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Behavioral finance, prices fluctuations and investor's sentiment

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Abstract:

In this dissertation we want to provide explanations for fluctuations and irrationalities on the market that can be caused by behavioral finance factors. Firstly we start the argumentation with the efficient market theory and end it with its critics in order to introduce the behavioral finance factors to show how they represent the investor's sentiment and how they can influence the investors in taking decision that influence price trends. In fact, agents (Investors, households ect..) can experiment behavioral factors that can influence their judgment during their decision-making process, such behavioral factors are essential but difficult to measure. After defining theoretically the different behavioral factors and their mechanism; in the second chapter we will define the models and variables that will be used and try to prove if these same behavioral finance factors and fear especially affect statistically significantly prices of stocks after certain events occurs.

Introduction

Behavioral finance searches to put together behavioral and cognitive psychological theory with the modern economics and finance to try to explain the reasons that pushes people to make irrational financial decisions. Following the books about conventional financial theory,we live in a world where all the participants or most of them are rational and all maximize their wealth. However, there are many situations where our emotion and psychology influence the decisions we make causing us to behave in unpredictable or irrational ways.
Following this, it is extremely important to understand the formation of people's expectations in this context and it is here that cognitive psychology, and other behavioral factors such as biases and animals spirits play such an important role in the behavioral approach to finance. Cognitive psychology is the study of mental processes that affect human behavior, avoiding cognitive biases allows investors to reach impartial decision based only on the available data. It is applied in a lot of modern different fields, such as economics, and interacts a lot with behavioral finance. Psychologists consider that heuristics and biases (mental shortcuts that allow for quick decisions) show up when people form beliefs, which can lead to serious deviations from rationality. In general, these are efficient rules that involve focusing on one aspect of a complex situation and disregarding the others, however they can also lead to biased decision-making. They have been shown to influence people's choices when faced with uncertain outcomes like investment decisions, decisions about legal cases, asset allocation and this will be shown in the first chapter based on different papers and principally on the book "Animal Spirits" by Georges Akerlof and Robert shriller…

The famous Great Depression of 1929, followed by the subprime crisis as stated in Akerlof's book, were the biggest tragedies that affected the economy in the last century; joblessness was increased all around the world and it was even accentuated by the World war 2. During this same context of depression in 1936, John Maynard Keynes who was a famous economist wrote his book 'The general theory of employment, interest and money" where he raised a lot of important issues, one of them being how creditworthy governments such as the US and Uk could borrow in order to re boost the economy. In this famous book, the main idea is the opposite of what the classical theory states that is, market do not regulate and adjust by themselves, we have to influence the aggregate demand through a regulation by the state and in order to boost the economy we have to increases the government spendings and decrease taxes. However these policies were not directly implemented firstly because they were doubting about the credibility of Keynes and most importantly these institution lacked of directives and confidence to initiate this type of poles. These policies were implemented much later around the end of the 90's and full employment became the main priority in the US. Classical economist stated that with no government interventions, as by the invisible hand theory private markets would regulate themselves and balances toward the full employment engaging in transactions leading to mutual benefits; however Keynes stated that the economy was not only governed by rational agents but he also observed that the economic activity was also governed by some Animal spirits. With these animal spirits, they are not totally rational in the pursuit of their economic interest as was saying Keynes but also that these same animal spirits are one of the reasons that makes the economy fluctuates affecting stock prices, company's health and consequently causing involuntary employment. To understand how the economies work, what causes volatility to vary ect.. we will be investigating the patterns that determines people reactions, feelings and ideas. In this context

lets define these Animal Spirits mentioned by Akerlof and Shriller; its a term used by John Maynard Keynes to explain why decisions are made even in times of uncertainty,the term "animal spirits" is used to describe the human emotions that drives consumer confidence.In modern economic terms, animal spirits describe the psychological factors that drive investors to take action when faced with high volatility in the capital market.Animal spirits is gotten from the Latin term spiritus animalis which means the breath that awakens the human mind. However most of the writers don't really like these factors to describe the difference events that could affect the economy so they end up forming complex and artificial interpretations of these events. For them any change in people's impressions, in their passions or feelings wont affect at all the aggregates of the economy and we just have to look at government policies and some other technical actions to get our explanation for these events. Despite these government action and technical factors we saw how the economy collapsed and many times; what happened in peoples mind?how didn't they see all of these events such as banks collapses and credit crunch coming before they actually happened?

The most common answer is people were always told that nothing would ever happen and this made them feel confident and safe, this theory proved to be inefficient and we saw how the lack of consideration of these animals spirits lead to the worst case scenario. For example until the last day before the crisis of sub primes, the rating agencies such as Moodies standard and poor gave the maximum grades AAA+ to the same institutions that went bankrupt the next day (lehman brothers ect..). A spontaneous reactions is a human reaction and it is lead by our feelings,predictions and ideas. Putting it in parallel with financial market, these behavioral reactions to some specific event can accelerate the trend if we have a massive reaction and it balances markets in both directions; however economists and governments lack to take into considerations of of these behavioral factors such as fairness, confidence ect…
In psychology, decision- making is regarded as a cognitive process in which an agent selects one alternative among several. Most of the decision-making process concludes in choosing among different possibilities depending on one's beliefs and preferences. This process is usually portrayed as a problem-solving action concluded by a solution deemed to be satisfactory.
By the end of this thesis, we hope to have a better understanding of some of the behavioral anomalies that conventional financial theories fails to explain and hopefully, the outcome and the elements of this thesis will help for making financial decisions. Furthermore, there are many investors and market participants on the financial markets, they're all faced with dilemmas and have to decide in a limited amount of time how to react and what to do with what their wealth or inside their company when some random positive or negative event happens. We will define the different biases, show how animal spirits can have an impact and analyze with some example different markets. Then we want to try to prove how behavioral finance factors can affect the prices and the health of a company and finally we will test and try show how event can be affected by behavioral finance factors at the empirical levels by using different models that will be defined later on.

Chapter I

Section 1: Theoretical Considerations:

What are the Behavioral factors anomalies that can cause disruptions in the markets; more precisely how can they have repercussions on the value of a company, on the Stock market and the aggregates of the economy ?

In order to answer to this question, we will first go through the classic theory about efficient market hypothesis by Eugene Famas; explain the different forms, and analyze briefly the limits of this theory. In the second part of this chapter we will show how behavioral finance can explain part the fluctuations since 1929, how they can lead to bubbles (different feedback effects), how they explain the anomalies in the stock market (Biases, heuristics,overconfidence) and finally explain why do we observe cycles taking the example of the real estate market.

1)The efficient markets hypothesis (EMH)

We will first define and explain this theory with reference to the author Eugene fama (1960) who is an American economist, often referred to as "The Father of Finance", best known for his empirical work on portfolio theory, asset pricing and stock market behavior. We will describe the difference forms of efficiencies that exist and state the critics in order to introduce behavioral finance as the main ones.

Introduction

Also called Random Walk Theory, it is characterized by the idea that current stock prices fully reflect available information about the value of the firm, and there is no way to earn excess profits (more than the market over all) by using this information. It has very important implications for investors as well as for financial managers. This term of “efficient market” was brought by the famous economist E.F fame in his paper written in 1965 where he stated that in an efficient market, thanks to the competition we have that the effect of a new information will be reflected "instantaneously" in the actual prices. We define **Technical and Fundamental** that are important in this theory; Technical analysis and fundamental analysis are the 2 main methods used in order to analyze the financial markets and its different components. On one hand technical analysis analyzes price movements of a security and the statistical data collected out of this is used as a reference to predict future price movements. On the other hand Fundamental analysis looks at economic and financial factors that influence a business and it tries to determine a company’s value by looking at variables such the income statement, the balance sheet and cash flow statement. These 2 types of analysis can be valid for some forms of efficiency but can also not valid in others as it will be proven later. The efficient markets hypothesis (EMH) states that profiting from predicting price movements is very difficult and unlikely and the most important factor driving prices to change is arrival of a new information in the markets. A market is

therefore considered as “efficient” if prices adjust quickly to new information and in general without bias. As a result, the current prices of securities reflect all available information at any given point in time, consequently there is no reason to believe that prices are too high or too low since the security prices will adjust before an investor has time to trade on and profit from a new a piece of information. These Efficient market exist because of the an important competition among investors aiming to take advantage from any new information and the ability to identify over- and under- priced stocks gives an advantage and is crucial since it implies that investors are able to buy some stocks for less than their “true” value and sell others for more than they were worth making profits. Thus in the EMH, we have to trust the market prices, prices are available all the time and they reflect all available information to investors; there is a faire pricing implying no possibility of arbitrage and finally price is a normal rational variable but the chances in price price follow random walk and are not rational since when we have a new information, price will be affected but however the arrival of new information is not random and predictable.

1.1) The 3 Different Versions of Efficiency

As we stated prices are influenced by new information but there are different kinds of information that influence security values and we have a distinction among three versions of the Efficient Markets Hypothesis, depending on what is meant by the term “all available information”.

1.1.1)Weak Form Efficiency

The weak form of the efficient markets hypothesis asserts that the current price fully incorporates information contained in the past history of prices only. Thus, no one can identify a mis-priced securities and “beat” the market by analyzing past prices and so enjoying an arbitrage opportunity. We call it weak since security prices are the most public and easily available pieces of information so consequently, someone can’t technically take advantage of something that everybody have access to and knows. Rules or strategies that traders use to usually to buy/sell stocks are not valid in this case and past return on stock cannot affect and are independent from the future returns. On one side, specialists said that fundamental analysis can be used to identify undervalued and overvalued stocks which implies earning profits by researching financial statements. On the other side financial analysts try to take advantage of the market by using technical analysis which assumes that a security’s price already reflects all publicly-available information so they have to focus more on the statistical analysis of price movements.

1.1.2)Semi-strong Form Efficiency

The semi-strong-form of market efficiency hypothesis suggests that the current price fully incorporates all publicly available information. Public information includes past prices but also data reported in a company's financial statements (for example: annual reports, income statements ect…), earnings and dividend announcements, announced merger plans, the financial situation of company's competitors, expectations regarding macroeconomic factors (such as inflation, unemployment), etc… Information in any period only affects that periods abnormal return so the prices cannot reflect future information or past information.

In fact, its not a necessity that the public information is strictly from financial nature. For example, for the analysis of pharmaceutical companies, the relevant public information may include the current (published) state of research in a drug to cure cancer. The implication here is also that one should not be able to realize profits by using something that "everybody else knows" since the information is public. Additionally, this semi- strong efficiency of markets requires the existence of market analysts who do not limit themselves to being financial economists able to analyze and understand financial information but who can also understand macroeconomists. 'Public' information here is relatively more complex to gather and costly to process. To analyze efficiently and accurately securities, there are some procedures that may be needed as stated in the paper by Fama such as "following wire reports, professional publications and databases, local papers, research journals etc" in order to gather all information."

We conclude that this is a more complex approach; prices reflect fully available information, we don't have any arbitrage possibility and market require specialist who also understand other than financial information. Thus, Information is costly and the newspaper's informations and companies publications are not enough for an efficient analysis since its required to also go trough precise procedures described above.

1.1.3)Strong Form Efficiency

The strong form of market efficiency hypothesis states that the current price fully incorporates all existing information, both public and private (that can be called insider information). The main difference between this strong form and the semi-strong efficiency is that in the former nobody should be able to directly generate profits even if trading on information not publicly known at the time. In fact, the strong form of EMH states that a company's management that can be considered as insiders won't be able to instantaneously gain from an insider information; for example by buying company's shares moments after they decided but didn't publicly announce their plan to proceed to a very profitable acquisition yet. In parallel, for example the members of the company's research department wont be able to take advantage from the information about a new important discovery only they completed very short time ago before any knew about it since no insider trading can be done. The 'strong form efficiency' hypothesis states technical and fundamental analysis are inefficient because all information in the market is already taken into account in a stock's price.

1.2) The CRITICS

Many economist Argue that this theory and its 3 different forms of efficiency doesn't hold and this is where behavioral finance starts playing an important role. There has always been a big controversy around this theory, we will examine briefly the critics in this part to go through behavioral finance factors and other factors more in depth in the second part.

First of all there is a lack of rationality in the financial market, a lot of investors are considered as irrational because they don't manage to manage their way of diversification to decrease risk and this causes them to invest with tax maximization making them pay a lot of taxes and commissions. The behavioral approach states that a big number of investors are irrational. In fact there are many factors that will be introduced in chapter 2 as Biases , heuristics ect.. causing effects such as overreaction, feedbacks ect.. However we will study thanks to the many behavioral finance factors why efficient market theories fails to explain many aspects of the market and also show how behavioral finance explains the volatility and anomalies in prices movements

As stated in the paper about the different efficiencies “The Efficient Markets Hypothesis, Jonathan Clarke, Tomas Jandik, Gershon Mandelker” “The rational for strong-form market efficiency is that the market anticipates, in an unbiased manner, future developments and therefore the stock price may have incorporated the information and evaluated in a much more objective and informative way than the insiders. Not surprisingly, though, empirical research in finance has found evidence that is inconsistent with the strong form of the EMH”.

Empirical evidence that stock prices do not reflect “E.g. According to Dreman, in a 1995 paper” low Price to Earning for stocks having greater returns. The founder himself of the Efficient Market Hypothesis, Eugene Fama found in one of his 1990’s study that many stocks didn’t follow a random walk model but that value stocks outperformed; was also found a ‘momentum effect’ meaning that stocks which performed well in the past continued in general to perform well in the future and to defend his theory Fama argued that the cheapest stocks had a greater risk which influenced the outcome. Nevertheless Joseph Stiglitz published a proof entitled “On the Impossibility of Informationally Efficient Markets” that he wrote with Sanford J. Grossman in “The American Economic Review Vol. 70, No. 3 (Jun., 1980), pp. 393-408” where he stated that if the efficient market hypothesis was totally accurate it would be logically useless to spend money on research, however it is a fact that people clearly do spend money on research especially nowadays.

Which elements can cause a high volatility of the financial prices and corporate investment? what factors can lead to poor decisions?

2)Volatility of financial prices and corporate investments: how behavioral finance factors and animal spirits have a role in explaining them

2.1) Stock market fluctuation and lack of judgment

As explained in the Book of the 2 famous economists Georges Akerloff and Robert Shiller "Animal Spirits", Since the crises of 29 the markets in the US have never been as volatile as now, leading to financial breakdowns and financial Booms. In real value, the market rose between 1920-29, then dropped between 29 and 32. In parallel real value of the stock market doubled between the period of 54-73, however the markets came all the way back down losing half of their value in 73-74 to then rose almost eighfold between 82 and 2000 and finally loose half of their value between 2000-2008. The problem is that even after these events happened, no one managed to give a concrete explanation of why these fluctuations happened, it is possible to give examples that justify the stock market change of some individual firms at the idiosyncratic levels but no one did give solid examples for the whole aggregate stock market. Aggregate stock price movements were the subject of many researches trying to explain them in terms of **economic fundamentals** (Investopedia definition: the fundamentals include the qualitative and quantitative information that contributes to the economic well-being and the subsequent financial valuation of a company, security or currency) without much success. Economist, as underlined in the book of Akerlof and Shiller didn't find explanation for these volatiles in terms of interest rates, dividends, earnings. Stock fluctuated a lot during the last 100 years but the fundamentals stayed the stable. Price changes can be correlated to social changes of different kinds and this is where the efficient market theory starts to be seriously questioned. These social changes can be the missing piece of the puzzle to understand these unexplained fluctuation and they start with **Public thinking** as illustrated in the book "Animal spirits" that can be very important and be as important as specialist's opinions. An example that illustrate perfectly this idea of why volatility of prices is incredibly high is illustrated by one of the most famous economist, John Mayard Keynes in his Famous 'Beauty contest' where he argues that we are driven by our 'animal spirits' so we forget to base our expectations on fundamentals.

The Keynesian beauty contest, taken from his book 'The General Theory of Employment, Interest and Money (1936)' shows that a big part of investment is driven by the expectations based on what the investors thinks personally and what he expects the others to think, rather than having expectations about the fundamental values like the profitability of a particular investment. John Maynard Keynes showed in this example that investment is volatile because it is determined by the "animal spirits" of investors. Keynes stated that the different investment strategies can be compared to a contest that was published in a London newspaper of his days: In fact, there were

featured pictures of a hundred of young women. The winner of the contest was the reader who submitted a list of the top five women that matched the closer the catalogue of all other contest choices. Here non efficient strategy for a new participant would be to choose the pictures based on his own personal opinion and therefore establish rankings; Instead each contest entrant would have to base his choices by trying to guess what other entrants reactions and choice, also as stated "the more advanced entrants would try to second guess the other entrants second guessing" and so on. At the end they are not judging the beauty of people, here compared to an alternative investments but each potential entrant also said investor doesn't really consider fundamental value (for example the expected profitability based on expected revenues and costs), instead they try to anticipate and predict the direction in which the market is going to move. The outcome is investment becomes very volatile since fundamental value becomes useless since it is not even considered by the investor (participant) and secondly most efficient investors are either lucky or very good at at understanding the psychology of the games and this makes them "strategic game players". "Animal spirits" are now known as "irrational exuberance" this beauty contest model is an explanation for phenomena such as stock market bubbles; investing in stocks is exactly as illustrated in this example because an investor will not make the most efficient decision by choosing the company that is the most probably going to perform very strongly in the long run but the most efficient would be to resonate by picking the company that will have the biggest returns and value in the smallest amount of time.

2.2) Different Feedbacks and How behavioral factors can amplify them

We will first talk define the feedbacks that exists in the market and then show how social behavior like animal spirits take part of them.

2.2.1)Defining the Different types of Feedback:

A phenomenon of **Price to price feedback** can be observed on the market; people buy in reaction to stock price increase and sell in reaction to stock price decrease and these reaction may feed back into more price changes tending in the same direction. This creates a vicious circle that can turn into a bubble that has to explode since prices cannot keep on increasing forever, however this type of feedback isn't big enough to create major asset bubbles, there are in fact other types of feedback that can amplify the effect of this one like for example the feedback that exist between asset price in the bubble and the real economy that increases the effect and the length of the cycle .

We find at least **3 different feedbacks** that Akerloff and Shriller bring up in their book and these feedbacks come from asset market to the real economy :
When we have prices of stock and housing sector increasing, people feel safer and save less. In fact they feel wealthier and this makes them spend more; they consider these two effects as stock gain and housing appreciation as part of their savings, this effect of asset prices on consumption is called **Wealth effect on consumption** . Asset prices is clearly essential in determining investment, for example as Akerlof and Shriller show in an example, if the shares of a company

drop it will automatically decrease its expenditures on new plant and equipment and if market for family home drops in value, consequently construction companies will build less homes since its less profitable for them because of lower demand. When asset value falls, debtor won't be able to pay their debts and this directly have consequences on the numerous financial institutions that, being the main sources of financing, will be less willing to make loans either because after what happened they went bankrupt and don't have any more trust in the customer (as we saw during the Subprime crisis) or because after loosing a lot of value they struggle to raise funds; all of these factors can feed back in further drop of the asset/stock prices. As proved in the example before, variables in the market are all interconnected and interdependent and this implies that if one falls, a domino effect can be detonated and can affect all the others agents; this is why its important to pay attention to the initial point, here being the initial reaction to a certain event.
In the same context, Asset prices fluctuations can influence the public confidence, when stock price increase, the feedback rise the confidence because it encourages people to buy more, corporate profits increase driving stock prices up; however this phase is more orientated on the short run; on the **downward feedback** the economy goes in the opposite direction and the previously stated variables decrease all together. Thus, reactions of the households and the agents in general toward an event (idiosyncratic or systematic) can determine what direction a company or the economy will be taking in the future since as we saw if there is less confidence they will spend less and this will affect company's earnings,stock prices, investors and the economy as a whole.
Nevertheless this feedback is amplified by other feedbacks called "**leverage feedback and cycle feedback"**. We first give the definition that Akerlof and Shriller wrote about the **The collateral ratio** in order to go through these feedbacks **:** "It is the amount lenders lend to investors as a percentage value of the asset posted as a collateral" and it has an important role there. When we have an upward trend boom of the economy, considering the housing market, it implies a leverage increase since what the banks are willing to lend more to home buyers as a fraction of the value of their home rises and this rise will 'feed back' into the asset price; the same happens in the opposite case scenario causing the asset price to decrease. These feedbacks follow the logic of the previously defined wealth effect on consumption effect because if investors and households see their asset prices increase they will go borrow even more increasing leverage for themselves to exploit investment opportunities or even to increase personal consumption.
Leverage cycle feedback happens following the new regulations of the banks minimum capital requirement in order to avoid banks using excess of leverage. As asset price rises, leveraged financial institutions have the right to increase their capital and debts compared to the regulatory requirements, this pushes them to buy more asset which can bid up the price freeing even more capital and creating a sort of pattern. This upward trend starts to pushing prices higher and higher; however in the opposite price decrease so they may have to sell to meet their Capital requirements and the effect is lower asset prices causing further downward feedbacks in prices.
Nowadays to counter effect this, a new set of banking regulations was created; Basel 1 in 1988 and Basel 2,. they were created by the Basel Committee on Bank Supervision whose role is to regulate finance and banking at an international level.

2.2.2)Animal Spirits and their role in the feedbacks, example:

Definition of Animal Spirits taken from Investiopedia: "it is a term used by John Maynard Keynes to explain why decisions are made even in times of uncertainty. In Keynes's 1936 publication, 'The General Theory of Employment, Interest and Money', the term "animal spirits"

is used to describe human emotion that drives consumer confidence.”We will illustrate these factors with an example taken from the book ‘Animal spirits’ from Akerlof and Shriller to show how these feedbacks work in real life. We want to show that they are a consequence of the animal spirits and the social factors influencing us and how they have an important role in affecting the companies health. This example compares the history of Toyota motor Company founded in 1933 in japan and industries Kaiser Argentina S.A founded in 1955 in Argentina. They both have very different stories but the 2 stories show us how animal spirits can enter in the feedback mechanism and go in favor or against the company. Toyota had a market capitalization of 157 billion $ and was ranked as the 8th largest company whereas IKA, after many years of failure ended up being sold to french auto maker Renault.

Lets now have a look at the 2 histories of these companies.

On one side, Toyota was initially founded by a family that was in the business of operating mechanical looms, this family had very strong preexisting bases, such as a lot of confidence and discipline. Nevertheless, in Europe and in the US car production was not a new thing, it was a booming sector whereas japan had a lack of industry to support the car manufacturing, for example there was no producers of stamping machines to stamp sheet metals. This made it more difficult at the start for Toyota since all of this had to be developed with time, from the beginning Toyota didn't have the technology and material to start well; they just had confidence,discipline and ambition to start this automobile business since all the other factors were playing against the company. However, Toyota became a leader in this sector successfully completing this challenge, it made the whole nation proud and installed a lot of optimism and patriotism. This national overconfidence existed in the culture from a long time, it was spread and reinforced by one of the founder of the modern japan Yukichi Fukaza who mainly encouraged to imitate the technology of foreigners saying that there is no shame in imitating a project of a technology that revealed to be successful. It was a smart strategy because the amount of time and money required to be spent on inventing and building new technologies is huge and by this time the foreigner would have become much more advanced.

On the other side IKA was an argentinian automobile producers founded in 1955 mainly thanks to the government assistance, there was no specific general philosophy that can compared to the one in japan, there was no reign of confidence, not much discipline and low ambition. In IKA, the managers were not argentinian, they were brought directly from the USA. This company was protected from taxes for 10 years because the argentinian government wanted to launch the automobile industry but without really installing the proper mentality to do it. The company as expected was doing very bad, there was a lack of confidence of the employees toward the administration and it was justified because IKA’s managers started firing employees as soon as the company had small problems and these whole processes started raising the question of fairness added to the other issues in this company. There were many violent strikes to the point that the army had to be brought to calm down the situation; investors being scared were not enthusiastic in adding any funds since the value of the company was being affected and all the factors including psychological ones as fairness and confidence were showing very bad signs. The workers didn't even have the right to form syndicates in order to do their claims and they all had limited time contracts. Therefore, this affected the stock price so the company was mainly relying on the government subsidiaries and had to keep on firing employees decorating the whole workforce.

Toyota also had subsidiaries and tax preferences but the different outcome was cause by was the general values that were reigning in this company such as self esteem, confidence, ambition and optimist. This company also had very big ambitions to be part of the future progress of the whole

country as a whole, exactly like samsung right now in South Korea that weights 17% of the National GDP. The labour unions barely existed and they didn't do strikes or even didn't have any conflicts with the management. In Argentina the strikes are in the tradition since the railroad strikes of 1910 that ended up in military encampment, labor management conflicts were prominent even in the national politics.

2.2.3)Interpretation of the differences between these 2 companies and why do they exist ?

In Japan the workers though about themselves as being part of the organization and the company as a whole part of the success, not thinking about every action in term of fairness but in term of success. Nissan who is a Japanese multinational automobile manufacturer installed this same confidence and discipline with their workers and this company became also one of the most important automobile producers in the world.
In conclusion we saw how the existence of a certain philosophy represented by behavioral factors such as confidence fairness ect.. differed according to the national cultures and how it affected in different ways the 2 companies IKA and Toyota. These factors are very likely to differ a lot through time, cultures, countries and they can affect many elements that are part of the health of the company such as the profitability that directly affects the stock price of the company. This represents a system of feedback from "**price to animal spirits (**behavioral factors) **to price"** which can be explained more simply as the following: We have a given stock price; after consider the role of factors such as fairness and confidence inside a country for a specific company; depending on the culture, it may feed back positively as in the Toyota case or negatively as in the IKA case. When you have a company encouraging the labour force, including their workers in the success of the company as Nissan did by creating Labour union and offering contracts for life; this gives a big confidence and optimism that will affect workers productivity, the company's earnings and the general success. Nowadays everything have changed and can also change in the future since these feedbacks does not limit to the present, they continue over time. A lot of economist found this concept of feedback as contradictory with the concept of rationality of the hunan and theres specifically one point : You cannot measure psychology, there is no real measure of it but it doesn't change the fact that Toyota is still one of the most important auto makers in the world and IKA stopped producing cars in 1985.

2.3)What causes the real estates to be so volatile ? what causes them to go through cycles ?

One very important example to illustrate the importance of behavioral factors and their impact on the economy is the fluctuations in the real estate sector bubbles. The real estate sectors is one of the most important and the most subject to fluctuations. We will show how fluctuations that led to bubbles especially in the early twenty first century are driven by the animal spirits and behavioral factors defined before and how most of them play a central role in the market and in the economy as a whole. During the late 90's, early 2000's real estate was one of the most attractive investments in parallel to the stocks, prices kept on increasing, excitements and enthusiasm of people followed and this is how animal spirits amplified the fluctuations in the real estate sector. There was an enormous growth in the United States, home prices almost doubled between the starting point in the late 90's and before the starting point of the crisis in 2006. This growth

affected the markets at an international level until the bubble exploded during the notorious subprime crisis in 2008.

2.3.1)How did we arrive to this point, what traits of people's behaviour are considered as driving factors?

As shown in the Book by Akerloff and Shriller, a good starting point we can take during this period of important growth of the real estate markets is the book 'How a second home can be your best investment' by Tommy kelly and John Tucciland that was published strategically during the period of fastest growth of the US real estate market. The authors were targeting the Average american, so it was more the quantity than quality of people (at the level of the wealth) and they tried to prove how real estate is the 'best investment' you can make and how owning more than 1 home is beneficial for you now and in the long term even if you have to increase your borrowing more.
Real estate investment were idealized as 'The' instrument to make money, without mentioning the risk of possible downturn that can be even worse especially if there is a lot of leverage used and it was the case of a lot of the american since the same house they bough was put as a collateral. There was no bad case scenario predicted, how did all of this happen?
Before even reading the book mentioned before, investors already had this confidence and belief that homes were the best risk-less investment for their future. Rationality of investors was questioned and it starts with their naive beliefs that is the utopia that prices are always going to rise. This kind of euphoria they had was driven by this reasoning: If there is growth of population and economic growth, demand is driven up and following this logic it should push real estate prices upwardly indefinitely and to satisfy this demand you either have to build more homes or build higher. This way of thinking of course proved to be wrong since prices did in fact drop later.
Wrong beliefs play a big role in this, when false stories are spread to the majority or participants and everyone starts spreading them because the others also believe them, the outcome is having a general wrong belief also feeding back in the boom, making it stronger than what it 'should be'. Statements such as when population increases, prices of real estates are destined to always follow as it happened for example during 1952 (in a context of baby boom right after the WW2) have a part of reality but however only appear during the limited situations of Booms; outside this they are very unlikely to be brought out. Money illusion can be defined as (Investipedia) "an economic theory stating that many people have an illusory picture of their wealth and income based on nominal dollar terms, rather than real terms." The real prices and income have to take into account the level of inflation of the economy; money illusion has an important role because this is were the false belief of people starts, in fact a lot of people remember the price of the house they bough a long time ago and see how much its worth now with the inflation. If you just make a passive analysis, its a huge return so the price got multiplied by 10 for example and prices kept on increasing; people forget to verify this in real term or even to look at the CPI (consumer price index) for the food and goods that is adjusted for inflation. At the end if we look at the real value it may have just doubled and the corrected return will show a tiny annual return, the lack of expertise of agents make them believe that they accumulated extraordinary returns on their real estate investment. This all plays in inflating prices and contributing to the formation of the bubble since people don't realize this and keep on borrowing to buy/invest more.
In the same context , the confidence factor played a major role and the different types of feedbacks explained before (from the Book Animal Spirits) also apply in the real estate. Prices of homes increased faster and this increase lasted more time since the confidence of the buyers

increased, strengthened by their belief of always upward trend kept feeding more in the prices. After the 90's particularly, when markets were booming like never before, anyone who bough a house was fairly rewarded since prices rose, investors became very confident and formed a strong self esteem since they believed that they were smart investors and this was just the reward of their 'smart investment'.
However this boom was also caused by the government who encouraged this through the creation of institution such a Freddy Mac and Fanny Mae that made huge amount of loans to americans households; even to those coming from the lowest class so they had to use enormous leverage to be able afford those houses. Furthermore, the context played a lot since the US were going through political disruptions and black minorities needed to be treated more fairly, in fact Martin luther king, being the political leader of the black movements wrote in an editorial the article 'Minority housing gap, Fannie mae, Freddie mac fall short' in 1999 where he criticized these institutions for leaving minorities out of the boom, not allowing his and other communities to take advantage. Thus institutions profited from this context to lend to anyone without accurately verifying the solvability of the borrowers and the rating agencies and regulators were totally inefficient not really verifying for the fairness of operations. We can say that this feedback is determined by a correlation between institutional and behavioral factors; the consequences were inevitable since low price home rose faster than high price homes which means the medium-class american households home price rose much faster than rich american-class homes. However the opposite trend occurred 2006 when low price homes dropped much faster than high price homes causing millions of people to loose everything including their homes that were put as a collateral. As written in Animal Spirits in the chapter about 13 about the cycles in real estate, 'Residential investment rose from 4.2% of US GDP in the third quarter of 1997 to 6.3% in the fourth of 2005 and then it had fallen ti 3.3% by the second quarter of 2008' . After the period of euphoria of investors , the downward trend finally happened and investors realized that it was not a safe heaven anymore and that as any other investment it can drop and make you loose a lot of money. In conclusion we observed how much factors such as confidence, corruption and money illusion can affect the decisions of people that directly feedback in the price fluctuation.

2.4)The different Biases that can lead to poor decision making

A bias is a predisposition toward error and we will define and analyze 3 different example of biases and their consequences: Excessive optimism, overconfidence, survivorship bias and heuristics.

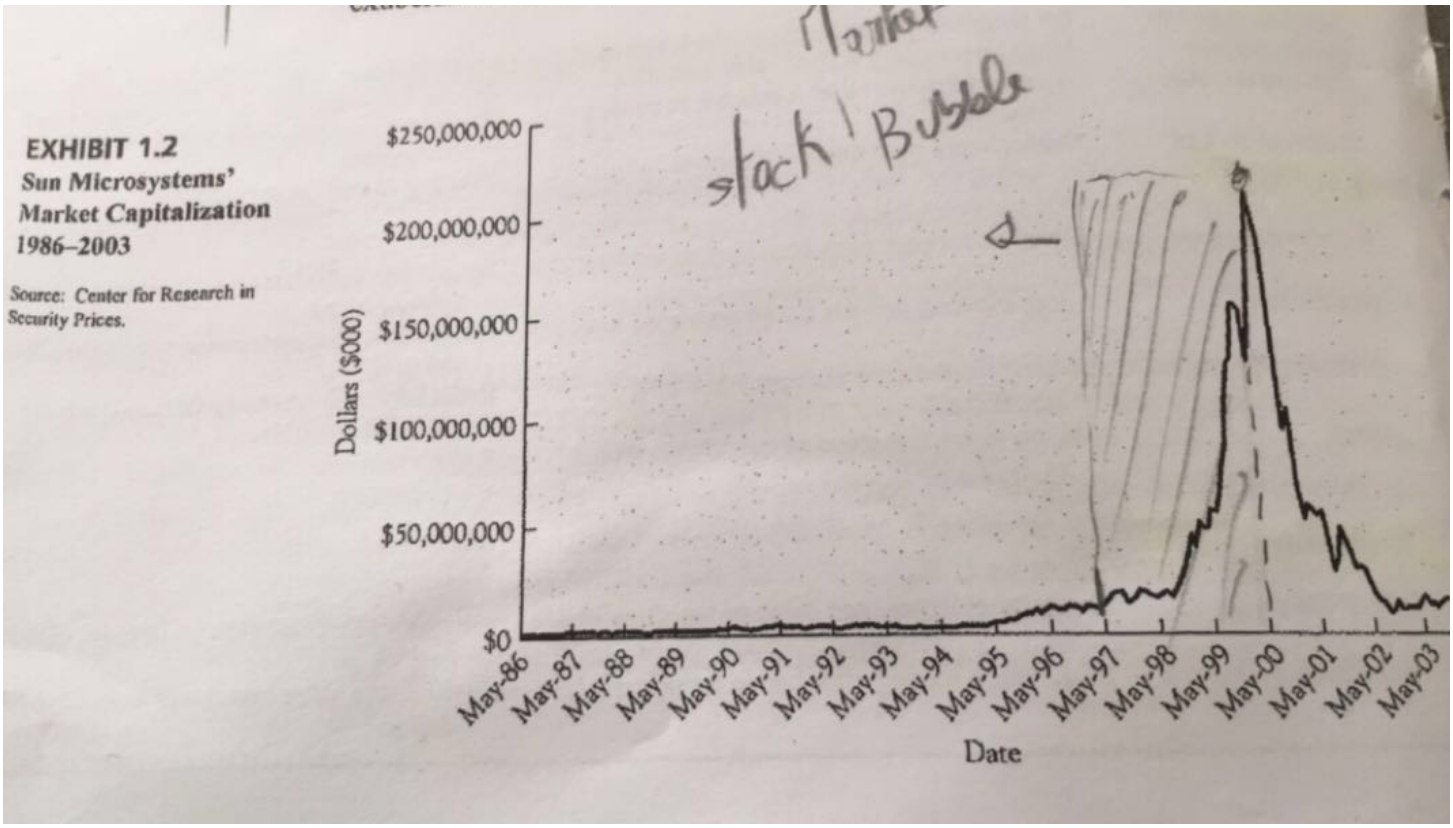
2.4.1)Excessive optimism

It is the first type of bias and we saw that this phenomenon touches especially the managers of companies who often overestimate how frequently they will obtain positive results and who also often underestimate how frequently they will face bad results.
In this Category we take the first example of excessive optimism taken from the book of Shefrin "Behavioral corporate finance" about Scott Mc Nealy who was the Chief executive officer of the high technology firm Sun Microsystems; he was described by 'The business Week' as 'Optimistic , smart , acerbic , cocky and combative.' He was known for taking strong decisions against the opinions of his entourage but that turned out to be very good calls: For example during the 80'S , against the advice of his advisers he decided to substitute the suns own microprocessor for those by mot oral and the decision turned out to be a very good one for the company. Few Years later, in the 90 the competitors produced servers that used Microsoft windows operating system but Mc Nealy decided instead to use his company's own software called solaris; this decision turned out to be a very good one since it increased the sales profits and cash holdings allowing the company to spend more on research and development.
Until then, all Scott's risky calls paid off positively causing naturally his self confidence and optimism to increase; however arrived the day where this trend got inverted; in fact in 2001 during the recession, all the wall streets analysts called for cost cuts but McNealy was optimistic that the recession would be short lived so instead he heavily invested in many projects justifying that there are many investing opportunities to be exploited while other companies where keeping low spendings. Even cisco, (that was the leader in producing routers products to be used on the internet) announced that the downturn lasted longer than expected and they consequently wanted to cut 18% of its workforce, many of the executives of Sun wanted to do the same . To cut cost, suns customers wanted low end servers so Sun acquired Cobalt that is a manufacturer of low cost servers but however after the acquisition sun chose to limit the budget of Cobalt and this was a mistake since the economic downturn lasted much longer than what Mc Nealy has expected and this caused sun to loose a third of its market shares, its sales fell by 48% and the stock price dropped from 64 dollars in 2000 to 4 dollars in 2004 .
In this case , Mc Nealy was so optimist that he kept on delaying the cost cutting measure always expecting that there bad times wouldn't last a long time, his prediction of the recession was over excessively optimistic . In fact the over optimism caused the drop of his company value to be even worst than the economy in general since the slowdown turned out to be longer for the companies that got engaged in business investment like the firms that purchased Sun's servers. The investment fell for six quarters in a row and this was twice as long as the period real gross domestic product's fall.

Was Scott McNealy's prediction Biased ? in other words , might Scott M prediction about the recession of 2001 have been reasonable even though it was wrong after the fact ?

Between the 2 world war and 2000, average length of Us recession was 11.6 month . During those recession GDP tended to fall for 12 consecutive quarters of negative growth in real GDP. During the recession of 90-91 , Real domestic product fell for 12 month.
In conclusion we can see that recession have always been long and nothing proves the contrary . The most reasonable conclusion is that Mc Nealy's predictions was biased in the direction of optimism and that his "over" optimism pushed him to delay cost cutting, thereby destroying value of the Firm. Over optimism can be value destroying, especially when someone carries such important responsibilities; this over optimism can come with luck and as we saw with a succession of good decisions (that worked thanks to the competence and experience of the person) that paid off positively, until the day where came the poor decision that destroyed the value of a company.

Graph 1: Sun Microsystem's Market capitalisation



As we can observe in Graph 1 taken from the book of Shefrin "Behavioral corporate finance", during the bubble between may 97 and may 2000 , "irrational exuberance" (defined in investopedia as :unsustainable investor enthusiasm that drives asset prices up to levels that aren't supported by fundamental) drove up the prices of Both S&P 500 and Sun's stock. An investor who held Sun stocks during this period would have seen his her stock increase by more than fourteen times; no firm from the size of Sun has historically reached a price-to-earning ratio (P/E) over 100 but in march 2000 Sun's price to earning ratio even exceeded this 100 and 119; this

happened at the moment where the bubble was at its maximum value. This quick and rich rise of Sun stock price encouraged some of the excessive optimism behavior observed in the Sun's manager.

2.4.2)Overconfidence

First of all overconfidence is when people make mistakes more frequently than they believe and when they consider themselves as better than the average. Its a bias that shows how well a person knows her capabilities and knowledge since if they are overconfident about their abilities they will tend to think that they are better than what they are and if they are overconfident about their knowledge, they will think they know more than they really know. This doesn't mean that they are ignorant or incompetent but it means that they over value themselves compared to what they really know or do.
For Overconfidence in ability, back to the example of Scott Mc Nealey, Shefrin mentioned he was described by the newspaper "the business" week as "cooky and smart". Cockiness is a kind of overconfidence; overconfident people a have big chances of being smart, but they think they are more than they really are and this can come from a lot of successes they lived in the past, as in the case for Mc Nealy especially with the decision he took of building Sun's own softwares. Nevertheless overconfident manager, in general tend to make poor decisions about investment and mergers acquisitions especially if they work in a firm that is this rich in cash. Sun's acquisition of Cobalt and investments in research and development are examples that both caused a decrease in Sun's firm value; proof is that in 2004 analyst published very negative reports about Sun but McNealy responded by saying that it was almost impossible that the firm becomes in bad health given the fact that it held more than 5Billion in cash .
In the same context, for what regards overconfidence of knowledge, Scott Mc Nealy was overconfident about his knowledge on the Us business cycles; in fact he though that it wouldn't last much and that he would beat the market and the contradictory opinions again as he managed to do previously. Overconfidence and being over positivism can come along together and cause disastrous effects, destroying all the past success of a company as in this example.

2.4.3)Survivorship Bias

A definition taken from investopedia "Survivorship bias is the tendency for mutual funds with poor performance to be dropped by mutual fund companies, generally because of poor results or low asset accumulation. This phenomenon, which is widespread in the fund industry, results in an overestimation of the past returns of mutual funds." A way to check whether financial markets are efficient is to investigate whether mutual funds that implies checking if they yield positive risk-adjusted returns, have any tendency to replicate abnormal returns overtime. For this analysis we will have 2 types of analysis and use different tools: a **selectivity analysis** that is based on what we call **Jensen's alpha** and a **persistence analysis** about the mutual funds performances. Firstly, to understand the Survivorship Bias, we have to understand what is the Jensen's Alpha by firstly defining it.
Jensen talked about this alpha in his paper "The performance of mutual funds in the period 1945-1964" from "the journal of finance issue 2 volume 23"

The Jensen's alpha

The Jensen's alpha is a risk-adjusted measure of performance that evaluates how good is the fund manager in selecting assets (comes from here the term selectivity) possessing superior performance.
Jensen's alpha for a mutual fund **p** is the intercept $\boldsymbol{\alpha_p}$ in the linear regression of the fund excess return, $\tilde{\mathbf{r}}_{\mathbf{p,t}} - \mathbf{r}_{\mathbf{f,t}}$, over the market portfolio excess return, $\tilde{\mathbf{r}}_{\mathbf{m,t}} - \mathbf{r}_{\mathbf{f,t}}$,

$$\tilde{r}_{p,t} - r_{f,t} = \alpha_p + \beta_p(\tilde{r}_{m,t} - r_{f,t}) + \tilde{\varepsilon}_{p,t} \quad \textbf{(1)}$$

-**rp,t** is the return on the portfolio of risky asset and risk free asset with respect to asset t
-**rf,t** is the risk free rate of return with respect to Asset t
-**rm,t** is the market rate of return with respect to Asset t

This is the linear regression used to provide a definition the Jensen's alpha, its derived from the CAPM model that we will be explaining in the chapter 2. In this context we define the OLS estimate of the Jensen's alpha as equal to the following relation:

$$\hat{\alpha}_p = (\bar{r}_p - \bar{r}_f) - \hat{\beta}_p(\bar{r}_m - \bar{r}_f) \quad \textbf{(2)}$$

-$\boldsymbol{\hat{\alpha}_p}$ **is the Jensen's Alpha in the OLS estimate**

-$\boldsymbol{\hat{\beta}_p}$ the OLS estimate of the fund's beta being the difference between the mean excess return on the fund, $\bar{r}_p - \bar{r}_f$ and the estimated fund's beta times the mean excess return on the market portfolio, $\hat{\beta}_p(\bar{r}_m - \bar{r}_f)$. The **fund beta** measures the amount of systematic risk (risk inherent to the whole market or a whole segment of it) corresponding to the fund portfolio.
Thus, the Jensen's alpha, $\hat{\alpha}p$, indicates that we find fund returns on average are larger (smaller) than the equilibrium value consistent with its amount of systematic risk; in other words the fund is located above (below) the security market line that indicates the relationship between the expected return and the Beta. Later, in his research in 1968, Jensen estimates the alphas for a sample of 115 mutual funds with data between 1945-1964 and the S&P500 index is used as a proxy for the market portfolio. The outcome of the experiment is interesting since he finds 72 funds with a negative alpha; 43 with a positive alpha and only 3 funds that possess a statistically significant positive alpha meaning that they beat the market. Thus, the conclusion searching public and private information does not allow you to realize any abnormal returns, but it just allows to cover its costs.

Persistence analysis

Persistence analysis is used to to show if a fund yields above or below a certain market benchmark for at least 2 consecutive periods, positive performance means here that the fund we are looking at have a tendency to beat the markets indexes realizing a very good performance. We

are using this analysis here to answer to the question: Are good performances realized thanks to real skills of the manager of a company or is it just due to his luck?
As the number of funds increases in the markets, the chances of having positive persistence (beating the benchmark) for the best increases a lot; this was proved since in the study as the number of firms increased, the probability that the best fund, pbest, beats the bench-mark in 13 out of 15 periods is ⋆ 43% if n=50 and 99.6% if n = 500.
However the critic here to Jensen's study is the previously defined survivorship bias.

2.4.4)Heuristics: Representativeness leading to Biases

Heuristics is a rule that is used to make a decision; we use past decision to make quick decisions. Heuristics can lead to biases known as representativeness, availability, anchoring and adjustment. The representativeness heuristic leads to excessively extreme predictions, or overreaction. First of all representativeness is making our judgments on a certain subject based on using stereotypes; we make decisions based on past similar observations and this will be the guideline of our decision making process for the future. Its based on the similarity of an object /person to an existing persona. Moreover, as stated previously, representativeness can lead to the overreaction factor, the overreaction factor has always been very important in explaining the price volatility. Representativeness heuristic can lead the investors to make poor decisions that can cause prices to fluctuate and disappoint their expectations. In the same logic, many investors follow a financial strategy based for example on an old financial strategy that already proved to be successful, profitable and that aimed the same kind of investment or financial products that they want to invest in. Investors prefer in this case to buy a stock that had abnormal high returns in the recent period or use in an inaccurate way the company's good characteristics such as high quality goods as an indicator of good investment. A lot of analyst for example will base their projection of future prices based on data that represents for example the history of the most recent past earnings as a references for them.
However, this method is not a good one, it will inflate or deflate the price of the stock making it overpriced (underpriced), investors don't consider that this sample of recent high return may be due to luck and have big chances of not repeating itself; in fact this period of high earning is unlikely to repeat itself and the consequences of this disappointment can cause the trend to reverse. When future forecasts are not met, the previous increase will be counter balanced by the very likely big drop and it will cause very high volatility in prices that can be intensified by over/ undereaction factors as it was underlyed in the paper of De BONDT, Werner F. M., and Richard THALER, 1985 "Does the stock market overreact? The Journal of Finance, 40(3), 793–805."
This overreaction can be as likely as undereaction.

II)Chapter II: Testing the significance of behavioural factors on important stocks following events

In this chapter II we would like to test weather stock prices respond to behavioral factors and in particular to fear. In part 1 We will first define the different model and variable that we will be using and in the second chapter we will explain in details the procedures and analyze the results.

Chapter 2 Section 1: The different models and variables

3.1)The CAPM

The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) points the creation of the asset pricing theory that earned a Nobel Prize for William Sharpe in 1990; Even now, the CAPM is still used in different applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios

This Model is crucial because it offers a relationship between return and risk. One important paper that gives a good explanation of the mechanism of the CAPM is the one written by Eugene F. Fama and Kenneth R. French "The Capital Asset Pricing Model: Theory and Evidence"

First draft: August 2003 This draft: January 2004. We will be using some informations extracted from this paper in this part about the CAPM.

3.1.1)How the CAPM works:

The CAPM builds on the model of portfolio choice developed by Harry Markowitz (1959). In this model we have an investor who wants to select a portfolio in date T-1 and get his return in the next period T.

For this we have: Risk averse investor and they only care about means and variance of the portfolio that represents respectively return and risk measures. The outcome is that they choose mean variance efficient portfolios meaning minimum variance of portfolio return given the expected return and maximum return given variance because we seek for less risk and more return. This is a mean variance model as stated regulated by a condition regarding variance and return; the CAPM transforms it into a perdition about the relation between risk and return by spotting the efficient portfolio if the market is composed by all clear asserts.

3.1.2)Deriving the CAPM:

1-We have 2 dates T-1 and T

2-Risk free asset paying rf

3-All investors agree on the distribution of the asset returns

4-All investors hold efficient portfolios

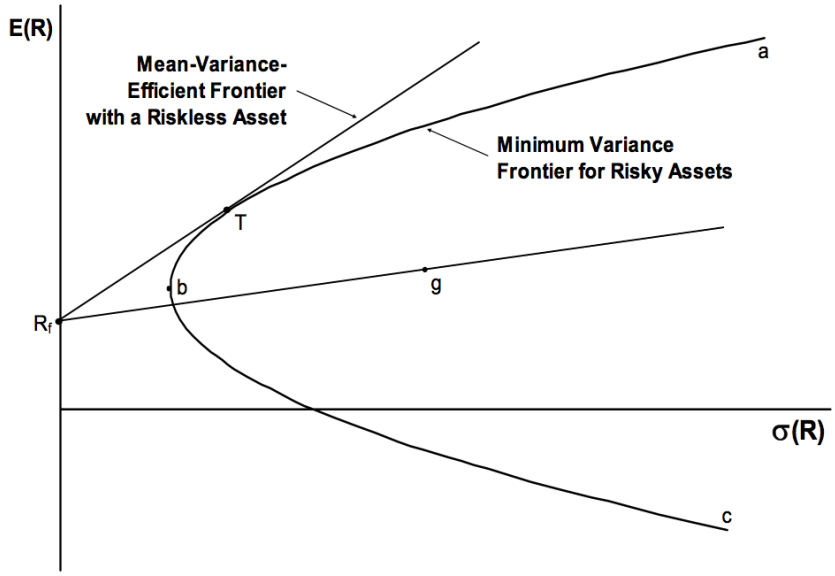
5-Demand=supply of assets in equilibrium

These assumptions imply that : Every investors invests his funds in 2 kind of assets, the risk free one paying return rf and the single portfolio of risky asset also called the tangent portfolio. This is the **2 fund separation property(by Tobin in 1958)**; in fact all investors hold the risky assets in the same proportion since they hold the most efficient portfolio being the tangent risky asset portfolio also called the Market portfolio.

3.1.3)Graph representing the CAPM taken from the Journal of Economic Perspectives Volume 18, Number 3—Summer 2004—Pages 25–46

The Capital Asset Pricing Model: Theory and Evidence by Eugene F. Fama and Kenneth R. French

Figure 1 -- Investment Opportunities



The horizontal axis is portfolio risk, measured by the standard deviation of portfolio return; the vertical axis shows expected return represented by the mean. To get the mean-variance-efficient portfolios available with risk free borrowing or lending, we get the line starting from R_f in Figure 1 up and to the left the further possible to the tangency portfolio here T. Thus we observe that all efficient portfolios are the combinations of the riskfree asset and a single risky tangency portfolio, T.' This result is the **Tobin's (1958) "separation theorem."** Following the assumptions of the CAPM, investors got the same opportunities and they consequently combine same risk free lending (or borrowing) with the risky tangent portfolio T. The risky portfolio T held by all the investor must be 'value-weight market portfolio of risky assets'; since we have risk free lending (or borrowing) and we have the risky tangent porfotlio (also market portoflio); investors get to choose how much to invest in each and this gives weights of wealth whose sum must be equal to 1 (if there is no short selling). Each risky asset's weight has to be equal the total market value of the outstanding units of the asset that we divide by the total market value of all risky assets. Additionally, the risk free rate must be set in parallel with prices of risky assets to clear the market for risk free borrowing and lending. Thus, the CAPM assumptions imply that the market portfolio M must be on the minimum variance frontier if the asset market is to clear.

We get at the end the following relations:

$-R_p = wR_f + (1-w)R_g$ Rp=Return on the Portfolio, Rf=Risk free rate, Rg=Risky Asset Return **(3)**

$-E(R_p) = wR_f + (1-w)E(R_g)$ w= Weight of wealth invested in Risk free Asset **(4)**

$-\sigma(R_p) = (1-w)\,\sigma(R_g)$, $w \leq 1.0$ σ(Rp)= Standard deviation representing the risk on the Return of the Portfolio **(5)**

This holds for any minimum variance portfolio must hold for the market portfolio. Specifically, if there are N risky assets. All the investors will hold the same risky-asset portfolio, the tangent risky asset portfolio.

As we said it before the efficient portfolio is an efficient frontier porfotlio (as we can see on the graph) it consists of : -the market portfolio and - risk free asset being on the return axis since there is no risk holding it meaning 0 Standard deviation. We define 2 different types of risk in this model;on one hand the **systemic risk** of assets that is defined by the covariance with respect to the market

$\sigma_{i,m} = Cov[\tilde{r}_i, \tilde{r}_m]$

Systemic risk correlated to any asset means the risk of the whole market cannot be diversified away because it affects the whole market and not a single stock, it needs to be rewarded by a premium. On the other hand the part of an asset's risk that isn't correlated to the market porfotlio but rather is proper to the stock called **idiosyncratic risk (non systematic)** and it can be diversified away by holding a frontier portfolio.

3.1.4)The Beta

As stated before systematic risk must be awarded by a premium, therefore the expected return on any asset i is the risk free rate plus a risk premium rewarding the part of the asset correlated to the market portfolio.

$E[\tilde{r}_i] = r_f + \pi$ **(6)**

This risk premium reward is composed by the risk premium for each unit of systematic risk
$E[\tilde{r}m] - rf$
multiplied by the Beta that is here a measure of the amount of systematic risk for the asset i, called Bi (Beta of asset i) because each beta is proper to each asset; therefore we obtain:

$E[\tilde{r}_i]=r_f +\beta_i(E[\tilde{r}_m]-r_f])$ **(7)**

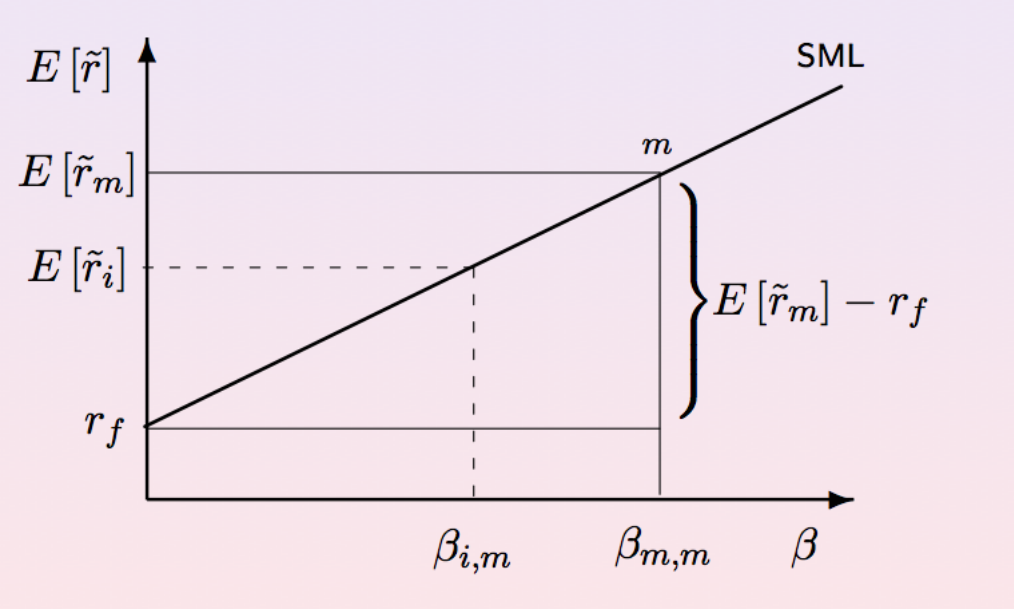
This beta itself is obtained by dividing the covariance on the asset i with the market return by the variance of the market return

$\beta_{i,m} = {}^{\sigma_{i,m}/}\sigma_m^2$ **(8)**

Finally with the following equation we get the CAPM that determines the expected return on any asset i with 3 components being the premium on the market portfolio,the risk free rate rf and the asset market Betas Bi,m

$E[\tilde{r}_i]=r_f +\beta_{i,m}(E[\tilde{r}_m]-r_f]$ **(9)**

The Security Market Line



The relationship between an assets expected return and the market Beta corresponding to this asset is called the Security Market line

3.1.5) One Critic of the CAPM

Roll's Critique

Richard roll was an important economist very known for his portfolio theory:
The CAPM states that "the market portfolio is efficient". Since the portfolio is efficient, there is an actual linear relation between the expected return of any asset and its corresponding beta since Beta is the measure of the amount of systematic risk by which you multiply the premium
E[˜rm] – rf

Testing the CAPM involves measuring market portfolio, asset returns and asset betas.
According to the study made by Roll(1977), the CAPM isn't testable. CAPM in its general description, is based on market portfolio, however perfectly accurate market portfolio is possible in theory but it showed to be unobservable. Thus, we can't run a test verifying the relation between beta and expected return, market portfolio is not observable so the empirical studies base themselves on market proxies that are represented by market indexes that we consider as a representative figure for the analysis.
Tests of the CAPM test for the existence of a linear relation between the expected returns of individual assets and their betas with respect to the chosen market proxy. They check whether the chosen market proxy and not the actual market efficient portfolio is efficient. However the market portfolio and the market proxy generally don't coincide at the statistical level so tests of the CAPM can lead to two different statistical errors. The first one Type I Error occurs when the test rejects the CAPM even though it is valid; thus the market portfolio is efficient, while the market proxy is not. Secondly we have the Type II Error that occurs when the test accepts the CAPM when it is not valid; thus the market portfolio is not efficient but the market proxy is.

3.2) Empirical evaluation of the CAPM:

3.2.1)Fama French 3 factors model: Definition and implications:

In this part about the Fama french 3 factors model we used the paper of Eugene F. Fama and Kenneth R. French " A Five-Factor Asset Pricing Model, september 2014".

Fama and French were professors at the University of Chicago Booth School of Business

Definition of the Fama French 3 factors model taken from investopedia: "The Fama French Three Factor Model is an asset pricing model representing an expansion of the capital asset pricing model (CAPM) where Fama and French added size and value factors additionally to the existing market risk factor that you find in the CAPM model".
In this model the assumption is that small-cap stocks outperform markets on a daily basis so when we the two additional factors HML SMB that are size and value premiums, the model adjust for this previously stated outperformance; this gives a more accurate model in order to evaluate the performance of managers.

Implications
Factors other than beta seem important in pricing assets.Since mid 1960s small stocks have outperformed large stocks. Fama and French's evidence suggests that several sources of risk, rather a single source as in the CAPM, determine systematic risk. In this multi-factor model, the original index model inspired by the CAPM is extended by linking the return on asset i, $\tilde{}$ri, to the return on a market index, $\tilde{}$rm, the book-to-market premium, $\tilde{}$rHML, $\star$ and the size premium, $\tilde{}$rSMB
Moreover, in their paper "The Capital Asset Pricing Model: Theory and Evidence 2004, Journal of Economic Perspectives vol. 18, no. 3, Summer 2004" Eugene F. Fama Kenneth R. French stated that **"**though size and book-to-market equity are not themselves state variables, the higher average returns on small stocks and high book-to-market stocks reflect unidentified state variables that produce undiversifiable risks (covariances) in returns that are not captured by the market return and are priced separately from market betas. In support of this claim, they show that the returns on the stocks of small firms covary more with one another than with returns on the stocks of large firms, and returns on high book-to-market (value) stocks covary more with one another than with returns on low book-to-market (growth) stocks. Fama and French (1995) show that there are similar size and book-to-market patterns in the covariation of fundamentals like earnings and sales.**"**

Based on these evidences, they proposed the three-factor model for expected returns that is derived or even can be counted as a continuation of the CAPM.

3.2.2)Formula and its components

(Three-FactorModel) $E(R_{it})-R_{ft}=\beta_{iM}[E(R_{Mt})-R_{ft}]+\beta_{is}E(SMB_t)+\beta_{ih}E(HML_t)$ **(a) (10)**

˜ri−rf=α+βi,m(˜rm−rf)+β˜i,HML˜rHML +β˜i,SMB˜rSMB +ε˜ **(b) (11)**

We describe the second formula (describing the model with actual returns instead of expected returns):

˜rHML measures the difference in the expected returns between firms with high versus low book-to-market ratios,˜rSMB measures the difference in the returns between small and large firms. Finally the betas are slopes in the multiple regression of r_{it} - r_f on r_M - r_f, SMB_t, and HML_t; εit is the error term.
One implication of the expected return equation of the three-factor model is that the **intercept α_i in the "time series regression" in equation 12**

$$Rit - Rft = \alpha i + \beta iM\,(RMt - Rft) + \beta isSMBt + \beta ihHMLt + \varepsilon it \quad \textbf{(12)}$$

is zero for all assets i. Based on this idea Fama and French find that the model captures a big part of the variation in average returns for portfolios formed on the different sizes and value premiums and other price ratios that made trouble for the CAPM. As we will show it later in the regression, it is proved that this model's version gives a more accurate results than a general CAPM version; in fact they found this in their previously stated paper by running test and observing the "average returns on portfolios formed on scaled price variables for stocks in 13 major markets."

The αi estimation coming from the time-series regression show how significantly stock prices will respond as soon as a new information emerges. The Arbitrage pricing theory comes along as a classic with the Fama fresh 3 factors model as an alternative model explain better relationship between returns and risk.

3.2.3)Arbitrage Pricing Theory - APT

Investopedia defintion: "Arbitrage pricing theory is an asset pricing model based on the idea that an asset's returns can be predicted using the relationship between that asset and many common risk factors. Created in 1976 by Stephen Ross, this theory predicts a relationship between the returns of a portfolio and the returns of a single asset through a linear combination of many independent macroeconomic variables."

Market in the perfect competition by theory have no arbitrage opportunity meaning that there can be no extra profit made by selling shares due to mis-pricing, you sell a share at the price you paid it; however this assumption is not very realistic and the APT states: An arbitrage opportunity exists in financial markets if two or more securities are mis-priced so that arbitragers can achieve risk-free profits, this arbitrage opportunity exist if a portfolio of securities can be purchased in a way that it is either costless yielding positive cash flows in the future or if it has a negative cost and yields zero cash flows in the future.

We suppose portfolio's beta is zero we have the following relation $(\beta p,m = 0)\tilde{}\ rp - rf = \alpha p$ (Equation 3.1 B 4) and so the return on the portfolio p is a constant value, $rf + \alpha p$ (Equation 13).
If **αp** is different from 0, an arbitrage opportunity emerges because there is no more equilibrium condition. Thus, for **αp > 0** to gain a certain profit that is, as we can see it proportional to αp, we need to borrow at the risk-free rate rf (or equivalently to short-sell the risk-free asset) and invest these borrowed funds in portfolio p. This can allow for **example** if we follow the first strategy (meaning a portfolio is costless and yields positive profits) to Short sell 100$ of a security yelling a 5% return meaning we borrow for 0 cost in Time 0 and we invest this amount in a security yielding 8% also in time 0. At time 1 we get 108 from the security we invested in and pay back 105 that is the cost of the short-selled security and end up having a profit of 3$ (108-105=3)

The Arbitrage Pricing Theory assumes that the return on any asset follows the index model that is a linear relation, since its corresponding coefficients are estimated using a market index as a proxy for the market portfolio.
The index model envisages that the systematic risk associated with any asset is function only of one source of risk, the re- turn on the market index.

$$\tilde{r} - r = \alpha + \beta\,(\tilde{r} - r) + \tilde{\varepsilon}$$

(14)

This model also applies to well-diversified portfolios, here, a well-diversified portfolio, p, is a highly diversified portfolio such that all diversifiable risk is eliminated and the error term vanishes,

$$\tilde{r}p - rf = \alpha p + \beta p,m(\tilde{r}m - rf)$$

(15)

As we can see here the error term $\tilde{\varepsilon}$ disappears after diversification (unsystematic risk)

3.3)The VIX "Fear Index"

Intro: During the 2007-2009 crisis, terrible consequences affected all the sectors of the economy of the US aiming directly the households and all of the most important markets in the world. Since this major event, the need for indicators of the risk aversion for the markets participants has significantly increased because risk taking is one of the major causes of any crisis and it needs to be controlled and measured. Consequently financial institutions has created a big variety of risk aversion indicators and the one we will go through in tho part is called the VIX.
The VIX index is explained in the paper on the VIX by Geert Bekaert and Marie Hoerova (ECB), it is the "risk-neutral" expected stock market variance for the US S&P500 contract and is computed from a panel of options prices. It is also famous as the "fear index" regarding asset

markets; in fact it reflects 'stock market uncertainty (the "physical" expected volatility)', and a 'variance risk premium, which is also the expected premium from selling stock market variance in a swap contract'

The equation and its components:

We define the variance risk premium in time t (VPt) as:

$$VPt = VIXt - Et(RVt+1) \qquad \textbf{(16)}$$

$RV\,t+1-VIX$ represents here the return for buying variance in a variance swap contract. Therefore, technically, the variance risk premium represents the negative value of the variance premium VP. This number is in the majority of the cases negative, it is defined as in the previous written equation. Theoretically this Index will help us because first of all its a behavioral index since it shows the fear and instantaneous reaction of investors; since fear is an emotion that can can lead the direction of our actions in reactions to some events

In economic term, the squared *VIX* is the "conditional return variance using a "risk- neutral" probability measure", whereas the conditional variance uses the actual "physical" probability measure. The risk-adjusted measure shifts probability mass to states with higher marginal utility (bad states) and this implies that in many realistic economic settings, the variance premium will be increasing in the economy's risk aversion.

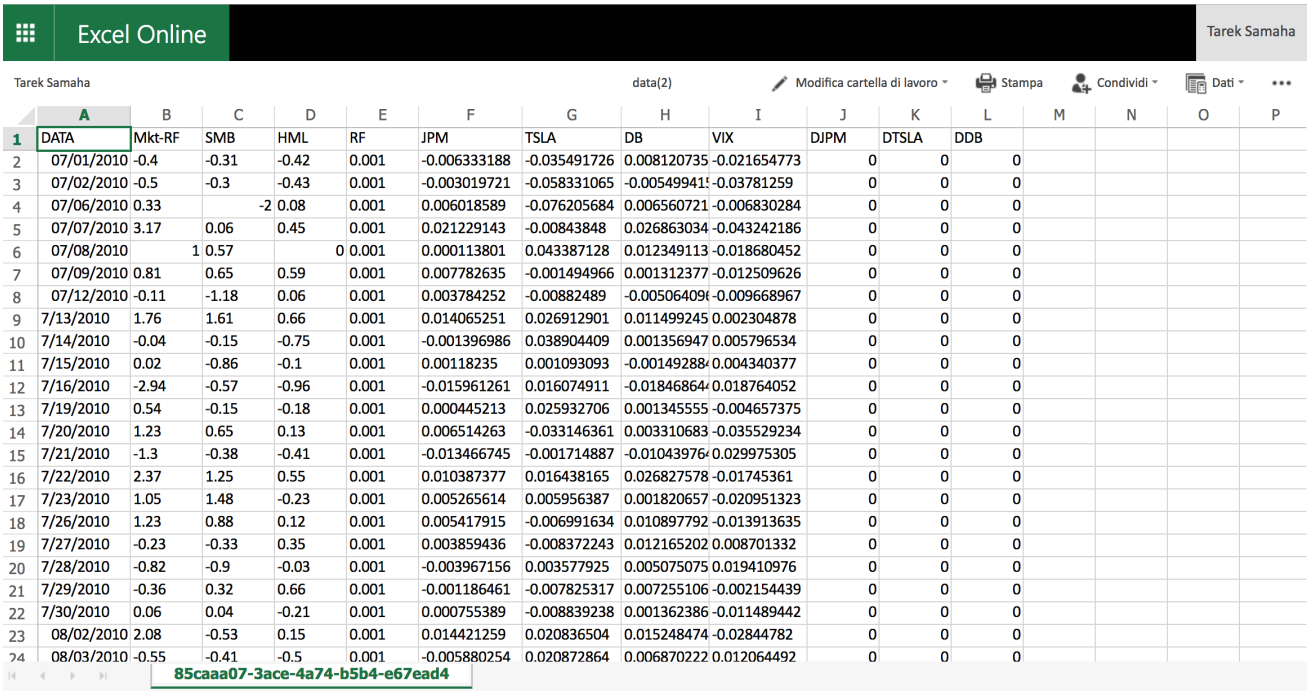
In the last part, (4) by adding the VIX in the model we will be testing the fear effect that is as stated before a behavioral component. We will try to verify if the sign of the coefficient in the regressions (using the CAPM and the Fama french 3 factors model) is negative and if it is statistically significant, if it is not statistically significant we will conclude that we wont be seeing any significant fear effect in the prices in reaction to some event.

4)Running regressions and interpretation of results

We want to test weather stock prices respond to behavioral factors and in particular fear following an event, more precisely: We want to look at 3 different stock prices history about 3 different companies and see how factors such as fear (measured by the VIX described in section 3.1 C) following certain events (described later) affected or not statistically significantly the stock prices after the events.

4.1)How the regressions work and whats the Objective

In this final part, we will first pick three different stocks corresponding to three different companies. First, we have Tesla, an automobile producer, then we have JP Morgan and Deutsche bank which are two among the biggest investment banks in the world and are considered the leaders in the financial sector. After proceeding so, we choose a non-systematic (idiosyncratic) event (meaning that they are proper to the company itself) that affected each of the companies and we will run three different regressions using the different factors described in the first part of this chapter. For the first three regressions for the three different stocks, we will use the well known CAPM model, after this we will use the Fama French 3 factors model, then we will add to the Fama French 3 factors model the VIX and finally in the last three regressions we will add to the precedent models a dummy variable which accounts for a "news event". The dummy is 0 before the event taking place and 1 otherwise, some the coefficient here is related to these news about the event. If the estimated coefficients are not significant it means that we don't have statistical evidence of the news effect. We would like to show how behavioral variables such as the VIX and dummy variable affect the returns of the stocks after the events, in fact if we find big differences between the interval before the event and after the event, these results will concordat with the fact that our animals spirits and behavioral factors may affect a lot the prices and the general returns and volatilities.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	DATA	Mkt-RF	SMB	HML	RF	JPM	TSLA	DB	VIX	DJPM	DTSLA	DDB				
2	07/01/2010	-0.4	-0.31	-0.42	0.001	-0.006333188	-0.035491726	0.008120735	-0.021654773	0	0	0				
3	07/02/2010	-0.5	-0.3	-0.43	0.001	-0.003019721	-0.058331065	-0.00549941	-0.03781259	0	0	0				
4	07/06/2010	0.33		-2	0.08	0.001	0.006018589	-0.076205684	0.006560721	-0.006830284	0	0	0				
5	07/07/2010	3.17	0.06	0.45	0.001	0.021229143	-0.00843848	0.026863034	-0.043242186	0	0	0				
6	07/08/2010		1	0.57	0	0.001	0.000113801	0.043387128	0.012349113	-0.018680452	0	0	0				
7	07/09/2010	0.81	0.65	0.59	0.001	0.007782635	-0.001494966	0.001312377	-0.012509626	0	0	0				
8	07/12/2010	-0.11	-1.18	0.06	0.001	0.003784252	-0.00882489	-0.00506409	-0.009668967	0	0	0				
9	7/13/2010	1.76	1.61	0.66	0.001	0.014065251	0.026912901	0.011499245	0.002304878	0	0	0				
10	7/14/2010	-0.04	-0.15	-0.75	0.001	-0.001396986	0.038904409	0.001356947	0.005796534	0	0	0				
11	7/15/2010	0.02	-0.86	-0.1	0.001	0.00118235	0.001093093	-0.00149288	0.004340377	0	0	0				
12	7/16/2010	-2.94	-0.57	-0.96	0.001	-0.015961261	0.016074911	-0.01846864	0.018764052	0	0	0				
13	7/19/2010	0.54	-0.15	-0.18	0.001	0.000445213	0.025932706	0.001345555	-0.004657375	0	0	0				
14	7/20/2010	1.23	0.65	0.13	0.001	0.006514263	-0.033146361	0.003310683	-0.035529234	0	0	0				
15	7/21/2010	-1.3	-0.38	-0.41	0.001	-0.013466745	-0.001714887	-0.01043976	0.029975305	0	0	0				
16	7/22/2010	2.37	1.25	0.55	0.001	0.010387377	0.016438165	0.026827578	-0.01745361	0	0	0				
17	7/23/2010	1.05	1.48	-0.23	0.001	0.005265614	0.005956387	0.001820657	-0.020951323	0	0	0				
18	7/26/2010	1.23	0.88	0.12	0.001	0.005417915	-0.006991634	0.010897792	-0.013913635	0	0	0				
19	7/27/2010	-0.23	-0.33	0.35	0.001	0.003859436	-0.008372243	0.012165202	0.008701332	0	0	0				
20	7/28/2010	-0.82	-0.9	-0.03	0.001	-0.003967156	0.003577925	0.005075075	0.019410976	0	0	0				
21	7/29/2010	-0.36	0.32	0.66	0.001	-0.001186461	-0.007825317	0.007255106	-0.002154439	0	0	0				
22	7/30/2010	0.06	0.04	-0.21	0.001	0.000755389	-0.008839238	0.001362386	-0.011489442	0	0	0				
23	08/02/2010	2.08	-0.53	0.15	0.001	0.014421259	0.020836504	0.015248474	-0.02844782	0	0	0				
24	08/03/2010	-0.55	-0.41	-0.5	0.001	-0.005880254	0.020872864	0.006870222	0.012064492	0	0	0				

For collecting the Data, we use the online Website of Nasdaq where we download all the last returns of these companies for the last 7 years and add them on an excel file next to the factors of the CAPM , Fama French 3 facotrs, the VIX and we finally add the dummy variables.

After completing this step we will explain the events that are being analyzed and how we run the regression on R with the results interpretation.

4.2)The Different events we are analyzing

4.2.1) JP Morgan

The event we want to analyze:

A five-year investigation by competition authorities in Brussels into rigging of interest rates drew to a close on Wednesday when three major banks – including HSBC – were fined €485m (£412m) for colluding to manipulate a crucial benchmark rate.

The three banks, which also included JP Morgan Chase and Crédit Agricole, did not agree to an earlier settlement involving a seven-bank cartel over the setting of the interest rate known as Euribor. All three deny wrongdoing. JP Morgan was fined €337m"
This extract is taken from The Guardian newspaper.
(Wednesday 7 december 2016)

4.2.2)Deutshe Bank:

The event to be analyzed is:

"Shares in Deutsche Bank, Germany's largest bank, took a dive after news that the institution faces a $14bn (£10.5bn) charge over mis-selling mortgage securities in the US. Here are some of the questions raised by the bank's latest spat with regulators.
Why is Deutsche Bank in trouble?
The prospect of a $14bn penalty from the US Department of Justice has rattled investor confidence in Deutsche. Sentiment was already weak following a turbulent start to the year when prospects of a slowdown in global growth and lower interest rates raised questions about the bank's future profits and dented the share price. The penalty aims to settle allegations, dating back to 2005, about the way the bank selected mortgages, packaged them into bonds and sold on to investors. These bonds are known as residential mortgage-backed securities (RMBS)."
This extract is taken from an article in the The Guardian newspaper.
(Sep 15, 2016)

4.2.3)Tesla:

“Elon Musk is in a class all by himself when it comes to teasing new products.

On Monday afternoon, shortly after tweeting about a trip to China, Musk teased fans with the prospect of a new, "major" non-car product to be unveiled in one month on April 30:

Musk's tweets have the ability to move markets by themselves. Tesla stock, which was slightly down on the day, immediately jumped more than 3% to over $190 per share. The stock is still down from all-time high price last September of about $280 per share. It's not obvious what product Tesla will launch next month, although Musk has previously hinted the company would sell a home battery that would store energy people generate with their own solar panels:

As we can see the first 2 events are bad events that could affect negatively the value of a company and the last one should have positive repercussions on the stocks.”
This extract is taken from an article in the Forbes newspaper.
(Monday afternoon, 30 Mar 2015)

4.3) The regressions and their interpretations with the CAPM

For the first two models, which are the CAPM and Fama French 3 factors we just want to analyze the data about the return and stock riskiness but later, when we add the VIX, that is considered as the fear index, and the dummies, we will be checking if the behavioral factors significantly affect the stock returns and fluctuations.

4.3.1) Tesla

```
> data<-read.table("data.csv",sep=";", dec=".",header=T)
> attach(data)
> ###CAPM
> ##Tesla
> summary(lm((TSLA-RF)~Mkt.RF))

Call:
lm(formula = (TSLA - RF) ~ Mkt.RF)

Residuals:
      Min         1Q     Median         3Q        Max
-0.090364 -0.006184 -0.000002  0.006240  0.096548

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.346e-05  3.142e-04  -0.075     0.94
Mkt.RF       5.552e-03  3.271e-04  16.975   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.01308 on 1739 degrees of freedom
Multiple R-squared:  0.1421,    Adjusted R-squared:  0.1417
F-statistic: 288.2 on 1 and 1739 DF,  p-value: < 2.2e-16
```

The intercept estimated is equal to -0.000023 and it indicates the conditional mean of the Tesla returns when the Market risk premium is equal to 0. It is also an indicator of stock profitability when it is positive and statistically significant. The Market risk premium coefficient (Mkt.RF in the regression table) indicates the strength of the relationship between the X (the market excess return) and the Y (the stock excess return). In this case, we observe from the output that the market beta (the relationship between market risk premium and the stock returns) is 0.0055. This means that if the market return increases by 1 unit, the stock returns increase, on average, by 0.0055. Given the fact that the coefficient is 0<beta<1, Tesla can be considered as a conservative (less risky) asset.
The p-value refers to the significance of the coefficients. Values lower 0.05 can be seen as evidence in favor of the statistically significance (statistically different from 0) of the coefficients. The intercept is not significant (p-value=0.94) while the market beta it is.

The Adjusted R-squared is the goodness of fit of the model. It is the percentage of the explained variance given by the model. The higher the better. In this case, it is 0.1417 which means that only 14.17% of the variance of the Tesla stock returns is explained by the model.
So we conclude that Tesla is not a risky asset and that the Tesla excess returns go in the same direction of the market excess return.

4.3.2)JP Morgan

```
> ##JP Morgan
> summary(lm((JPM-RF)~Mkt.RF))

Call:
lm(formula = (JPM - RF) ~ Mkt.RF)

Residuals:
      Min        1Q    Median        3Q       Max
-0.040099 -0.002444 -0.000081  0.002314  0.026087

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0005021  0.0001098  -4.572 5.17e-06 ***
Mkt.RF       0.0058198  0.0001143  50.911  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.004573 on 1739 degrees of freedom
Multiple R-squared:  0.5985,    Adjusted R-squared:  0.5982
F-statistic:  2592 on 1 and 1739 DF,  p-value: < 2.2e-16
```

Also for JPM we find a negative intercept estimate equal to -0.0005021, meaning that we have a negative conditional mean for JP Morgan returns when our market risk premium is equal to 0. The market beta (the estimate of the market risk premium Market RF), being the relationship between the stock return and market risk premium is here equal to 0.00518198 which is higher than the Beta of Tesla but still between 0 and 1 indicating that we have a stock which has returns less volatile than the market excess returns. Said more technically, we observe from the output that when we increase our X (the market excess return) by 1 unit, the Y (being the stock excess return) increases by 0.0058198. The p-value refers to the significance of the coefficients, the

intercept and the beta are both significant since their respective values are both less than 0.05 which is the threshold for having statistical significance. The Adjusted R-squared which, as defined before, is the goodness of fit of the model, in this case is 0.5982 which means that the 59.82% of the variance is explained by the Market factor revealing a relatively good proportion.

4.3.3)Deutsche Bank

```
> ## Deutsche Bank
> summary(lm((DB-RF)~Mkt.RF))

Call:
lm(formula = (DB - RF) ~ Mkt.RF)

Residuals:
      Min        1Q    Median        3Q       Max
-0.053249 -0.004365 -0.000051  0.004332  0.049961

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0011255  0.0001965  -5.728 1.19e-08 ***
Mkt.RF       0.0081384  0.0002045  39.791  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.008181 on 1739 degrees of freedom
Multiple R-squared:  0.4766,    Adjusted R-squared:  0.4763
F-statistic:  1583 on 1 and 1739 DF,  p-value: < 2.2e-16
```

We also have a negative intercept estimate for Deutsche bank which is equal to -0.0011255. So, when the market risk premium is equal to 0 we have a negative conditional mean for the returns for Deutsche Bank stock. We observe from the output that the market Beta is 0.0081384 (the relationship between X and Y), so Deutsche bank is not a risky asset as-well (compared to the market). The p-value numbers, both being less than 0.05, indicate us that the intercept and the beta (Market RF) are both significant.
The Adjusted R-squared is 0.4763, which means 47.63% of the variance explained which express a good explanatory power of the factors.

In conclusion for this model we analyzed the most important values and we saw that the 3 stocks are relatively not risky; Tesla has a weak R squared meaning the model doesn't explains a big part of the variance that also represents the risk squared and that the stocks of Deustche Bank and JP morgan have an average good Rsquared so they have better goodness for fit of the model. The only non statistically significant variable is the intercept of then Tesla stock.

4.4) The regressions and their interpretations with the Fama french 3 factors model

4.4.1)Tesla

```
> ###3 Factors Fama-French
> ##Tesla
> summary(lm((TSLA-RF)~Mkt.RF+HML+SMB))

Call:
lm(formula = (TSLA - RF) ~ Mkt.RF + HML + SMB)

Residuals:
      Min        1Q    Median        3Q       Max
-0.091787 -0.006158 -0.000227  0.005861  0.094706

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0000283  0.0003075  -0.092    0.927
Mkt.RF       0.0052604  0.0003525  14.923   < 2e-16 ***
HML         -0.0046897  0.0006821  -6.875 8.61e-12 ***
SMB          0.0030255  0.0006375   4.746 2.25e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.01279 on 1737 degrees of freedom
Multiple R-squared:  0.1804,    Adjusted R-squared:  0.179
F-statistic: 127.5 on 3 and 1737 DF,  p-value: < 2.2e-16
```

This model explains better since were considering size premium(SML=small minus large) and Book to market ratio premium additionally to the CAPM that uses instead only one variable to describe the returns of an individual stock or a portfolio compared to the whole market.
Tesla

The Estimate of the intercept is negative meaning that if we have all the 3 other factors equal to 0, the conditional mean of the sample return will be -0.0000283. Furthermore we have the SMB estimate being the size Beta (relationship between size premium and stock excess return) equal to 0.00320255, if we increase the X (size premium) by 1 unit (taking all the other factor fixed) the stock returns Y will increase by 0.00320255. In this same context we have the market Beta equal to 0.0052604 so when we increase the market excess return by 1 unit, the stock excess return moves in the same direction by 0.0052604 and it is the opposite relation for the last factor HML estimate being the value Beta , the value premium estimate here is equal to 0.0048526; if you increase value premium X by 1 unit the stock excess return increases by 0.005603.

Adding the size and value premium factors, we can see that they are both statistically significant additionally to the market factor corresponding to the CAPM.
We interpret it as that market factor corresponding to the CAPM explain the riskiness of the stock, then the size and value premiums corresponding to the Fama French factors tell us that the size and premium values observed in the equity market affect the returns of the stocks under consideration. Furthermore, when we add those two factors the regression we can see that we have a better fit compared to the CAPM so that it explains more of the variance. In fact the Adjusted R-squared here is 17.9% instead of 14.17

4.4.2)JP Morgan

The Estimate of the intercept and the Size estimate (Size beta of the market) are negative meaning that first, for the intercept if we have all the 3 other factors equal to 0, the conditional mean of the JP return will be -0.0004579, and second, that the SMB estimate (the Size Beta,

```
> ##JP Morgan
> summary(lm((JPM-RF)~Mkt.RF+HML+SMB))

Call:
lm(formula = (JPM - RF) ~ Mkt.RF + HML + SMB)

Residuals:
       Min         1Q     Median         3Q        Max
-0.034894 -0.002140  0.000055  0.002105  0.022834

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -4.579e-04  9.042e-05  -5.064 4.54e-07 ***
Mkt.RF       5.532e-03  1.037e-04  53.363  < 2e-16 ***
HML          5.603e-03  2.006e-04  27.929  < 2e-16 ***
SMB         -5.568e-04  1.875e-04  -2.970  0.00302 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.003763 on 1737 degrees of freedom
Multiple R-squared:  0.7284,    Adjusted R-squared:  0.728
F-statistic:  1553 on 3 and 1737 DF,  p-value: < 2.2e-16
```

relationship between size and stock return) is equal to -0.0005568, that if we increase the X (size premium) by 1 unit the stock return Y will decrease by 0.0005568. In this same context, the market Rf estimate being the market beta is 0.005532, so if we increase market excess return by 1 unit the stock excess return moves in the same direction by 0.005532 and it is the same logic for the last factor HML equal to 0.005603(the value B); if you increase value premium X by 1 unit the stock return increases by 0.005603.
The intercept and the 3 other factors (Mkt.Rf so the B, the HML, the SMB) are all statistically significant. This means that both the CAPM variable being the Market factor affect the riskiness of the stock and the Fama French variable being the size and premium vales affect the returns of the stocks. This results shows that by adding the 2 factors of the fame french model we get better explanations of the returns.
We have the same observation that the R squared fits well better the model than with only the CAPM so that it explains more of the variance, here 72.8% instead of 59.82% before.

4.4.3)Deutsche Bank

```
> ## Deutsche Bank
> summary(lm((DB-RF)~Mkt.RF+HML+SMB))

Call:
lm(formula = (DB - RF) ~ Mkt.RF + HML + SMB)

Residuals:
      Min        1Q    Median        3Q       Max
-0.049388 -0.004172  0.000076  0.004140  0.048468

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0010773  0.0001895  -5.684 1.54e-08 ***
Mkt.RF       0.0077247  0.0002173  35.549  < 2e-16 ***
HML          0.0048526  0.0004205  11.540  < 2e-16 ***
SMB          0.0003070  0.0003930   0.781    0.435
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.007888 on 1737 degrees of freedom
Multiple R-squared:  0.5141,    Adjusted R-squared:  0.5132
F-statistic: 612.5 on 3 and 1737 DF,  p-value: < 2.2e-16
```

The Estimate of the intercept is negative meaning that if we have all the 3 other factors equal to 0, the conditional mean of the Deutsche bank return will be equal to -0.0010773. Furthermore, we have the SMB estimate being the size Beta (relationship between size premium and stock excess return) equal to 0.0003070. So, if we increase the X (size premium) by 1 unit the stock return Y will increase by 0.0003070. In this same context, we have the market Beta equal to 0.0077247 so when we increase the market excess return by 1 unit, the stock excess return moves in the same direction by 0.0077247 and it is the same logic for the last factor HML being the value premium here equal to 0.0048526; if you increase value premium X by 1 unit the stock return increases by 0.0048526.
Here also we have the same observation that the R squared fits well better the model than with only the CAPM so that it explains more of the variance, here 51.32% instead of 47.63%.
The intercept, the Mkt.Rf and the HML are all statistically significant while SMB is not, meaning that the SMB has chances of randomly representing the phenomenon whereas for the other factors, we interpret it as they are able to explain the riskiness of the stock returns.

We finally conclude that this last model is more suitable and it is used to explain asymmetries in stock returns between big-small companies, high low book ratios and different Risk premiums.

4.5) Adding the VIX to the regression

4.5.1) Tesla

```
> ###3 Factors Fama-French + VIX
> ##Tesla
> summary(lm((TSLA-RF)~Mkt.RF+HML+SMB+VIX))

Call:
lm(formula = (TSLA - RF) ~ Mkt.RF + HML + SMB + VIX)

Residuals:
      Min        1Q    Median        3Q       Max
-0.091810 -0.006161 -0.000225  0.005838  0.094740

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.029e-05  3.084e-04  -0.066    0.948
Mkt.RF       5.104e-03  5.751e-04   8.875  < 2e-16 ***
HML         -4.673e-03  6.840e-04  -6.832 1.16e-11 ***
SMB          3.054e-03  6.430e-04   4.750 2.21e-06 ***
VIX         -5.577e-03  1.619e-02  -0.344    0.731
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0128 on 1736 degrees of freedom
Multiple R-squared:  0.1805,    Adjusted R-squared:  0.1786
F-statistic: 95.58 on 4 and 1736 DF,  p-value: < 2.2e-16
```

For this model we added the fear index that is the previously defined VIX, we are testing the fear effect (which is behavioral). We want to verify if the sign of the coefficient is negative and if it is statistically significant. If it is not statistically significant you can say that you do not have a fear effect on the stock you are considering during that sample period.
In this case the p-value corresponding to the VIX is 0.731, which is much more than 0.05 implying that there is no statistical significance so that investors didn't show any significant reaction that influenced the stock even though we know that this day the stock went up more than 3% on the 30th march 2015.

4.5.2)JP Morgan

```
> ##JP Morgan
> summary(lm((JPM-RF)~Mkt.RF+HML+SMB+VIX))

Call:
lm(formula = (JPM - RF) ~ Mkt.RF + HML + SMB + VIX)

Residuals:
      Min        1Q    Median        3Q       Max
-0.034965 -0.002132  0.000054  0.002108  0.022845

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -4.643e-04  9.068e-05  -5.120 3.39e-07 ***
Mkt.RF       5.657e-03  1.691e-04  33.458  < 2e-16 ***
HML          5.589e-03  2.011e-04  27.792  < 2e-16 ***
SMB         -5.797e-04  1.891e-04  -3.066   0.0022 **
VIX          4.479e-03  4.762e-03   0.941   0.3470
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.003763 on 1736 degrees of freedom
Multiple R-squared:  0.7286,    Adjusted R-squared:  0.7279
F-statistic:  1165 on 4 and 1736 DF,  p-value: < 2.2e-16
```

In this case the p-value referred to the VIX is 0.3470 is also much higher than 0.05 implying that there is no statistical significance for such behavioral factor even though we know the day in which it was announced that JP Morgan had to pay the fine investors got scared and pushed downward the stock price.

4.5.3)Deutsche Bank

```
> ## Deutsche Bank
> summary(lm((DB-RF)~Mkt.RF+HML+SMB+VIX))

Call:
lm(formula = (DB - RF) ~ Mkt.RF + HML + SMB + VIX)

Residuals:
      Min        1Q    Median        3Q       Max
-0.049061 -0.004158  0.000046  0.004117  0.048455

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0010708  0.0001901  -5.632 2.08e-08 ***
Mkt.RF       0.0075967  0.0003545  21.429  < 2e-16 ***
HML          0.0048662  0.0004217  11.540  < 2e-16 ***
SMB          0.0003303  0.0003964   0.833    0.405
VIX         -0.0045630  0.0099832  -0.457    0.648
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.007889 on 1736 degrees of freedom
Multiple R-squared:  0.5141,    Adjusted R-squared:  0.513
F-statistic: 459.2 on 4 and 1736 DF,  p-value: < 2.2e-16
```

Here the p-value referred to the VIX is 0.648 and since 0.648 > 0.05, we do not have evidence of statistical significance, so there were no behavioral factors significant enough to affect the fluctuations even if it was announced that Deutsche had pay to one of the biggest fines in history for banks, fine investors got scared and pushed downward the stock price.

Finally, after trying the fear index on the 3 stocks, we observe after these non-systematic events happen we still have no statistically significant reaction from the investors meaning behavioral factors didn't “show up” in this sample period and are not the cause of these fluctuations.

4.6)Adding a Dummy Variable for the last test

In this last part we will try to add another variable which is a dummy variable: This variable is 0 before the event taking place and 1 otherwise, so the coefficient is related to the effect of the news. If it is not significant it means that we don't have statistical evidence of the news effect.

4.6.1)Tesla

```
> ###3 Factors Fama-French + VIX + INF_dummies
> ##Tesla
> summary(lm((TSLA-RF)~Mkt.RF+HML+SMB+VIX+DTSLA))

Call:
lm(formula = (TSLA - RF) ~ Mkt.RF + HML + SMB + VIX + DTSLA)

Residuals:
      Min        1Q    Median        3Q       Max
-0.092017 -0.006219 -0.000302  0.005850  0.094537

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0001865  0.0003725   0.501    0.617
Mkt.RF       0.0050879  0.0005753   8.844  < 2e-16 ***
HML         -0.0046613  0.0006841  -6.813 1.31e-11 ***
SMB          0.0030555  0.0006430   4.752 2.18e-06 ***
VIX         -0.0059386  0.0161991  -0.367    0.714
DTSLA       -0.0006541  0.0006608  -0.990    0.322
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.0128 on 1735 degrees of freedom
Multiple R-squared:  0.181,     Adjusted R-squared:  0.1786
F-statistic: 76.66 on 5 and 1735 DF,  p-value: < 2.2e-16
```

By looking at the p-value of the dummy variable, putting all the elements apart, we observe a value that is higher than 0.05 meaning there is no statistical significant. Without adding the other pictures of the model ran for Jp morgan and deutsche Bank, we also have non statistically significant coefficient for the dummy variable. Considering the stocks and the sample period that we took, behavioral factors seems to not be present. The VIX and the dummies are not significant and it means that there was not significant fear effect and news effect on the data. Finally, after trying to add to these models two different behavioral variables being the fear index VIX and the dummy variable, we can see that if affect the variables such as risk and return but however not in a statistically significant way implying that the behavioral factors don’t have an impact strong enough to account for the biggest part of variations in the stock return.

Conclusion

As we observed in the first section (1.2) of the first chapter, the efficient market hypothesis fails in some extent that we previously discussed about and we use behavioral finance as an alternative theory to explains many anomalies in the markets. Our human behavior and reactions to certain notices can have big repercussions on the variables of the economy such as stock prices, housing prices ect.. This was firstly illustrated in the whole section 2 of chapter 1 by defining the different feedbacks, biases and other variable with examples such as the Keynes beauty contest and the Toyota versus IKA case. On one side, this was done to underly how important it is to understand how market bubbles are sometimes simply the results of the "animal spirits" of the investors and on the other side also how different can be the health of a company if workers work in a good atmosphere, are heard, respected, rewarded and can trust their company. In general the biases and feedbacks fail to be considered in the publications and explanation of many economists when some economic cycles take place, especially given their complexity of measurement because in fact it is almost impossible to measure in numbers or percentages fairness, optimism, confidence and many other important behavioral factors. We reached the conclusion that in fact behavioral finance is a crucial science that has to be taken more seriously in consideration in explaining anomalies and fluctuations in the financial markets and the economy as a whole. Nevertheless in the second part, we tried to prove this theory in numbers; we first defined the different models and variables that we want to use (endogenous and exogenous), in the second part we ran a regression trying to find statistical significance and show wether the stock prices responded to behavioral factors and in particular fear. However we found that the stock was in fact affected by fear but not in a statistically significant way and this regarded the 3 different stocks following the idiosyncratic events (proper to the company itself); we want to understand how did we get this result and if it could have been possible to have a different outcome if we had taken into consideration other elements, tested for some other phenomenon or changed other variables. First of all there may be an error in the model chosen, the CAPM and Fama French 3 factors model may not be suited for this kind of test and so they may give inaccurate results and in econometrics it is called a misspecification; that is the model we made with the regression analysis is in error so it it doesn't account for everything it should, misspecified models can have biased coefficients and error terms and tend to have biased parameter estimations that is there is an under or over estimation of the parameters. If in our 2 models we had the right explanatory variables such as excess return, value and size premiums we would have obtained other results so there may nne failure in accounting the relationship between the explanatory and dependent variables, in this case the model has functional form misspecification. Furthermore we may have not have chosen the right stocks and the right events. In fact, it may be that JP Morgan, Deutsche Bank and Tesla were not the most suitable stocks to prove that fear increases statistically significantly the volatility of stock prices and it could also be the event in question that was not strong enough to shake these companies.

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