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Abstract

The time-honored doctrine of finance, the so-called Efficient Market Theory, is primarily founded on the basic assumption of individuals acting rationally, i.e. bearing in mind all available information before undertaking an investment decision; in this perspective, corporate finance has developed an organized and consistent set of requirements that, ideally, should enable financial managers to maximize firm value. Why, then, so often in reality things are such different? Behavioral finance constitutes a brand-new approach which, standing at the meeting point between finance and cognitive psychology, seeks to improve the understanding of these phenomena and to explain how emotions and cognitive errors can systematically influence investors ' decision-making process.

A consistent number of studies in the field of behavioral finance have attempted to overcome the frequent abnormalities emerging out the classical approach, rooting on the analysis of major behavioral distortions that would lead to sub-optimizing decisions, thus providing valuable contributions to the understanding of market's mechanics. In light of this, the argument in question is to analyze the concept of Behavioral Finance and Behavioral Corporate Finance, after briefly summarizing the main guidelines of the Efficient Market Theory, to better deepen the reasoning that have been leading many academics to bolster this approach from the early seventies on. In addition, the purpose of this dissertation is to focus on the most usual behavioral distortions that characterize economic organs' conduct in the field of Behavioral Corporate Finance, through discussing typical and recurring cognitive biases, which will subsequently be applied to the major principles and processes of corporate finance, and to financial or investment decisions of business and financial managers, with the aid of mathematical models.

1.Efficient market theory

1. 1 Historical Background

The theories about the behavior of the capital markets began to develop at the dawn of the twentieth century, with the thesis put forth by Bachelier (1900) reported in his doctorate in mathematics.

Bachelier was the first to postulate that "past, present, and even discounted future events are reflected in market price, but apparently they do not show any relationship with the fluctuations in the prices." In the following paragraphs of his dissertation, Bachelier essentially states that if the market can not predict their fluctuations, it will just classify them as more or less probable, and this probability can be mathematically defined.

Unfortunately, Bachelier's dissertation was taken in low esteem by his contemporaries, and it was only subsequently revalued by Paul Samuelson in the late 50s.

Subsequent studies in the field enjoyed the same way as poor luck. Bachelier ended with the conclusion that prices change randomly and subsequent investigations carried out by Cowles and Jones, respectively in 1933 and 1937, relating to this the prices of U.S. stocks and other financial instruments led to similar conclusions, or at least It found that the behavior of these instruments seemed to be moving along the same path. At the same time they began to come to light a burdensome series of tokens about the difficulty or impossibility of beating the capital markets.

Cowles again, found out that there is not enough evidence about the possibility of encompassing the market in performance. Consequently, in the early 40s there was a wide range of scattered tests and dissertations about the efficiency of the market, even though the term itself was not coined yet.

1.2 Birth of Efficient Market Theory

To understand how, in the 60s, a first formalization of market efficiency theories managed to emerge, we consider the problem posed by Karl Pearson at the beginning of the century about the procedure for finding a drunkard left alone in a

field, called the "model of random walk".

Basically, if you expect that the drunken stagger around in a totally unpredictable and random manner, he would be more likely to end up with finding himself in the exact spot where it was abandoned, that in any other point in the field.

In 1965 Samuelson applied this theory to the capital markets.

He essentially said that, on the market there is a buyer for every seller. If, therefore, there is an overall certainty that a given price will rise, it will already be risen. Similar arguments are used to show that competitive prices must necessarily illustrate changes in price, or which carry out a random walk with no predictable bias. *(The Properly Anticipated Prices Randomly Fluctuates, 1965).

In any case, Samuelson himself admitted his theorem as being far too general, and obvious to the extent of causing him significant doubts upon the validity of its publication.

On the basis of this theorem, however, rests the famous argument of Eugene Fama (1970) which for the first time assembled a complete and all-embracing reassessment of the theories on market efficiency.

The efficient market theory defines an efficient market in which transactions carried out on the basis of information up for grabs it is impossible to make a profit that exceeds the threshold set by the market.

Essentially the assumption exists in three distinct forms: the weak one, which states that the market price reflects all available information implicit in the sequence of past prices, the semi-strong, which asserts that prices reflect all publicly available information, and that strong, which postulates that any information that is known to anyone in the market is reflected in the price.

Fama merges the previous studies on the random walk and the other studies regarding the historical sequences of prices with its own argumentations, concluding that the evidences stands strongly in favor of the weak version of the theory. Later, he audits several tests to prove the leftover two versions, and extends the validity of the theory to both the semi-strong form and the strong one.

1.3 The Behavioral Approach

Moving towards the field of behavioral finance, Fama is known as the most fervent opponent to the behavioral approach towards markets.

From the mid-80s, this particular approach has begun to put its roots in the analysis of markets. It essentially relies on the difference between economic man and real man. The dichotomy between the two models essentially lies in the complete (as well as entirely ideal and non-existent) rationality of the "homo economicus" and the irrationality that conversely characterizes the real man. Actions carried out by real man, are in fact subject to a multitude of cognitive biases, which significantly affect the rational action.

In particular, the model which has been taken into account for the application of behavioral finance theories on the markets, is the model of Kahneman and Tversky, 1982, the founders of the so-called "Prospect Theory": this is a "descriptive" alternative to the expected utility theory of John von Neumann and Oskar Morgenstern.

In contrast to the classical theory, which was intended to establish the ideal conditions that define the concept of rationality, prospect theory is being proposed to procure a description of how individuals (irrational by definition) behave in front of a decision. Prospect Theory focuses, in particular, on decision-making in presence of risk, which are defined as those decisions in which it is known, or it is possible to estimate, the probability associated with every possible outcomes of each and any available alternative.

It defines utility in terms of gains and losses and advances the issue of heuristic judgment ruling, ie states that the intuitive judgment of probability is mediated by attributes which are not correlated with the uncertainty.

To explain and disown these theories, Fama takes into account two behavioral models proposed by Barberis, Shleifer and Vishny (BSV model) and Daniel, Hirshleifer and Subramanyam (Model DHS), respectively in 1998 and 1997.

The behavioral model of Daniel, Hirshleifer and Subrahmanyam (DHS) is based on the existence of two psychological phenomena, both in the present cognitive models adopted by investors: overconfidence and the self-attribution (self-attribution bias).

1.4 The DHS model

A person is defined as overconfident if it overestimate the accuracy and the reliability of their private information set and attaches no importance to public news; acting this way, it clearly underestimates the magnitude of its error.

The financial aspect of this attitude is a disproportionate reaction to the news . Private equity prices, which will be corrected, even if only partially, by the arrival on the market of public information. Clearly, if more and more public informations keep flowing over time, the average price will tend to converge to the true value of the security. Thus the share price shows essentially a dual response to new information, depending on whether this information results to be private or public: in the first case, there is an 'overreaction, while in the second case there shows an underreaction.

Moreover, investors are also subject to a further cognitive bias, self-attribution, which, in turn, determines a variation in the level of hyper-security: it deals with the way in which a generic private signal-based subject, which already operates on the market, reacts to the arrival of public informations. In particular, if the latter results to be in line with the former, the confidence the investor puts in his own ability grows exponentially; if, on the other hand, the public news are in contradiction, with, or does not confirm the private ones, the investor suffers from a relatively modest decrease in its self-esteem. This suggests that public data may bring about further overreaction in prices when compared to a previously gathered private signals: according to the authors this continuous overreaction constitutes the origin of the effect, which reverses its trend with the advent of later and more widespread information, which gradually and constantly push the price towards its fair value.

1.5 The BSV model

The BSV model is based on two cognitive biases, the representativeness (Kahneman and Tversky) where it is assumed that people tend to estimate a very large sample on the basis of characteristics of a narrow part of the same sample (in this case overestimating the recent behavior of a sequence of data, and underestimating the characteristics of the population that generates the data in question), and the conservatism bias (Edwards), which is the adjustment of the

models too slow in front of new evidence.

It hypothesize the existence of a single asset class, paying 100% of the profits distributed as dividends ; Furthermore, despite corporate profits derive by a process of random walk, depositors are persuaded to find themselves in front of two regimes, originating from two different models. So, while the world being in state 1 profits are generated by model 1; conversely, in state 2 they are spawned by model 2. As already specified, none of the two schemes follows a random walk: in model 1, earnings performance actually suffers a reversal of long-term abnormal returns: thus in scheme 1 the price of a stock under-react to a change in profits because investors mistakenly believe that this change is temporary. When this prediction is not confirmed by subsequent earnings, the stock price shows a deferred response compared to previous earnings.

Conversely, in model 2 the earning path is seen to follow a trend. A series of changes in gain of the same sign suggests to investors that these changes follow a trend. Once convinced that the regime 2 is trending, investors erroneously extrapolate the trend and the share price tends to overreact.

The premise of a world ruled by one of the two models aims to demonstrate the field of action of the two cognitive biases. In particular, model 1 generates conservatism bias : the investor who uses it to make earnings forecasts reacts silently to an announcement of profits, as well as a person who suffers from conservative distortion does; on the contrary, an investor which anticipates the trend of future profits through the model 2, acts as those who show a strong tendency to representativeness.

Fame argues that the long term return reversals are rather an exception than a rule, and that the BSV model succeeds in explaining the same anomalies that it has been designed to clarify.

In addition, his expectation of long term return reversals have a much narrower scope than the observations that result from the literature on the subject, which instead result to be much more in favor of the efficient market theory.

Generally speaking, Fama affirms that the behavioral approach is always too case-specific, and eventually fails to explain a broader view of the market behavior as a whole, i.e. to explain abnormalities in the market in a way that significantly

contradicts efficient market theory.

Fama bases his criticism on two breakers. The first is that the anomalies brought to light tend to appear as often either as overreactions and under-reactions by investors.

Secondly, Fama claims that the same anomalies tend to disappear as time passes by, alongside with the emergence of more accurate methods of examination.

The criticism of Fama are rather weak. There is actually no psychological principle stating that investors should solely either overreact or underreact, thus, clearly, the research on this field do not reveal the existence of such a principle.

In addition, the first and major anomaly of excess volatility, is far from being demolished, and eventually results to be even reinforced by the experiences of global financial markets in recent years.

The fair value of a security is difficult to measure; in the presence of speculative bubbles lasting over a long enough time span, for example, this variable is not measurable in a sufficiently accurate way, if not referring to extensively long time horizons.

Specifically, volatility anomaly is associated with the so called noise trader risk. This two variables are in fact directly proportional, and, in some sense, interdependent: the higher the volatility, the higher the risk of noise trading.

2. Noise trader risk and limits to arbitrage

2.1 Noise Trading and Behavioral Implications

We define noise trader an investor who makes his own investment decisions in a completely irrational and wrong fashion, with no recourse to fundamental analysis. Generally speaking, these investors share a bad timing, follow trends, and tends to incompetently and way too poorly diversify their portfolio, thus considerably increasing variance, and therefore risk. The unpredictability of noise traders' beliefs restricts the notion of perfect arbitrage (broadly taken into assumption in the efficient market theory) because it eventually prevents rational arbitrageurs from aggressively betting against them. The result is that prices come to substantially differ from their fair value, even if in absence of fair risk (in an efficient market risk has a negative effect on the price of the shares).

The case of noise traders is highly debated in behavioral finance, because many investors do not believe they are actually noise traders, and wrongly assume to take rational and prudent decisions. In fact, most people are considered to be noise traders, as the actual number of people who makes investment decisions solely relying on fundamental analysis is indeed extremely nether.

In addition, fundamental analysis itself, is considered to nourish noise trading, since the data are often uncorrelated with fundamentals of companies.

Friedman (1953) and Fama (1965) argue that irrational investors clash with arbitrageurs, who trade against them on the market . This process is assumed to gradually pushing the price toward its fundamental value. Friedman also stresses that speculation is destabilizing, tun speculators are deemed to lose money, since speculation is destabilizing only if , on average, speculators sell low and buy high. So a speculator can not influence the market, and if it could, he would not do so for a long time, being his judgment on the [1]value of an asset wrong enough to produce significant losses in money, in turn resulting in the exit of speculators from the market.

The main problem with this assertion is that, first of all, arbitrageurs are virtually risk-averse, and therefore tend to repeatedly focus on short-term investments (because

time is a compelling risk factor). This factor undoubtedly limit their willingness to take position against noise traders.

So it will take a reasonably extensive time horizon for noise traders to lose most of their money, as long as arbitrageurs take into account the onliest fundamental risk (thus taking rather limited positions) [1].

In addition, fundamental risk aversion typical of arbitrageurs, constitute itself a forceful limitation to arbitrage.

There exists also the risk that beliefs of noise traders would not hereafter revert to their mean for enduring periods of time, not to mention them becoming even more extreme. If today the noise traders are pessimistic about the value of an asset, in such way to significantly lower its price, arbitrageurs must infer that, in the future, noise traders might become even more pessimistic in providing an expectation on the value of that asset, thus further lowering its price. If the arbitrageurs would have to liquidate this asset in advance, he would incur into a loss, and aversion towards the risk of such loss, limits its original arbitrage position. When, on the other hand, prices has been raised from noise traders mistaken beliefs, arbitrageurs must consider that their overconfidence can lead to an even more significant increase in price tomorrow, that is to say, they must consider the possible risk that the price of a stock goes slightly, when they have the intention to by that again.

This indeed constitutes a further limit to arbitrage.

Noise trader risk makes it difficult to classify an asset relying on its fundamental risk. Irrational investors collect their information from analysts, brokers, or economic consultants, and account these signals as actually representing valid information. The misperception of noise traders and speculators about the risk (embodied by , and directly proportional to the interest rate) lead to the underestimation of the fundamental risk of an asset, because the relatively high price classifies it as high valuable, in terms of fair value.

[1] Figlewski (1979)

2.2 Overconfidence and self-attribution in Investment decisions

To introduce this topic, it is useful to recall the DHS model; it is essentially based on the existence of two psychological anomalies investors are submitted to: overconfidence and the self-attribution (self-attribution bias).

People are defined as overconfident, when they appear to overestimate the soundness and the trustworthiness of their private data, therefore attaching poor or hardly any relevance to publicly shared knowledge; in doing such, they undeniably underestimates the massively erroneous nature of their assessments.

The financial turnover of this distorted approach is a lopsided reaction of stock prices to private announcements, which would eventually be partly corrected, by the disclosure of public information. Intuitively enough, the average price will tend to converge to the true value of the security as time passes by, as a result of the circulation of public scores. Share prices show virtually a dual response to new signals, whether their nature being public or private: in the first case, they tend to overreact, in the second to under-react.

However investors are recurrently susceptible to self-attribution bias, in turn ultimately leading to a shift in the intensity of hyper-confidence: it refers to the way in which the reaction of generic investor, operating on the market relying on private signals, to the exposure towards public news. Specifically, if the latter are consistent with those in private possession, or at least they follow the same trend, this leads to a huge increase in the investor's self confidence with respect to its skills; if, the opposite verifies, on the other hand there the decrease in self-esteem faced by the investor is rather modest or insignificant. If this holds, public information may trigger further overreaction in prices, compared to a previous private signal: this continuous overreaction at the dawn of the effect, results to revert its trend as more and more public information glide, gradually pushing prices towards its fundamental value.

In line with these assumptions, DHS develop two models: a static one, characterized by a constant level of overconfidence, and a dynamic one, aimed at formalizing the effect of self attribution bias over time.

2.3 The static model

The static scheme, in which there are two types of investors, informed (I) and uninformed (U), is characterized by four important hypotheses, spanned through four distinct moments in time:

1. Time t = 0: all individuals share the same set of information and trade relying on this common knowledge

2. Time t = 1: group I receives private information related to a stock lying in its portfolio and, according to this news, interacts with U; assuming the final value of the risky asset is equal to θ, the private info received is constructed as:

$$s1 = \theta + \varepsilon$$

Where (formula); Furthermore, while group U correctly estimate the variance error, while I underestimates it, deeming that $\sigma c \wedge 2 < \sigma \varepsilon \hat{} 2$

3. Time t = 2: there occurs the arrival of the first public information on the market, $s2 = \theta + \eta$ con $\eta \sim N(0, \sigma p \hat{} 2)$. Meanwhile, trade between the two groups is still enduring, this time the variance error being properly evaluated by both groups;

4. The time t = 3: the latest public information pops up. Prices of the stock at times

t = 1, t = 2 and t = 3 are summarized as follows:

P1 = EC [$\theta \mid \theta + \varepsilon$]

P2 = EC [$\theta \mid \theta + \varepsilon ; \theta + \eta$]

P3 = θ

Where the subscript C indicates that the expected value is calculated on the basis of hyper-sound forecasts by informed investors; In addition, the properties of the standard normal variables, we get:

$$P_1 = \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_\varepsilon^2}(\theta + \varepsilon)$$

And:

$$P_2 \frac{\sigma_\theta^2(\sigma_\varepsilon^2+\sigma_p^2)}{D}\theta + \frac{\sigma_\theta^2\sigma_p^2}{D}\varepsilon + \frac{\sigma_\theta^2\sigma_\varepsilon^2}{D}\eta \text{ with } D = \sigma_\theta^2(\sigma_\varepsilon^2+\sigma_p^2)+\sigma_\varepsilon^2\sigma_p^2$$

Theoretically expounding the previous expressions, they basically show that excessive confidence in the private signal s_1 results in price shock at time t = 1, which ultimately hatches price overreaction (under-reaction) to good (bad) news.

Any which way, when public news start flowing in the market, at time t = 2, the inefficiency suffered by the price at t = 1 is partially adjusted.

Thus, there can be distinguished two distinct phases of group I's reactions, in response to private or public news: the overreaction phase (under-reaction, whether the signal be negative), culminating in the reaching by the asset price of its highest (lowest) value, and then the correction phase, whose beginning coincides with the arrival of the first public broadcast, and which would endure as market keeps on acquiring public information, therefore until the stock price gets to converge to its fair value.

The excess reaction, whether positive or negative, and its subsequent correction implies that, intuitively, the covariance between price changes from time t = 1 to t = 2 is negative ⇒ cov (P_2-P_1, P_1-P_0) <0.

Likewise, if you include time t = 3, in which overreaction (under-reaction), is ultimately matched, covariance is still = cov (P_3-P_1, P_1-P_0) <0.

If this holds, as a result from an investor's overconfidence, we mark:

a) Price fluctuations triggered by the influx of private signals are, on average, partially reversed in the long run;

b) Price fluctuations triggered by the influx of public information are positively correlated with most recent distortions suffered by quotas.

The static model is that it only provides a theoretical and non-exhaustive support regarding trend reversals for long run earnings, as confirmed by the preposition a) and b).

In addition, is not quite realistic to assume the level of confidence being constant, as empirical evidences show that the events confirming one's opinions, tend to increase

confidence toward its skills, while disconfirming happenings lead hardly any change in overconfidence.

These considerations brought DHS to develop a dynamic version of the previous model

2.4 The Dynamic Model

Here, the initial level of hyper-soundness investment is assumed to be positive, therefore $\sigma_c^2 \leq \sigma_\varepsilon^2$

Furthermore, public signal s_2 is inferred as being a discrete random variable which can only assume two values 1 and -1

There are essentially two cases:

1. Sign (θ + ε) = sign (s_2) ⇒ investor's hyper-soundness increases the effect of self-attribution, consequently decreasing its estimate of the error variance, compared to the one observed in the static model:

$$\sigma_c^2 - k < \sigma_t^2 \; with \; 0 < k < \sigma_c^2$$

2. Sign (θ + ε) ≠ sign (s_2) ⇒ hyper-soundness holds almost constant.

Estimation on variance goes back to $\sigma_c^2 \leq \sigma_\varepsilon^2$

Obviously, in the dynamic model *basic* P^*_1 the same as *basic* P_1 static version; the difference appears at time t = 2, where the drift depends on which type of public information spills into the market, namely:

1. Whether sign (θ + ε) = sign (s_2) ⇒ $P^*_2 \neq P_2$, thus the new value of the price at time t= 2 is to be computed using the new estimate of the variance error:

$$P_2^* = \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_c^2 - k}(\theta + \varepsilon)$$

2. Whether sign $(\theta + \varepsilon) \neq$ sign $(s2) \Rightarrow P^{*}_{2} = P_2$.

The dynamic model highlights that, in contrast to what its static version, the step of overreaction (under-reaction) extends up to time t = 2, namely:

$$\text{cov}\,(P_2-P_1,\, P_1-P_0) > 0$$

Noticeably, the correspondence expressed by the previous inequality, justifies the existence of a temporary price levels' distortion in the short run. The subsequent correction phase crops up in the long run, during which it occurs that:

$$\text{cov}(P_2-P_1,\, P_1-P_0) < 0$$

$$\text{cov}(P_2-P_3,\, P_2-P_1) < 0$$

Therefore, is it possible to conclude that if confidence investors put in their own abilities is varies in response to a distorted self-attribution and also, if overreaction and correction phases are gradual enough, then the price will differ from the market value in the short term to adjust back to it in the long term. In the span of time in which the price is distorted, in fact there is the possibility of obtaining unexploited profits (the so-called free-lunch). This is actually associable with noise trading.

Such practice is being investigated as being the ultimate cause of, or at least for having contributed to the development of historical financial crises, through the aforementioned increase in volatility, and because of limits they pose to arbitrage.

The terminology of "speculative" bubble is not really casual, when referring to a time span in which market prices of certain assets go through periods of uncontrolled inflation or deflation.

In addition, the bursting of these bubbles causes not indifferent imbalances in market equilibrium, causing either disproportionate gains or disastrous losses, depending on the inflationary or deflationary nature of the bubble.

Rather intuitive is the assumption that noise trading does actually lead to not indifferent distortions even in the balance of individual companies, which ultimately constitutes the theme of discussion for the following paragraphs

3. Behavioural Corporate Finance

3. 1 Behavioural Corporate Finance - An Introduction

In the study of behavioural corporate finance, is it possible to distinguish two distinct approaches. The first[2] assumes that the managers of the company are not to be fully rational, affirming that certain psychological phenomena can lead to distortion in the level of prejudice and judgment on corporate decisions. When it comes to investments carried out by corporate managers and which have proved detrimental to the company, the traditional theory tends recall the issue of so-called agency conflicts.

These are defined as conflicts arising from a contract under which, one or more persons (principal) en-charges another person (agent) to cover on its behalf a given task, thus implying a delegation of power to the agent. At corporate level, agency costs typically originate from conflicts between managers, shareholders and bondholders.

The problem of agency costs emerges clearly when the firm gets leveraged. Because of agency costs related to the debt, companies generally have a less than 100% leverage ratio. When a firm has debt, b conflicts between shareholders and bondholders are rather likely to manifest. The property of a company, in case of failure, costs the sole amount of their investment (if limited liability holds); the risk of failure turns to be therefore entirely borne by the bondholders, who's credits will not be refunded in any way anymore. As the E/D ratio decreases, the property manager gets more and more persuaded to undertake risky investment projects, as in case the project manages to succeed, shareholders will fully enjoy a significant increase in their profits, while the risk being entirely born by bondholders.

In real world cases, though, these strategies are way too expensive, as their inevitable backlash is the reduction of the company's market value. A risky project, will actually increase the value of the firm only in case of success; in this case, the increase in value would be captured by the shareholders , bondholders being fully repaid. But in case of failure, the decrease in value would be to the detriment of

bondholders, which would fail in getting fully repaid, while shareholders position would not be in any way influenced, as if the project in question had never been undertaken. In this sense, it is possible to infer that shareholders have nothing to lose in taking a risky investment.

At the same time, shareholders may also have the incentive to under-invest. Assuming it bears a positive NPV, the cost of the investment would actually be entirely covered by the shareholders, while the benefits derived from it will be shared with bondholders.

In addition during periods of financial distress, shareholders may be boosted to liquidate their dividends, in order to subtract their extra funds from creditors' clutches. This process is addressed as "milking the property", consequently draining the business activities. All the costs of these "strategies" would not be eventually paid by the creditors, which will protect themselves by demanding for a a higher interest rate. As a result, the cost of debt will soon become unbearable and the company incur in further costs, which eventually will rain on shareholders' shoulders.

But agency problems do not solely arise between property and creditors. They can also emerge from conflicts of interest between shareholders (ownership) and managers (control).

The greater the percentage of risky equity held by the manager of a company, the harder behaviours that may harm the value of the firm will be dodged. Typical examples lies in the creation of "empires" through multiple acquisitions of other companies, exertion of corporate assets for personal purposes, and so on.

An individual would be assumed to manage with higher commitment a company of which he is entitled with (even part of) the ownership, since returns on endeavoured projects would directly affect its investment and quotas. Intuitively enough, the greater the stake hold, the stronger the commitment. Hence, the use of incentives based on a variable remuneration on results, and on other instruments such as stock options or shares allocated free of charge that, giving the manager a share capital of the company, are aimed to make him more involved.

We can therefore expect an higher frequency of behavioral mind trips in companies with eminent cash flows. Here the leverage results to be beneficial, as it limits the

[2] Baker (2007)

opportunity for managers to dissipate resources. Coercing them to pay fixed cash-outs for cash flow- reducing interest , eventually succeeds in mitigating agency costs. Is thus reasonably conceivable that the alignment of interests of these two parties, and the resulting increment in managers' entitlement to corporate capital, may limit the emergence of these costs and opportunistic behaviour of managers. Behavioral finance tends to distinguish harmful investments dude to conflicts of interest, from those caused by behavioral biases and psychological traps in which managers occur to fall.

The second branch of the subject emphasizes on investors' bounded rationality. Managers who follow the traditional value-based approach, assume that fundamental and market values coincide.

But there are also behavioral distortions of investors and analysts, both inside and outside the firm, who may eventually cause these two variable to sensibly differ from one another, causing errors in the assessment of the security's fair value.

Here it is necessary to recall the foretasted topic of noise traders: when relating to corporate finance, they are to be identify either outside and inside the company, as generally speaking, noise traders are defined as investors.

Corporate investment and financing decisions are identified as rational responses to market mis-pricing and noise- trading.

These two distinct views of sources of damage for the company, specifically require distinct remedies: Aforementioned incentives to minimize agency problems on the one hand, and exertion of processes aimed at debasing distortions of behaviour on the other.

When investors are the dominant origin of bounded rationality, maximization of long-term value and economic efficiency require managers to be neutral to price pressures in the short term. Contrarily, if the source of irrationality comes from corporate managers, efficiency requires them to respond to price signals from the market, thus limiting the use of their acumen.

3.2 Internal Analysis and Agency Problems

One of the main topic of discussion is whether endowed with designed incentives,

managers would better perform in maximizing the value of the firms they are employed in.

Stock-option plans, for example, are way complex financial instruments used to endow managers with the right to exercise an option-to-buy on some shares of the company at a predetermined price. In this way, the acquisition of stocks by managers turns the good performance of the firm to be of their direct interest, as it would naturally enhance the value of the company's shares. However, a stock option policy is not backlash-free. Managers tend to evaluate stock options relying on the difference between the exercise price and the market value of the stock (intrinsic value) , thus penalizing the value of options issued at a strike price greater than or equal to the market price of the shares. Furthermore, there could be venture of impairment of the relationship between the quality of managerial behavior and the compensation paid by the plan . If the plan does not create a strong bond between the salary of the employee and the company's performance, the company runs the risk not to reward managers who have actively contributed to the company's brilliant results, in periods marked by unfavorable equity securities, while unjustly rewarding managers who have produced unsatisfactory business results in a period of favorable trend of the stock market. Another point to be discussed is the possible loss of value of the shares, following the sale of the shares acquired by managers through the plan; it is possible that managers , once they exercised the options and came into possession of the shares, assume a behavior aimed at protecting the gain obtained, thus not developing a more risk-oriented entrepreneurial mindset. Furthermore, the market may interpret the sale of shares, concentrated in a short period of time by providers of employees , as the judgment of overvaluation of the title. In addiction, it could occur the risk of underestimating the implicit cost of the issuance of a large amount of options. When a massive number of options that allow you to buy (or subscribe for) shares at a price significantly lower than the market price is issued, this would likely produce a remarkable damage to the shareholders. This can happen for two reasons: on the one hand, the the price of a security is possible to decrease , consequently dragging the sale of the shares down. On the other hand, one should consider the effect of dilution resulting from the exercise of options to values lower than market one. Last but not least, managers could adopt aggressive or evasive budgetary policies, in order to achieve the quantitative targets resulting from the stock option plan . There are also several concerns affecting other

firm's constituencies; stock ownership by an employee means that there would be a new party staring over the company's shoulder.

3.3 External Analysis and Value Assessment

Now consider the behavioral obstacles to value creation that are external to the firm, or more specifically, action taken by the firm and addressed to the outside . The behavioral approach towards this area appeals CAPM as not being a realistic and exhaustive model for risk evaluation, as market prices often differ from fundamental values. When this occurs, managers struggling to maximize fair value often end up in depleting, at least temporarily, the value of their firm. What kind of recovering actions can be taken in order to avoid such circumstances? Which types of adjustments might managers make to the EVA-based[3] approach? In conventional EVA (economic value added) analysis, the discount rate of the stream of cash flows is usually derived using Capital Asset Pricing Model (CAPM). However, when mis-pricing due to investors' and analysts' errors takes place, managers may regard adjusting the discount rate in order to properly fit the mis-pricing.

Next passage presents some of the more outstanding behavioral characteristics and biases of decision-making process.

[3] fair value assessed as the present value of a future stream of discounted cash flows, Stern Stewart and Co

3.4 Principle Cognitive Biases and Effects

Cognitive biases are defined as propensities to shape oneself's mind toward a certain tendency, which lead to a sensible reduction in rationality. Biases' nature is rather irrational, and because of this irrationality they are extremely ticklish to phase out. The most common biases to which corporate managers are subject to when evaluating projects are the ones the following. Each one has a specific manifestation and each one can lead to several and severe consequences for the firm.

a. Optimism bias : the subject has the belief of being less exposed to risk with respect to others, and conceives itself as better performing than others in the same plight: doing such, he overestimates the frequency of good results stemming from its actions. A manager could, for example, unreasonably adjourn a cost cutting policy in times of recession, leading to a significant reduction in profits

b. Overconfidence: the subject perceives itself as "above average", above all in situations in which it could possibly be compelled to show its skills. Notwithstanding this feelings, it makes more mistakes than it thinks it does. A common error made as a result of overconfidence could be to make less valuable investments only because the company has excess cash, consequently lowering both the value of the firm and its performance.

c. Confirmation Bias: the subject is prompted to only consider the reasons, subjects and data supporting and confirming its hypotheses, investing them with too high importance, while underestimating and avoiding thesis that could disavow its beliefs. It could thus ignore information which stand against its current point of view, reducing profits because of missed or delayed reaction to market fluctuations. Several groundwork identified decision-makers who are liable for a breakdown as being more contemplative than those who are not, hinting that they hunt for proofs to support the reasonableness of their forward choice. Such behavior could be addressed at as being subject to confirmation bias.

d. Illusion of control: it is the tendency of the subject to overestimate the degree of control it has on events, even if it has undeniably no ascendancy on them. An investor could thus be more willing to accept risks, as if he feels able to handle it. In this case the company may undertake speculative investments, decreasing its rating

and lowering the value of its stocks, not to mention being exposed to losses and unreasonably high costs .

e. Representativeness: defines the subject's tendency to build its assessments upon analogies and stereotypes, assessing the probability that a certain event belongs to a certain class relying on how the event itself represents the class. It could lead to wrong investment choice on the basis of biased estimates, i.e. considering a class of investments universally assumed to be not profitable, as being indeed profitable because of a small part of profitable investments belonging to that class, or evaluating a portfolio of securities with the same benchmarks. Doing such, tanned investor would eventually fail to maximize the NPV, ultimately decreasing the value of the firm

f. Anchoring: When referring to decision making, anchoring happens when the subject uses only the first piece of an information to make subsequent appraisals. Once the "anchor" is set, resultant judgements are adjusted to it. The estimates are influenced by few, salient information, and decisions are influenced by completely random additional information, though perceived as being neighboring.

In behavioral corporate finance this could draw the investor to cling to a reference value and adjust the shot, dwindling the value of the company due to distorted estimates of growth.

g. Framing: This bias is peculiar of, and presently provides the basis for Kahneman and Tversky's "Prospect theory". It essentially states that decision-making is based on how the scenario is presented. One peculiar offshoot of such bias is so-called "loss aversion". Loss-averse individuals confronting risky alternatives, weight their decisions in terms of gains and losses, adjusting them for the relative probability.

This bias can turn into rejection of the benefits of the interest-tax shield, as a result of debt aversion. Also, in several cases, loss aversion lead to keep investing in value-disrupting projects, thus reducing the value of the company.

4. CAPM and Capital Budgeting

All the above mentioned cognitive biases essentially bear an ultimate result: mispricing.

This erroneous assessment is responsible for all kinds of struggles between managers. As well as striving about when to issue additional equity, financial managers are also deeply involved in the search of the most precise and appropriate hedge rate to discount the future cash-flow of a project. Traditionally , capital budgeting is managed within the boundaries of the capital asset pricing model (CAPM), providing the codified basis to derive the appropriate hedge rates. Yet, this approach lies on the state that prices are efficient.

When prices are inefficient but managers are fully rational (i.e. they do not commit errors due to behavioral biases), the proper assessment of discount rate is influenced by two variables: the time horizon of the project, namely the timeline over which value maximization is spanned, and interplays between capital budgeting and capital structure. When there is an excess optimism among investors and analysts about a firm’s future prospects, resulting in a rise in price by its stock, it brings about firm’s prospective expected returns to be unnaturally low. Managers may thus look at the emission of new equity, as well as subsidizing new projects.

In the most trivial case possible, the firm is indifferent toward t the correct combine of debt and equity, and the market does not promptly devaluate the firm's share after a new equity emission. In this case, it is convenient for the firm to issue new, overpriced shares, dislocating in such way wealth from new to old shareholders. On the other hand, when it comes to bankroll a value-enhancing project which would increase the stock price even in an overoptimistic ambience, but at the same time, would curtail value if the firm were efficiently priced?

Being shareholders rational and informed, they would not hold long-term overpriced shares. They would rather liquidate them, anticipating the price dropping back again to its fundamental value. But isn't manager’s objective to maximize wealth by properly adapting to the current conditions, i.e. by engaging in projects that will increase the current market value of the company, even in venture of possible long-term drawbacks? In any case, if shareholders plan to keep long-term stock, either

because they are irrational, poorly cognizant, or held down from short-selling, managers should possibly abstain from undertaking project constituting a source of value only for the short run. Doing such, the manager appoints toward long-term value maximization, which quite resembles the classical case.

Behavioral finance provides customary benchmarks to help managers toward wealth maximization in presence of inefficient markets. According to these, managers could happen to find themselves to accurately fix hedge rates, while they they should not in other occurrence. Capital budgeting turns out to be rather more complex to this extent, than in an efficient market position. To sum up, the ground rules are the following.

If there are no relevant overflows from project decisions onto capital structure, and managers aim to long-term value maximization, then they should properly apply CAPM-based rate, only fixing this rate to mirror the level of project risk. If this is not the case, specifically, if project selection does affect capital structure, then the project rate should be assessed in order to represent the extent to which firm's equity is misevaluated on the market. They could also properly allocate funds, for instance finance a new project instead of using cash to repurchase undervalued shares.

Imagine that investors share overoptimistic expectations about the value of a projects, consequently driving stock-price up to a point in which it becomes overvalued. In such scenario, a rational manager would expect prices to revert to their fundamental value in the long run, consequently lowering the value of the project undertaken under overvaluation. Therefore, when deciding to endorse the project for short-term value creation, managers implicitly use a lower rate. The project is expected to be expensive in the long run, but its adoption would bring the stock price up in the short run.

The converse holds for the opposite plot. Indeed, a manager who pursues long-term value creation is effectively advised to use CAPM to assess rates, as prices are assumed to adjust to their fair value in the long run. In other words, the best estimates of returns in the long-run is CAPM beta-based. CAPM rate is indeed the opportune rate whenever capital budgeting decisions and capital structure share no correlation.

When, on the other hand, capital budgeting and financing decisions are linked, the

convenient rate is effectively a weighted average of the CAPM rate and a rate based on behavioral adjustments properly reflecting market distortions, weighted accordingly to the firm's capital structure. For instance, if the firm's D/E ratio is 1.0, CAPM rate being 10%, and fluctuations resulting into an overvaluation of the firm's shares, bringing its expected return up to 20%, then the appropriate hurdle rate would be between 10% and 20%, then 15% (because being D/E=1.0, proportions are respectively 50% for equity and 50% for debt).

An example on how to determine the more fitting rate, is provided by a situation in which the firm's capital is undervalued, the firm being unleveraged (perhaps because of burdensome provisioned costs of bankruptcy due to the firm's riskiness). The firm in question is entitled with a certain amount of cash and has to decide how to better allocate it. It can either repurchase undervalued shares, or capitalize a project with a nonnegative NPV.

Being the problem addressed rationally, the repurchase policy means exchanging cash for a less diluted holding of the future cash flows streaming from firm's further assets. Financing the project draws in trading cash for being entitled with a share of the future cash flows deriving from the new project. If the equitably fair NPV of the recoup exceeds the equitably fairy NPV of the project, then a rational investor would favor the share repurchase over the project in the long-run. In case the project would bear a null NPV, a rational investor would be strongly in favor of the share repurchase.

Rejecting a positive-NPV project in favor of a share repurchase implicate an higher rate with respect to the associated fundamental rate. Despite this, a value-maximizing manager must pick a higher rate due to capital structure and capital budgeting interdependence. A manager who is not forced to take into account capital structure would rather get leveraged in order to bankroll the project, repurchasing shares later on. Namely, he would adopt an hedge rate reasonably near to the CAPM.

Hence, the adoption of a higher hurdle rate by the firm's managers, is mainly due to the the burden of the cost of debt.

This holds even in presence of positive debt ratio . In such situation, however, the company would partially finance the project with debt. The expected return on the debt-capitalized part, will at least have to be the fundamental rate, ore a CAPM-

defined rate. But as stocks had previously decreased in value, the equity-capitalized portion will have to earn an higher the expected return on equity. Hence, the overall interest rate will be a weighted average of the two, with the weights respectively given by E/D and D/E ratios.

This actually claim the firm's stock price as being indeed heavily relevant in capital budgeting. In firms which are tightly constrained by capital structure, interest rate's policies tend to fluctuate more in occurrence of price distortions than those of unconstrained firms.

As already mentioned, managers should adjust interest rate for a project to the level of systemic risk associated with the project's expected returns.

Not surprisingly, risk assessment is often anything but straightforward. In practice, indeed capital budgeting is frequently poorly performed, as firms tend to uniformly use their mere cost of capital to evaluate any project.

5. Overconfidence and Capital Budgeting

Now we switch to the analysis of how the bias overconfidence can possibly interfere with capital budgeting.

This simple model of capital budgeting is injected with managerial overconfidence, which will provide arguments for the ultimate discussion. Here, the hypothesis is that an economy has one sole period and that an all-equity firm must take a capital budgeting choice at time t=0. This decision has to be taken by a manager generously acting to pursue the best interest for the shareholders, namely, shares their purpose of value-maximization. He has thus to decide whether the firm should undertake a project, engendering a cash flow of at the closing of the stage, where $\tilde{v}$ is a random variable located somewhere in the interval $(-\infty,\infty)$, and having a mean of $\bar{v}$. Inferring the cost of the project as being c>0, incurring at t=0, being the appropriate one-period discount rate equal to r > 0 , then the profits the firm earns from undertaking this project, in terms of present value, are formalized by the following random variable

$$\tilde{p} = i\left(\frac{\tilde{v}}{1+r} - c\right) \qquad (1)$$

where i∈{0,1} describes the decision of tackling (i=1) or abandoning (i=0) the project.

This means that the firm's earnings from the project are zero when the manager chooses not to commence the project, or they are (insert formula) in case he decides to make an initial investment of (insert formula) aiming to gain a conditional payoff of $\tilde{v}$.

The manager gathers a private information about $\tilde{v}$, before picking *i.* He could use this signal to get more awareness about the investment decision.

Assume this signal as being mirrored in $\tilde{s} = \tilde{\varepsilon}\tilde{v} + (1-\tilde{\varepsilon})\tilde{\eta}$ where

$$\tilde{\varepsilon} = \begin{cases} 1, & prob.a \\ 0, & prob.\ 1-a \end{cases}$$

a ∈[0, ½] , and η shares the same distribution as $\tilde{v}$ though being autonomous from it. That is to say that the private news has the same actual distribution as $\tilde{v}$, but the probability of it being actually equal to $\tilde{v}$ is assessed through a, representing the manager's capabilities.

Diversely, namely with probability 1 − a , the information is merely noise. This entails that

$$E(\tilde{v}|\tilde{s}) = a\tilde{s} + (1-a)\bar{v} = \bar{v} + a(\tilde{s} - \bar{v}) \qquad (2)$$

That is, a positive (negative) information $\tilde{s}$ above (below) $\bar{v}$ is translated into higher (lower) backsides about $\tilde{v}$. When individuals come up against a relatively challenging task, their degree of overconfidence is highly correlated with their perception of being above average[4]. Specifically for such duties, overconfidence can be said as sharing no effective connection with one's skill[5]. This correspondence between overconfidence and perceived shows that managers tend to perceive themselves as having a complete control over outcomes, therefore assuming the

[4] Larrick, Burson, and Soll (2007)
[5] Gervais and Odean (2001), Gervais and Goldstein (2007) Gervais et al. (2009)"model of overconfidence"
[6] March and Shapira's (1987)

level of risk of project under their entitlement as being relatively low[6].

Managers' overconfidence is thus modeled as being correlated with their attitude toward their skills. That is to say, the manager is presumed to model his skill as $a + b$, where $b \in [0, 1/2]$. When $b = 0$, the manager is rational and appropriately weights the news incorporated in ; as instead b approaches 1/2, the manager stoutly overestimates the reliability of his information, consequently overweighting it. Particularly, in its viewpoint,

$$E(\tilde{v}|\tilde{s}) = (a+b)\tilde{s} + (1-a-b)\bar{v} = \bar{v} + (a+b)(\tilde{s}-\bar{v}) \quad (4)$$

where the "b" subscript illustrates the manager's distorted expectation under his biased bundle of news. The overconfident manager consequently overvalues (undervalues)the project's forthcoming stream of cash flows when $\tilde{s} > \bar{v} (\tilde{s} < \bar{v})$
In order to fulfill his scope of maximizing firm's value, the manager will engage in the new project if and only if its conditional NPV= $\frac{1}{1+r} E_b(\tilde{v}|\tilde{s}) - c$ > 0, According to equation (4) this means that s > sb where, assuming an interior solution,

$$s_b^* \equiv \bar{v} - \frac{\bar{v} - c(1+r)}{a+b} = \bar{v} - \frac{1+r}{a+b}\left(\frac{\bar{v}}{1+r} - c\right) \quad (5)$$

embodies the news brink above which projects are undertaken. Since a small value of s_b^* heads to the undertaking of a greater number of projects (as it is actually decreasing in s_b^*), equation (5) illustrates that the effect of overconfidence on investment as being two-sided, depending on the sign of $\frac{\bar{v}}{1+r} - c$, , which represents the NPV of the project with no noise about it. When the expected value ex ante of a cash flow from a project is small, or the project results as being too burdensome to undertake (c is large), overconfidence leads to over investment, the news brink exploited by the manager being lower than the one

$$s_0^* = \overline{v} - \frac{\overline{v} - c(1+r)}{a} \qquad (6)$$

that shareholders would point out the manager to elect.

Undoubtedly, overconfidence can also cause managers to underinvest when $\overline{v}$ is large or in presence of a small c . This is because the manager are more prone to capsize projects because of overweighting pessimistic information rather than undertaking them relying on overweighed encouraging signals. Every firm displays a durable option to tender on a slew of other companies, indeed a positive signal about a possible cooperative earning with one such firm is commonly what bring about a M&A. Specifically, in most sensible scenarios, $\frac{\overline{v}}{1+r} - c < 0$, and only a confident enough sign would eventually head to an investment.

In conclusion, this model is clearly to show that overconfidence will generally bring to over-invest.

Conclusions

From noise trading on, mathematical models suggest that there is a rather influential market response to noise, and that the flow of private information causes irrationality, at least in the short term.

When referring to behavioral corporate finance, the presence of private information generates a number of various cognitive biases, significantly compromising the ability of a given investor to make rational decisions, and to assign the adequate risk level to a project, consequently failing to correctly determine its expected value. With regard to the problems that arise within the corporate environment, they can be ultimately summarized in terms of agency costs, and, despite the incentives are proposed as the best debiasing technique, they result to be hardly ever efficient in completing the their task, even occasionally contributing to the development of additional cognitive biases.

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