the expected impact of this type of event on the wealth of the firms’ stockholders. It can also be used in macroeconomics to produce broader inference and analyze the impact of an event on an industry, a sector or a whole market. Remembering that stock prices, according to modern financial theory, take into account all available information and are the result of rational expectations from market actors, event studies employ statistical tools to virtually separate the effect of a single event from such rational expectations.

Event studies have been used over the years for two main purposes:

- to test the null hypothesis that the market efficiently incorporates information.
- to examine the impact\(^2\) of some event on the wealth of the firm’s security holders.

As introduced in Chapter 1, the ideal efficient response of a market to relevant information being disclosed is represented in Figure 1. Nevertheless, in reality stock prices react to new information with different degrees of efficiency, according to some factors such as market transparency, technological complexity or industry regulation. The many nuances of this econometrical technique, starting from its inception, will be presented in detail in the following paragraphs.

---

\(^1\) Corporate Event, Information Disclosure or Public Announcement that can propel the price of a security.

\(^2\) Under the Semi-Strong form Hypothesis of Market Efficiency, at least with respect to publicly available information (Binder, 1998).
3.1.1 Fama, Fischer, Jensen, Roll

The paper that originated the event study methodology was published in 1969 by the already well-mentioned Eugene Fama, with Lawrence Fisher, Michael Jensen and Richard Roll. This study became so popular among financial economists that in literature, and in this thesis as well, it is often simply referred to as FFJR. In fact, it has been cited in more than 500 papers by scholars and researchers all over the world (Binder, 1998) and hence earned the rank of a literature classic. A special mention must be made about the fact that FFJR is part of the empirical knowledge base on which the theory of efficient markets has been originally formulated, laying the foundations for the semi-strong form of the EMH.

In this paper, the authors investigate the existence of unusual behavior in the rates of return in the months preceding and following the split, and whether such splits\(^1\) are actually associated with the unusual returns (Fama, Fisher, Jensen, & Roll, 1969). To perform this analysis, they collected a sample made of 940 splits observed from January 1927 to December 1959 on common stocks traded at the New York Stock Exchange. The stock prices were adjusted for general market conditions, benchmarking them with the S&P’s Composite Price Index and the Logarithmic Market Model, described further in the following paragraphs:

\[
\ln(R_{it}) = \alpha_i + \beta_i\ln(R_{mt}) + \epsilon_{it}
\]

Then, the authors measured the stock returns on the 60 months\(^2\) surrounding the event, 30 months preceding it and 30 months succeeding it, for each security and compared the result with a benchmark "normal" performance to detect any abnormal behavior. Finally, hypothesis tests on the cross-sectional average of such returns were conducted and the results thoroughly commented.

It is also important to specify that the event around which the analysis of FFJR is built is the effective split of a stock, and it is not its bare announcement. In fact, the authors suggest that when a split is announced or anticipated, the market interprets this as greatly improving the probability

---

1 A **Stock Split** is a corporate action in which a publicly traded firm divides its existing shares into multiple shares to boost their liquidity. In FFJR the specific type of split described is the exchange in which at least 5 shares are distributed for every 4 shares formerly outstanding (Fama, Fisher, Jensen, & Roll, 1969).

2 Using monthly data, the authors used the close price recorded on the last day of the month.
that dividends\(^1\) will soon be substantially increased (Fama, Fisher, Jensen, & Roll, 1969). This offers a partial explanation to the sharp upswing in stock returns that have been observed in the few months preceding the split, compared to the previous ones, as Figure 12 shows.

![Average residuals—All splits](image)

**Figure 12** — Cumulative average residuals in FFJR (Fama, Fisher, Jensen & Roll, 1969)

Finally, the paper concludes by stating that the evidence indicates that, given that stocks splits have been very often associated with substantial dividend increases in the past, the market realizes that and uses the announcement of a split to re-evaluate the stream of expected income from the shares (Fama, Fisher, Jensen, & Roll, 1969). The authors argue that it is likely that the event, in this case the stock split, is caused by prolonged in time abnormal returns and not the opposite. Although, the results published in Figure 7 also seem to suggest this. The bulk of newer event study literatures instead, focuses on establishing the opposite causal relationship: whether the abnormal performance can be ascribed or not to the target event. The study performed in this thesis will pursue the investigation of a causal relationship of the latter type. In the next paragraphs techniques, as well as assumptions and restrictions, will be described in detail.

---

\(^1\) In FFJR stock dividends had also been included in the overall calculation of the rate of returns using the following formula: \( R_t = (P_t + D_t)/P_{t-1} \)
3.2 Case Study Definition

The event study object of this thesis draws inspiration from a paper published by CONSOB\(^1\) and written by Nadia Linciano in 2004, in which the reaction of stock prices to rating actions in the Italian stock market has been investigated. The author analyzes a sample of 299 rating actions on Italian firms performed from January 1991 to August 2003 (Linciano, 2004) and then concludes that statistically significant abnormal returns are observed only in correspondence of downgrades and negative watches. Furthermore, it is observed that the results seem more likely to be driven by the disclosure of information surrounding the rating action than by the rating change announcement itself.

The purpose of this thesis is somehow to update this paper and analyze the results in more recent years. For this reason, the results of Linciano’s paper will be discussed more in detail, alongside the outcome of this thesis' event study, in the following paragraphs, in order to highlight eventual differences that occurred over the years.

In the first place, it is important to remember that since 2004 financial markets have undergone a major series of changes that cannot be neither ignored nor underestimated. The 2008 “grey” financial crisis represents without any doubt the biggest difference between more recent years and the past and can be easily defined as a “game changer”. The trust in financial markets to regulate themselves and institutions to supervise them has dramatically fallen, and the regulatory framework of the industry has been completely revolutionized.

Moreover, following the crisis of subprime mortgages, sovereign debt soared in many developed economies and worries about possible default of involved states started spreading around. This one consequence is particularly relevant for Italian financial markets because of some key characteristics of the Italian Economy:

- Extremely high Debt/GDP ratio: 131.8% in 2017.
- Relatively low growth rate: 1.5% in 2017.
- Political refrain to implement effective growth policies.

\(^1\) Commisione Nazionale per le Società e la Borsa, with initials CONSOB, is the Italian government authority responsible for the regulation of the Italian securities market and the Italian stock exchange.
All the elements listed above, as shown in Figure 8, contribute to make Italian Sovereign Bonds a particularly volatile security. This volatility has also significant repercussions on the country’s banking sector. In fact, it has been reported that in 2017 Italian banks had €338 billion in sovereign securities, of which €245.9 billion in BTP\textsuperscript{1} and the rest in CCT\textsuperscript{2} and BOT\textsuperscript{3}, in their portfolio and the number has been diminishing year after year since 2011 (Malagutti, 2018). It follows that Italian banks are notably sensitive to the volatility of sovereign bonds, and this characteristic has appreciable impact on the returns on their stock.

![Figure 13 – Yield on Italian 10-years Bonds (Bloomberg, 2019)](image)

While Linciano’s paper includes rating actions performed on the whole Italian industry, this thesis focuses only on the banking sector, for the reason mentioned above and because banks still constitute the bulk of companies listed at Piazza Affari. Furthermore, Linciano herself admits that the results observed in regard to non-financial firms is inconclusive, due to the low number of events concerning such companies (Linciano, 2004). In a nutshell, this thesis tries to quantify the

\textsuperscript{1} Buono del Tesoro Poliennale, BTP in short, is a debt obligation with multiple years (3, 5, 10 or more) maturity term issued by the Italian State.

\textsuperscript{2} Certificato di Credito del Tesoro, CCT in short, is a variable-yield debt obligation with 7 years maturity term issued by the Italian State.

\textsuperscript{3} Buono Ordinario del Tesoro, BOT in short, is a zero-coupon bond with 12 months or less maturity term issued by the Italian State.
magnitude of this post-crisis changes by analyzing a small market within the financial services industry with distinct characteristics.

In the event study that follows, the data set includes a total of **139 Issuer Rating** actions performed from **04/02/2005** to **29/12/2018** on listed Italian Banks by the three major rating agencies: Fitch, Standard & Poor’s and Moody’s. Of these 139 actions:

- **114** are downgrades.
- **21** are upgrades.
- **4** are first assigned ratings.

Needless to say, these number depicts quite a negative image of the Italian financial system. This event study focuses on issuer ratings and their effect on stock price rather than the more widely available bond ratings for two main reasons:

- For some firms only the issuer rating is available; other ratings widely differ for the characteristics of the reviewed bank
- It is well known that the Italian bond market is thin and illiquid; considering bond ratings might have implied incurring in a poor data quality problem (Linciano, 2004).

In addition to the ratings mentioned above, the effect of **16 Rating Actions** on **Italian BTP**, of which **14 downgrades** and **2 upgrades**, has been also analyzed for the reasons introduced earlier.

The 13 banks’ stocks reviewed are:

- Banca Carige S.p.A.
- Banca IFIS S.p.A.
- Banca Monte dei Paschi di Siena S.p.A.
- Banca di Piccolo Credito Valtellinese S.p.A.
- Banca Popolare di Sondrio S.c.p.A.
- Banco BPM S.p.A.
- Banco di Desio e della Brianza S.p.A.
- Bper Banca S.p.A.

---

1 Only the Big three will be considered, because in Europe minor rating agencies mostly don’t provide ratings for, or are not selected by, Financial Institutions (ESMA, 2018).
In order to effectively parametrize the return of the whole market, the choice has fallen on a broad market index, which consists typically of a weighted average of stocks of the companies with highest capitalization traded in a stock exchange (NASDAQ, S&P 500, etc.). The reference market index used is the **FTSE Italia**. The historical close prices and daily returns have been extracted from **Thomson Reuters Eikon**. The FTSE Italia index includes every stock traded in Milan’s Stock Exchange, (200+ companies of different industries).

The FTSE MIB index, the most popular index for the Italian stock exchange, has not been chosen because the capitalization of banks weights too much on the overall index. Therefore, especially in the case of the major banks such as UniCredit S.p.A. and Intesa Sanpaolo S.p.A. it does not provide meaningful information.

The stock prices also have been extracted from Eikon, and we have included all the banks that have been traded and rated at least once on the Milan stock exchange from the 04/02/2005 to the 29/12/2018.

The stock’s normal return will be modeled with a **Market Model**, estimating the relationship between the individual stock’s return and the FTSE Italia Index’s return.

Once the normal return model has been selected, it is necessary to estimate the parameters. Close to each event, an estimation window must be defined. It consists of a set of days prior to the event that will function as entries in a regression model. The event period itself must not be included in the estimation window, to prevent the event from influencing normal performance.

The **estimation window** has been created by selecting the closing prices, with daily frequency, of the firm I’s stock from 109 days to 10 days prior to the event. The size of the estimation window is generally unlikely to greatly influence the results in any predictable way or even with too great a magnitude (Krivin, Patton, Rose, & Tabak, 2003). That is why this number has been chosen; because the power of the study shows that we can obtain the best statistical results, and we can ignore the variance of the estimators in the AR’s variance.
Moreover, given the high volatility and sensitivity to external events of the Italian financial markets, having a shorter estimation window allows to make an estimate not influenced by the many possible catalysts for Italian Banks.

In this event study, the event window $\tau$ has been sized on 3 days, one for the announcement of the rating change, one day prior, and one day after. The effects of the event instead, have been studied on a wider observation window of 20 days, 9 preceding the event and 10 afterwards, as shown in Figure 14.

![Figure 14 – Cumulative Residuals over Observation Window](image)

The size of the event window has been chosen both to capture eventual trading delays into the analysis and to take into account the fact that rating agencies are mostly based in the United States. Therefore, changes could be communicated at a different time zone and the effect may be evident only the day after. The size of the observation window instead, has been chosen to infer on the efficiency of the market, to see whether a rating change was expected or not. Moreover, in order to avoid clustering, all events in the same firm, whose event window overlapped with the estimation window related to another event have been excluded. A typical example of this may be when rating agencies review their evaluation of such firm and announce it with few days of distance.

In the next paragraph, the specific methodology employed for this event study will be described in detail, in order to provide a useful framework to the reader.
3.3 Inference on the Methodology

Before describing the methodology in detail, it must be pointed out that this chapter has drawn considerable inspiration from the paper “Event Studies in Economics and Finance” by Craig MacKinlay, which it is strongly recommended to anyone interested in learning more about the topic of event studies.

After FFJM was released, the event study methodology has constantly evolved and undergone frequent reviews and updates. Nevertheless, the basic statistical format introduced with the 1969 paper hasn’t changed over time. Given an event to be studied, this standard methodology allows only a limited number of choices to the analyst, thereby reducing the potential for subjective decisions and bias (Krivin, Patton, Rose, & Tabak, 2003). Since the 1980’s, a copious amount of literature which specifically reviews the methodology of event studies, rather than solely their economic implications, started to develop (Kothari & Warner, 2006). Dozens of papers that specifically deal with the statistical properties of event studies have been released so far.

The main change implemented on event studies over the years consists, according to Kothari & Werner, in the fact that recent analyses have been performed mostly on short-time-horizon events, as serious limitations and unforeseen variables still influence long-term-horizon events and the reliability of their findings (Kothari & Warner, 2006).

In this paragraph, a comprehensive description of the event study methodology will be provided, with the addition of a specific parameter selection that has been used in the analysis subject of this thesis, starting from the definition of abnormal return and later discussing the statistical implications and assumptions. In fact, in order to extract some valid information from such econometric methodology, it is necessary to describe in detail the procedure to calculate the abnormal returns.

Fetching the definition of abnormal return from Chapter 1, it is possible to mathematically define the abnormal returns of the security $i$ on the time-interval $t, t + 1$:

$$AR_{it+1} = R_{it+1} - E(R_{it+1} | \theta_t)$$
\[ R_{t+1} = \ln(P_{t+1}/P_t) \]

in which \( R_{it} \) is the observed return in logarithmic form, \( AR_{it} \) the abnormal and \( E(R_{it} | \theta_t) \), is the expected return conditional to the information set \( \theta_t \), already introduced in Chapter 1.

In other words, \( E(R_{it} | \theta_t) \) is the return that the security \( i \) is expected to have in an efficient market. This relationship can be considered valid as long as the semi-strong form of market efficiency is verified. This implies that an event with relevant information content for the market is supposed to generate an immediate reaction among the investors in the market itself. If abnormal returns are still observed days after the event, this suggests that the market may not be completely efficient.

It is necessary to specify that, by definition, the whole concept of abnormal return is meaningful only if it is related to a “normal” or “expected” return. In fact, the appraisal of the impact on securities caused by an event can be measured only because it differs from investors’ expectation. Such normal returns can roughly be defined as an estimate of the firm’s returns in absence of the event (Schweitzer, 1989). For these reasons, to establish whether a set of observed returns display abnormal behavior or not, it is crucial to set first a normal return benchmark, on which the analysis will be performed.

### 3.3.1 Estimating Normal Returns with the Market Model

Several techniques, both statistical and economical have been employed over the years to model the behavior of stocks and fixed income securities’ normal returns, including some very complicated ones such as the Fama-French model, which involves also variables like the firm’s size. Nevertheless, in the striking majority of event studies papers published over the years, normal returns have been estimated with the market model.

The main reason is because the trade-off between precision and simplicity offered by the market model makes it the favorite choice for event studies. Several analyses in the past have shown that a simple event study methodology based on the market model is both well-specified and relatively

\[ \text{1 The return is logarithmically defined in standard event studies because of the assumption that stock prices are log-normally distributed.} \]
powerful under a wide variety of conditions (Brown & Warner, 1985). On the other end, more simplistic methods like the Constant-Return model have instead shown a persistent precision loss, as the variance for the average abnormal return increases with respect to the market model (MacKinley, 1997). Therefore, it is harder to infer results with a satisfying level of precision from such model.

The information set \( \theta_t \) introduced in Chapter 1 can be interpreted as the overall performance of the market and parametrized as its return. This means that, assuming that weak and semi-strong market efficiency hold up, investors base their expectations for the return of the firm partially on the return of the market. The magnitude of such relationship can vary, even significantly, from firm to firm.

The market model is represented by the following equation:

\[
R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}
\]

\[
E(\varepsilon_{it}) = 0 \quad Var(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2
\]

For a generic firm \( i \), the parameters \( \alpha_i \) and \( \beta_i \) are estimated through a linear regression on the returns of the market \( R_{mt} \) and returns of the firm \( R_{it} \) over a pre-determined time frame prior to the event, namely referred to as the “estimation window”. It is important to remind that this model implicitly assumes a standard linear relation between the returns of the market and of the firm \( i \), and it relates the return of any given security to the return of the market in the form of the parameter \( \beta_i \); the higher the value of \( \beta_i \), the more sensitive is the firm to changes in the market return.

In FFJR it is already stated that the regression of security returns on market returns over time is a satisfactory method for abstracting from the effects of general market conditions on the monthly rates of return on individual security and, on general conditions, the ordinary-least-square method is the right methodology to estimate the normal returns (Fama, Fisher, Jensen, & Roll, 1969). Nevertheless, the paper also includes the admission that this is a grossly over-simplified model of price formation and the effect of many potential omitted variables is captured by the sole disturbance term \( \varepsilon_{it} \).

In Figure 15, it is possible to observe the estimation process of the market model through a scatterplot. On the x-axis there are the FTSE Italia returns, while on the y-axis, the returns of Mediobanca S.p.A. Both in correspondence of the rating downgrade disclosed on 21/09/2011.
It is also necessary to highlight that the mandatory conditions of linear regression, such as the homoskedasticity and independence of residuals are assumed to be verified. Although, later on in this chapter, it will be explained that this ideal situation doesn’t happen most of the times, and other complications, such as cross-sectional correlation of residuals, are actually very frequent. In fact, although the usage of daily sampling offers considerable advantages, it has been reported that the daily stock return for an individual security exhibits substantial departure from normality that are not observed with monthly data (Brown & Warner, 1985).
Even though there are many papers published that warn about how results can be compromised by such problems, in the majority of event studies in literature, this problem is simply ignored. Even in early findings, with compelling evidence in the picture above, it is evident that often data do not conform very well to the normal, or Gaussian linear regression model, with significantly longer tails (Fama, Fisher, Jensen, & Roll, 1969).

### 3.3.2 Abnormal Returns Calculation

Once a model of normal returns has been selected, it is possible to finally quantify the definition of abnormal returns. Such definition can be also interpreted as the average deviation of the returns from their normal relationship with the market.

In the previous paragraph it has been stated that the information set $\theta_t$ represents the knowledge of the relationship between the return of the firm and the market return for a generic firm $i$ at the time $t$.

This implies that:

$$E(R_{it}|\theta_t) = \alpha_i + \beta_i R_{mt}$$

Therefore:

$$\bar{AR}_{it} = R_{it} - E(R_{it}|\theta_t)$$

$$\bar{AR}_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

$$\bar{AR}_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt} + \hat{\varepsilon}_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{im})$$

$$\bar{AR}_{it} = \hat{\varepsilon}_{it}$$

It is important to underline that $\bar{AR}_{it}$ is an estimate, as the parameters $\hat{\alpha}_i$ and $\hat{\beta}_i$ of the market models are also estimates of the real coefficients, which are unknown. This explanation roots deeper into the definition of linear regression itself. It is possible to state, in a nutshell, that the abnormal returns on an individual security $i$ are the residuals $\hat{\varepsilon}_{it}$ of the regression on its returns and market’s returns.
The benefit of this model also depends on the $R^2$ regression coefficient, ranging from 0 to 1, which measures how much of the variability observed can be explained by the regression model. The higher the value of $R^2$ the more precise will be the detection of abnormal returns.

The presence of abnormal returns it is investigated only on the event window in Figure 17, as we assume that such event has information content relevant enough to change investors’ expectations. It is now time to write down some notation, to ease the mathematical formulas shown in the following pages. Here it is possible to see from the timeline:

\[
\begin{array}{ccc}
\text{estimation window} & \text{event window} & \text{post-event window} \\
T_0 & T_1 & 0 & T_2 & T_3 \\
\end{array}
\]

Figure 17 – Event Timeline (MacKinley, 1997)

As showed in the Figure 16:

- $T_0$ to $T_1$ – Estimation Window.
- $T_1$ to $T_2$ – Event Window.
- $T_2$ to $T_3$ – Post-Event Window.

For convenience, from now on the event window $T_2 - T_1$ will be indicated with $\tau$.

Differently from the methodology described in FFJR, in more modern event studies it is typical for the estimation window and the event window not to overlap. Thanks to this small but significant nuance, the normal returns estimated with the market model are not influenced by the potential changes in return around the event. Therefore, the estimate provided is generally more correct.

Given that the abnormal returns are the disturbance terms of the market return calculated on an out-of-sample basis, their existence is conditioned to the existence of a normal return model.
Under the null hypothesis, conditional on the event window market returns, the ARs will be jointly normally distributed with conditional mean equals zero and conditional variance:

$$\sigma^2(\widehat{AR}_{it}) = \sigma^2_\varepsilon + \frac{1}{L_1} \left[ 1 + \frac{(R_{it} + \mu_m)^2}{\hat{\sigma}^2_m} \right]$$

The second component of the variance is due to the sampling errors in the parameters estimates of the regression $\widehat{\alpha}_i$ and $\widehat{\beta}_i$. Sampling error, which in turns may lead to serial correlation of the abnormal returns despite the fact that the true disturbances are independent through time. This complication can be easily overcome by performing the regression on a sample with size sufficiently large, nominally with $N>30$. In this way, the second component of $\sigma^2(\widehat{AR}_{it})$ tends to zero, and the $t$ distribution that models the probability can be approximated with a normal distribution. This leads to the abnormal return observations becoming independent through time.

Assuming a one-day-long event window $\tau$, it results that the abnormal returns of a firm $i$ over $\tau$, will follow this distribution:

$$\widehat{AR}_{it} \sim N(0, \sigma^2(\widehat{AR}_{it}))$$

Although the one-day-long event window offers a convenient and simple framework to understand the mechanics of an event study, it has limited explanatory power and is rarely used in practice. An event study usually seeks to establish whether the cross-sectional distribution of returns at the time of an event is abnormal (Kothari & Warner, 2006) and such exercise, can be conducted only by aggregating such returns coming from multiple trading days into one single test statistic.

### 3.3.3 Abnormal Return Aggregation and Testing

Some recent studies have highlighted a method to produce valid inference on single-firm-single-event studies, popular in the field of forensic statistics. Nevertheless, to make valid inference on the returns for the events of interest and to allow the employment of and event window larger than one day, it is necessary to aggregate the abnormal returns. As the aggregation can happen both through time and through securities, for practical reasons the aggregation over the various days of event window and events for a single firm will be considered first.
To include the effect of multiple trading days on abnormal returns, the aggregation can happen simply by summing the abnormal returns observed in each day in the event window. Therefore, the sample cumulative abnormal return for the firm $i$, on the event window $\tau$ will be:

$$\hat{CAR}_i(\tau) = \sum_{t} \hat{AR}_{it}$$

The variance of such cumulated abnormal returns, remembering that the size of the estimation window is larger than 30 days and the component of the variance due to sampling errors can hence be ignored, is calculated like this:

$$\sigma_i^2(\hat{CAR}_i(\tau)) = \tau \sigma_{\varepsilon_i}^2 = (T_2 - T_1 + 1)\sigma_{\varepsilon_i}^2$$

It follows that the cumulated abnormal returns for a firm $i$ over $\tau$ is:

$$\hat{CAR}_i(\tau) \sim N(0, \sigma_i^2(\tau))$$

Given the distribution of the abnormal returns with mean equals to zero and the cumulative abnormal return, finally the test of the null hypothesis can be conducted.

The null hypothesis that it is going to be tested is:

$$H_0: CAR = 0$$

$$H_A: CAR \neq 0$$

With this hypothesis, we mean to test both the significance of abnormal returns and their magnitude. Because the variance $\sigma_{\varepsilon_i}^2$ is unknown, an estimator must be used to calculate the test-statistic. It follows that the usual sample variance measure of $\sigma_{\varepsilon_i}^2$ from the market model regression is an appropriate choice (MacKinley, 1997). Moreover, for simplicity’s sake eventual mean effects or variance changes issues raised by McKinley’s paper, or time-series dependency analyzed by Binder will not be investigated further. It is also assumed that there is no overlap between the various event windows, therefore the abnormal returns and the cumulated abnormal returns will be independent across securities.

Once the cumulated abnormal returns for each one of the $N$ firms have been computed, we aggregate the results in order to make inference on the portion of market on which we want to investigate.
The average cumulated abnormal returns are then obtained:

\[
\overline{CAR}(\tau) = \frac{1}{N} \sum_{i=1}^{N} \overline{CAR}_i(\tau)
\]

Considering the assumption that the event windows of the various securities do not overlap, it is possible to set the covariance terms to 0 (MacKinley, 1997) and then obtain the variance:

\[
Var(\overline{CAR}(\tau)) = \frac{1}{N^2} \sum_{i=1}^{N} \sigma_i^2(\tau)
\]

In the case study, we will also examine time frames prior and after the event, to investigate whether the event has been partially anticipated or the market reacts slowly.

Moreover, we assume that the various cumulated abnormal returns are independent over time. It follows that the CAR follows the distribution:

\[
\overline{CAR}(\tau) \sim N[0, Var(\overline{CAR}(\tau))]
\]

Finally, inference about the cumulative abnormal returns to test the null hypothesis that abnormal returns are zero can be drawn by using the sample statistic \( t \), which is described by:

\[
t = \frac{\overline{CAR}(\tau)}{\sqrt{Var(\overline{CAR}(\tau))}} \sim N(0,1)
\]

This distributional result is asymptotic with respect to the number of securities \( N \) and the length of estimation window \( \tau \).

The economic interpretation of the result obtained is not straight-forward, because event study tests are joint tests of whether abnormal returns are zero and of whether the assumed model of expected returns is correct (MacKinley, 1997).

For example, a standard t-test for mean abnormal performance assumes, among other things, that the mean abnormal performance for the cross-section of securities is normally distributed. Depending on the specific t-test performed, there may be additional assumptions that the abnormal return data are independent in time-series or cross-section.
3.4 Results

After having reviewed and described in detail the event study methodology, as well as the characteristics and assumptions of this specific case study, here the outcome of the analysis will be discussed. In the table below, it is possible to observe the overall results of this event study on the sample made of 139 rating actions performed from 04/02/2005 to 29/12/2018.

<table>
<thead>
<tr>
<th></th>
<th>Cumulative Abnormal Returns (ACAR)</th>
<th>Variance of CAR</th>
<th>T-test for Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nº of Ratings</td>
<td>139</td>
<td>2.772%</td>
<td>1.504*E-05</td>
</tr>
<tr>
<td>Nº of Downgrades</td>
<td>114</td>
<td>-1.146%</td>
<td>1.934*E-05</td>
</tr>
<tr>
<td>Nº of Upgrades</td>
<td>21</td>
<td>-0.117%</td>
<td>9.014*E-05</td>
</tr>
<tr>
<td>Nº of First Ratings</td>
<td>4</td>
<td>5.870%</td>
<td>5.549*E-04</td>
</tr>
</tbody>
</table>

According to the numbers reported above, the null hypothesis $H_0: CAR = 0$ is rejected at 95% significance level for the total number of ratings, with an average cumulated abnormal return (ACAR) of 2.772%. Since this value has little or no explanatory value by itself, the sample of rating changes must be divided into the three main rating categories:

- With downgrades, $H_0$ is rejected at 95% significance and the ACAR is -1.146%.
- With upgrades, $H_0$ is accepted and it cannot be excluded that the ACAR is actually 0%.
- With first ratings, $H_0$ is rejected at 95% significance and the ACAR is 5.870%.

Observing these results, two considerations must be done immediately. The sample size on which $H_0$ has been tested with the first ratings category is extremely small, and the ACAR is driven mostly
by just one outlier from Banco BPM’s stock. Therefore, no valuable information of any kind can be extracted from this sample. Concerning rating upgrades instead, the whole body of literature covering their effect on stock price, including Linciano’s event study, has brought nothing more than mixed and inconclusive results so far. Given also that the sample size is relatively small, the existence of further implications will not be investigated. Thus, this analysis will focus from this moment solely on the effect of rating downgrades.

In Figure 18, it is possible to see more in detail how the rating changes have been “distributed” to the various banks included in the sample.

<table>
<thead>
<tr>
<th>Bank Name</th>
<th>Total Ratings</th>
<th>N° of Downgrades</th>
<th>N° of Upgrades</th>
<th>N° of First Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banca Carige</td>
<td>25</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Banca IFIS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Banca Monte dei Paschi di Siena</td>
<td>13</td>
<td>12</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Banca di Piccolo Crediti Valtellinese</td>
<td>9</td>
<td>7</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Banca Popolare di Sondrio</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Banco BPM</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Banco di Desio e della Brianza</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Bper Banca</td>
<td>14</td>
<td>11</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Credito Emiliano</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intesa Sanpaolo</td>
<td>20</td>
<td>14</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Mediobanca</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ubi Banca</td>
<td>19</td>
<td>15</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>UniCredit</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 19 – Italian Banks in the Sample
It is immediately observable that the most frequently rated banks in the sample are either those with the largest capitalization, such as Intesa Sanpaolo and Unicredit, or those with major financial and legal troubles, like Banca Carige and Banca Monte dei Paschi di Siena.

Moreover, among the three rating agencies in charge of reviewing the creditworthiness of Italian banking institutes it is possible to see that:

- Fitch disclosed 59 rating changes.
- Standard & Poor’s disclosed 53 rating changes.
- Moody’s disclosed 27 rating changes.

It is evident that even though Moody’s is the rating agency with the biggest market share, it has a visibly lower presence than its competitors in the Italian Stock market.

When comparing the results obtained in this event study with those form Nadia Linciano’s paper, there are some differences that emerge immediately:

- From 1991 to 2003, rating agencies disclosed 108 issuer rating changes on Italian banks, of which 44 were upgrades and 64 were downgrades.
- In the sample used by Linciano, the average yearly rating frequency was 8.3 changes per year. In the sample used for this thesis’ event study, the average frequency has now increased to 9.9 changes per year.
- In Linciano’s study, 59% of the rating changes were downgrades and 41% upgrades. In this event study, 82% are downgrades and only 15% are upgrades.
- In Linciano’s study, the normal performance had been estimated on a 110 days estimation window. In this event study, it has been estimated on a 100 days window.
- In Linciano’s study, downgrades have significant ACAR of -0.482% and the upgrades a non-significant ACAR of 0.553%. In this event study, downgrades have significant ACAR of -1.146% and upgrades a non-significant ACAR of -0.117%.

The ACARs from both studies can be directly compared because, in both cases, the cumulated abnormal return has been calculated on a “-1,+1” three-days event window. Assuming that other methodological conditions are identical, it is possible to observe that the impact of rating downgrades on stock price has more than doubled from 2003.

Before drawing any conclusion and starting to build possible interpretations of this result, it is important to have a look first at the normal probability plot of the CARs sample.
In Figure 20, it is possible to observe that the sample of 139 CAR clearly departs from its assumptions of normality. Therefore, in order to provide valid inference, it must be somehow “polished” by removing the outliers.

![Figure 20 – Normal Probability plot of “Unpolished” Sample](image)

Using a popular heuristic, all the elements exceeding its confidence interval of $[\mu - 3\sigma, \mu + 3\sigma]$ have been removed, reducing the number of downgrades from 114 elements to 93. This method implies that, if a random variable is normally distributed, 99.73% of values fall between the $\mu - 3\sigma$ and $\mu + 3\sigma$ sigma values. Elements falling beyond these values must be treated as outliers.

![Figure 21 – Normal Probability plot of “Polished” Sample](image)
The economic rationale behind the adoption of this heuristic lies in the fact that previous literature on the effect of rating on stock prices describes the effect of rating disclosure as modest. Therefore, it is reasonable to expect that more extreme results observed in the sample may have been driven by external factors.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Pr(Skewness)</th>
<th>Pr(Kurtosis)</th>
<th>adj ch2(2)</th>
<th>Prob&gt;ch2</th>
</tr>
</thead>
<tbody>
<tr>
<td>var1</td>
<td>93</td>
<td>0.9181</td>
<td>0.0185</td>
<td>5.40</td>
<td>0.0672</td>
</tr>
<tr>
<td>var2</td>
<td>114</td>
<td>0.5625</td>
<td>0.0000</td>
<td>14.70</td>
<td>0.0006</td>
</tr>
</tbody>
</table>

Figure 22 – STATA Output on Skewness/Kurtosis test

Figure 21 and 22 (in Figure 22 var1 is the “polished” sample, and var2 is the “unpolished” one) show that, after applying the heuristic described above, the sample has now a way more normal behavior, and it also passes the Skewness/Kurtosis test, according to which we cannot reject the hypothesis that it is normally distributed. It must be specified that the next splits of the sample will be done on the “Polished sample”

It is now time to test again $H_0$ on the newly cleaned sample:

We can immediately notice that the ACAR has slightly reduced, going from -1.146% to -1.089%. The value of the t-test has also reduced, followed by a variance increase to 2.149*E-05.
Being these latest results backed by stronger statistical assumption, it is now possible to state with more confidence that the average abnormal reaction to rating downgrades has more than doubled from 2003, going from -0.482% to -1.146%.

Given that the years of the grey financial crisis\(^1\) are included in the sample, it is then fundamental to account for this factor in the overall analysis and try to isolate its effect. Assuming the crisis has changed the perception of investors towards financial markets, it is useful to perform the same test on the subsample of the downgrades happened after 2009.

Unfortunately, there are only 6 downgrades happened from January 2005 to January 2009. Therefore, the t-test will be run on the remaining 86 downgrades performed after:

<table>
<thead>
<tr>
<th>Nº of Downgrades</th>
<th>Cumulative Abnormal Returns (CAR)</th>
<th>Variance of CAR</th>
<th>T-test for Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>86</td>
<td>-1.201%</td>
<td>2.404*E-05</td>
<td>-2.49</td>
</tr>
</tbody>
</table>

![Figure 24 – Output of the post-2009 Subsample](image)

As expected, the results do not dramatically differ from the previous test. The ACAR and the variance have slightly increased to respectively -1.201% and 2.404*E-05. Even though the abnormal performance has indeed increased from the test on the 2005-2018 sample, the fact that there are only 6 downgrades preceding 2009 does not allow to make a more detailed inference. For the purpose of making a valid comparison, it would be necessary to extend the scope of the analysis to several years prior to 2005.

As it has already been introduced in Chapter 2 and in paragraph 3.2, the financial solidity of banks is strongly related to the characteristics of the country they operate in and the assistance it can provide. It has also been highlighted that Italian banks, in particular, have several billions of Italian

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\(^1\) Even though the crisis originated in the United States in September 2008, its effects were not perceived in Europe until 2009, year which was disastrous for the Italian economy.
Sovereign bonds written in their balance sheet. Hence, they are indeed sensitive to the yield movements of these bonds, which are also constantly solicited by political interventions.

In Chapter 2, it has also been Rating agencies also consider the so-called “country risk” when they provide credit scores for banks. In fact, the rating of financial institutions is sometimes lowered shortly after a downgrade in the rating of Sovereign bonds occurred, as a consequence of the increased country risk. For Italian banks, this situation is worsened by the fact that lower rating on Sovereign obligations almost automatically implies higher yields.

As these rating changes can be partially anticipated by the market, a lower magnitude reaction is expected. The downgrades which happened within a 30 days distance from a downgrade on Italian BTPs, assigned by the same agency, have been isolated and compared with the so-called unanticipated ratings.

Repeating the t-test for both subsamples lead to this outcome:

<table>
<thead>
<tr>
<th></th>
<th>Cumulative Abnormal Returns (ACAR)</th>
<th>Variance of CAR</th>
<th>T-test for Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipated Downgrades</td>
<td>38</td>
<td>-1.429%</td>
<td>5.189*E-05</td>
</tr>
<tr>
<td>Unanticipated Downgrades</td>
<td>48</td>
<td>-1.0239%</td>
<td>3.538*E-05</td>
</tr>
</tbody>
</table>

Figure 25 – Output of Sovereign-Interference Subsample

The result of these tests is indeed surprising. In fact, the “anticipated” downgrades, which should be somehow predicted from the market, instead lead to the highest ACAR observed among the various subsamples of -1.429%.

As a consequence, the last test’s outcome brings to make some questions on the efficiency of the Italian stock market. The most convenient way to investigate semi-strong efficiency is by observing the behavior of cumulative abnormal returns on the residual charts and remembering that an efficient response is supposed to look like Figure 12.
In Figure 26, it is possible to see the behavior of cumulative abnormal results for the whole Italian banking sector.

There are evident signs of inefficiency in this chart, as the market does not expect any bad news, with the cumulative return growing until the day of the event, and when the news is released, the reaction is still slow and uncertain. Also, by analyzing charts from individual banks, some interesting conclusions can be drawn.
In Figure 27, it is possible to see that Banca Carige’s reaction to rating changes is somehow peculiar. After the disclosure of a downgrade, the price drops slowly and steadily, as if the market required some time before realizing the practical implications of such event. Monte dei Paschi di Siena, in Figure 28, shows a behavior that is both far from efficient and difficult to interpret.

![Figure 28 – Cumulative Average Residuals for Monte dei Paschi di Siena S.p.A.](image)

On the other hand, Intesa Sanpaolo’s chart in Figure 29, shows a decently efficient response to downgrades, especially if compared with other banks. The price immediately absorbs the “shock” of the downgrades and goes back to floating around its fundamental value.

![Figure 29 – Cumulative Average Residuals for Intesa Sanpaolo S.p.A.](image)
4. CONCLUSION

In conclusion, this thesis has investigated the impact of rating changes on the Italian stock market by performing an event study on a sample of 139 rating actions on Italian banks. Two results from this study can be highlighted immediately:

- The magnitude of abnormal returns observed in correspondence of rating changes has doubled from 2003, suggesting that the Community regulation into force since 2011 may have been positively welcomed by investors, who now pay more attention to credit rating changes, assuming the higher transparency.
- On the other hand, the value of abnormal performance still floats around 1% and it is hence in line with the expectation that the informational content provided by rating is indeed modest and mostly related to publicly available information, as Linciano already noted.

For what concerns market efficiency instead, the results presented above show little room for interpretation. The Italian stock market is indeed highly inefficient. Investors systematically fail to predict rating changes, even when those events are highly anticipated, and their response after several days is still uncertain and slow. This can be partially explained also by the high level of financial illiteracy in Italy (Tripodi, 2018). Moreover, banks in distress and plagued by numerous scandals like Banca Carige (25 downgrades in the last 14 years) show even a more inefficient response to downgrades, suggesting a constant flow of “bad news” following every event.

This thesis aims at being nothing more than a starting point in studying this very complex phenomenon. Therefore, a comparison study performed in other European markets may shed some light on the overall bank response to these particular events.
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