Global Journal of Management and Business Research: C Finance
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4588 & Print ISSN: 0975-5853

Investor Sentiment and its Role in Asset Pricing: An Empirical Study of the American Stock Market

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GJMBR - C Classification : JEL Code : G12

Strictly as per the compliance and regulations of:

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I. Introduction

Neoclassical financial theory is based on investor rationality hypothesis and retains rationality as a phenomenon which influences their expectations and their investment decisions. However, behavioral finance confirms that emotions are predominant, mainly in the process of non-substantive rationality. In addition to cold, complete and decontextualized reasoning of economic theory, individuals are able to make judgments and decisions based on mental images to which they associate positive or negative feelings.

Finucane Alhakai, Slovic and Johnson (2000) describe this type of rapid reasoning as an "affect heuristic". Thus, behavioral finance rejects the purely theoretical vision of homo economicus that reacts in a cold and isolated manner. In financial markets, investors exhibit emotional behaviors. Investors' decisions are based on mood, which is in general an emotional state. Nevertheless, these decisions do not consider the underlying determinants of assets values that are subject of the exchange. These moods are likely to bias their judgments and, in some cases, control their actions. They influence their financial decisions by biasing their forecasts. Authors such as Shleifer and Summers (1999), Fisher and Statman (2000), Brown and Cliff (2005) tried to explain prices evolution and their volatilities in terms of affective factors. In other words, investor sentiment plays an important role in financial markets.

Before analyzing the impact of investor sentiment on stock prices evolution, it is necessary to define investor sentiment.

The latter is defined as the investors' expectations which are not justified by the fundamentals of the value of assets subject of the exchange. This feeling reports to a set of emotional states (pride, satisfaction, joy, shame, fear, etc ...) that call for stereotyped responses. These states are behavioral phenomena that play an important role in pricing financial assets (Mangot, 2005). Defining investor sentiment reports to describing mood (optimistic or pessimistic), independently of economic reasons. In case they are optimistic, investors show an upward trend (the price is above its fundamental value), otherwise, when they are pessimistic, investors drive prices below their fundamental value (downward trend). This behavioral phenomenon can be explained by the fact that investor sentiment plays an important role in financial decisions and consequently in assets pricing. Moreover, opting for this behavioral frame of analysis allows us to account for the different anomalies reported on efficiency theory, namely excess volatility of stock prices compared to the fundamental values. Behavioral phenomena cast on efficiency a strong counter argument. Using this analytical framework, the purpose of this paper is to study the impact of change in "noises traders" sentiment on both future financial assets returns and their corresponding volatilities.

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II. Role of Investor Sentiment in Capital Asset Pricing: Theoretical Foundations and Empirical Analysis

a) *Theoretical Foundations*

i. *Investor Sentiment and financial assets returns*

MacGregor, Slovic, Dreman and Berry (2000) found from experience that financial decisions of individual investors directly depend on the affective assessments they make of industries. Affective assessments of industries measured by associations of spontaneous words and semantic differentiation collected from imposed scales (good / bad, useful / useless, boring / exciting, etc ...) and financial evaluation estimations (expected returns, motivation to participate in a possible introduction into the stock market) are positively and significantly correlated.

Similarly, among professionals, the emotional dimension may intervene in financial estimates when substantive reasoning is difficult. According to Ganzah (2001), financial analysts base their judgments of risks and securities returns they are not familiar with on a global attitude. When securities are very well perceived, they consider that their returns will be high and their risk will be low. When securities are badly perceived, they expect low returns and high risk. However, for familiar securities, perceived risk and returns tend to be positively correlated, consistent with the neoclassical financial theory, and thus they seem to result less from a global approach. Finucane, Alhakai, Slovic and Johnson (2000) show that in financial markets, individuals are able to make judgments and decisions based on mental images to which they associate positive or negative feelings. According to these authors, the affect heuristic implies that shares of companies that have a positive image are likely to be bought than those of companies perceived negatively. The overall positive feelings felt by investors have them both minimize the risk associated with the investment and increase the expected returns. Thus, company image plays a powerful role in the weighting of information that should be involved in the substantive judgment of its value. For the newly introduced companies and those with no significant prior image, company image and its emotional perception are perhaps the main criteria on which investors base their financial decisions.

Studying the role of emotions in decision-making dates back to the work of the neurologist Damasio (1994). This neurologist linked individuals' decision-making process to emotions. He has shown in a study of patients suffering brain pathologies that an emotional deficit affects the ability to make decisions. He argues that his patients were unable to feel emotions because of damage to the frontal lobe, but their knowledge, attention, memory, language, and their ability to solve abstract problems were not affected. Faced with simple problems, these individuals experienced great difficulties in making decisions and were unable to make plans for the future or choose an action. Affection had left them able to analyze the situations they faced but unable to find the solution because of lack of emotional selection criteria and to draw conclusions by figuring out an action. The scientific study of emotions dates back to Darwin and his work "the expression of the Emotions in Man and the animal" published in (1872). Darwin first described emotion as something essential to the survival of the species. Usefulness of emotions will be then taken by almost all other scientific conceptions of the phenomenon. Emotions are considered ancestral biological reflexes that allowed species to adapt themselves and survive in their environment. They are, at least for the most primitive of them, common to all men who live in the same environment and are subject to the same constraints.

Many other authors, such as Izard or Plutchnik, offer, starting from an evolutionary point of view, a description of emotion from a universal basis. It would be emotions that every man whatever his culture and environment of the moment comes to feel, express towards and recognize in other men in different situations. These primary emotions are distinguished from more built and more sophisticated emotions that would need more cognitive elaboration. Reviewing many intellectual studies of facial expressions, Eckman was able to identify six basic emotions used by all men: joy, sadness, anger, fear, surprise and disgust.

Weiner and Graham (1989) link emotions, primary or sophisticated, to life events that take an emotional value depending on their causes, their consequences and their agents. They describe a social taxonomy of emotions, depending on the elements being integrated in their evaluation and the resulting interactional trends.

Delong, Shleifer, Summers and Waldman (1990b), Lee, Shleifer and Thaler (1991), Brown and Cliff (2003, 2005, 2006), Glushkov (2006), Ho and Huang (2008) link investors' irrational behavior in financial markets to emotional states. Accordingly, anomalies reported on efficiency hypothesis, observed in these markets, likely result from emotions.

Concrete markets are clearly not perfect markets. Indeed, a basic realism recommends considering that there are "noise traders". It is for this reason that Delong, Shleifer, Summers and Waldmann (1990b) distinguished between rational investors or "smart money" and irrational investors, also called "noise traders." The former base their expectations on the determinants of the fundamental value of the traded assets. While the latter are investors who are not fully rational and their demand for risky financial assets is affected by their beliefs or emotions, which are obviously not fully justified by economic fundamentals. In this sense, the theoretical rationale for "noise traders" states that if "noise traders" are optimistic they push asset prices beyond their fundamental values. However, when they are pessimistic, the gap between price and the fundamental value of the security in question is negative, i.e. they push prices above the fundamental value.

In a more recent literature, several contributions of great interest have sought to test this theoretical position. They consist, essentially, in justifying assigning to behavioral variables (investor sentiment) measurable proxies, in this case, a number of economic, financial or psychological variables that can be associated with them. In this sense, Brown and Cliff (2004) define different substitutes (proxies) as measures of emotions characterizing investors' mood. Indeed, these moods are in general emotional states that likely influence financial decisions by biasing expectations. Good mood would, for example, underestimate risks and increase expected returns. It therefore encourages investors to buy and to opt for riskier securities.

According to Brown and Cliff (2004), there are three different proxies for measuring investor sentiment, which are:

- The first is based on proxies (substitutes) that measure sentiment calculated on the basis of economic and financial variables.
- The second category of proxies measures investor sentiment using explicit measures, based on sample surveys.
- The third category of proxies measures investor sentiment using feelings and collective action.

In this paper, we are particularly interested in the second category of proxies measuring investor sentiment.

ii. *Explicit measures of investor sentiment*

Explicit measures of investor sentiment are based on opinion surveys.

These surveys are carried out by specialized institutions that publish a weekly index reflecting the average, optimistic or pessimistic, opinion of the surveyed individuals. These individuals may be individual and institutional investors. The opinion of these will be compiled into indices. To study the impact of these indices on the future profitability of the American S & P500, Fisher and Statman (2000) used various direct measures of sentiment. To do this, they used a method of classifying investors into three groups:

- The first group consists of individual investors;
- The second group consists of publishers of financial records;
- The third consists of experts and financial analysts;

Empirical studies of the impact of investor sentiment on asset returns used sentiment indices calculated from the following sources:

- A sentiment index based on data from the American Association of Individual Investors (AAII). The association calculates and publishes a sentiment index created on the basis of the opinions of its members. The index so calculated is defined as the percentage of optimistic or pessimistic investors out of the total investors who expressed an opinion. Considered a proxy for the direct measurement of investor sentiment, this index is used to analyze the impact of mood of individual investors on the profitability of the S & P500 index.
- A sentiment index based on data from the service company of American investments; "Investor Intelligence (II)":

This company calculates and publishes a sentiment index reflecting the views of more than one hundred and forty investment advisers in the American financial markets. They transmit their optimistic or pessimistic opinions via email or mail. The sentiment index is defined as the number of optimistic views respectively pessimistic of the total number of letters received from consultants.

- A sentiment index based on data from Market Vanes "Mvan": the approach to calculate this index used by this agency is expressed as follows:

Once "Mvan" receives the opinions of individual and institutional investors via e-mail or mail, every opinion on the trend of the overall sentiment in the stock market is weighted on a scale of 0-8 where 0 and 8 represent respectively a perfect pessimistic or an optimistic sentiment.

Measured from opinion surveys, investor sentiment summarizes the expectations of individual investors from stock markets. The American Association of Individual Investors (AAII) issues, weekly, the results of questionnaires asking investors if they are bullish, bearish or neutral. These indicators generally have no usable information to predict future market returns, but provide insights into how individual investors make their judgments on market developments. Regression of market returns on monthly changes in investor sentiment showed a zero or a slightly negative correlation. Regression of investor changes in asset allocation on this indicator is positive, but only slightly.

However, investor sentiment strongly correlates with its past market returns. Fisher and Statman (2000) find for example that performance of large capitalization in the month preceding the survey accounts for 10% of the variation in investor sentiment. Fisher and Statman (2003) also show that investor sentiment changes along with consumer trust, as measured by the United State Conference Board and the University of Michigan.

The positive relationship between changes in investor sentiment and consumer trust, including questions on the expectations of the macroeconomic situation, given the anticipatory nature of financial markets. If information suggests future improvement or deterioration of the economy, this should not change market outlook, since it is supposed to, according to efficiency hypothesis, immediately transform this information onto prices. The authors consider this result as a support for the idea that investors confuse the prospects of the companies and the prospects of securities. Shefrin and Statman (1995), in fact, show that people tend to consider that the securities of "good" companies are "good" securities in total contradiction with efficiency theory and with empirical results that point to the outperformance of valued stocks, i.e. those of companies with poor prospects for growth. Sturm (2003) reported, meanwhile, that the environment of recent markets conditions investor response to sudden price changes. When a stock suddenly drops following an information, the fall in the day of the event results in abnormal average positive returns in the following days. Positive returns are stronger in bull markets than in bear markets, suggesting that investors are watching the "mood" of the market to determine how a sharp decline is an attractive opportunity to buy.

These results support the hypothesis of emotional reasoning of individual investors. Past positive signals about the markets or the economy create an overall positive emotion that makes investors consider positively the future, bias their expectations which subsequently affects their investment decisions. Again, institutional investors largely seem to be immune against the intrusion of the cognitive affect as their feelings about the market show no significant correlation with consumer trust or short-term past returns.

Against this synthesis of the literature on the impact of investor sentiment on future returns of financial assets, we can conclude that they do not correlate with changes in investor sentiment. Most empirical studies that examined the impact of investor sentiment on future profitability did not lead to significant results. However, investor sentiment strongly correlates with past market returns. This state of mind biases their expectations and influences their investment decisions.

b) The Empirical Analysis

We will test in the context of this empirical investigation the impact of investor sentiment on future stock returns. With reference to the studies of Black (1986), De Long et al (1990), Shleifer and Vishny (1998) and Brown and Cliff (2005)), the aim is to test the importance of mood in investors' decisions and consequently in the returns-generating process. We can confirm that some decisions are taken on the basis of a rapid reasoning that integrates a global emotional evolution of opportunities. The feeling experienced by an investor towards a stock or a company reflects his/her perception of performance and associated risks.

If the sentiment is positive, investors tend to overestimate performance and underestimate risk and will tend to buy the security.

If the sentiment is negative, the investor tends to underestimate performance and overestimate risk and will tend to sell the security.

Before analyzing the impact of investor sentiment on financial assets returns, we will highlight the evolution of the direct proxies measuring investor sentiment on the American market, using different data sources. The latter are considered explicit measures of investor sentiment based on sample surveys. They allowed us to calculate substitutes (proxies) of the most representative of investor sentiments, because these opinions were inspired directly from the surveyed investors.

i. *The Empirical Methodology*

Unlike some studies that suggest ad-hoc hypotheses about the use of direct proxies measuring investor sentiment and its impact on asset returns, we will conduct empirical tests to identify the appropriate proxy reflecting investor sentiment in financial markets. According to Bandopadhyapa (2006), the aim of these empirical tests is to determine which proxy among the proxies used is the one that best reflects changes unrelated to the basic price. Our methodological approach is twofold:

- The first is to regress the S & P500 stock index on its lagged value. This latter is assumed to integrate all economic information explaining fluctuations of this index.
- The second is to regress the residuals from the first regression, which are supposed to reflect all information unjustified by fundamentals, on each of the proxies considered in order to select the proxy that best reflects changes in market price not justified by fundamentals.

a. Data sources and proxies used

To study the impact of investor sentiment on the American stock market, we selected opinions (optimistic, pessimistic, neutral), reflecting the overall investor sentiment as recommended by the financial community.

We will use the sentiment proxy of the Bull-Bear deviation type, like Brown and Cliff (2005), which is expressed as follows:

$$\text{Ecart Bull} - \text{Bear} = \frac{\text{Bull} - \text{Bear}}{\text{Bull} + \text{Bear} + \text{Neutre}} \quad (1.1)$$

This sentiment proxy is calculated on the basis of different sources of the used opinions in this study:

- Opinions compiled into a proxy whose source is Investor Intelligence (II). This institution has been collecting opinions since 1964 of more than 140 consultants on market trend. Opinions are divided into three categories (optimistic, pessimistic, neutral),

- Opinions are collected from a sample survey conducted by UBS and Gallup. These two agencies have been conducting since 1964 sample surveys of 1,000 investors with revenues greater than $ 1,000. This survey is conducted during the first two weeks of each month and opinions are released on the last Monday of the month,
- Opinions extracted from a poll conducted by the American Association of Individual Investors (AAII) on its members. Measured from opinion surveys, investor sentiment summarizes individual investors' expectations of the stock markets. The American Association of Individual Investors (AAII) has been publishing since 1988 the results of questionnaires asking investors if they are bullish, bearish, or neutral in the mid-term.
- Opinions extracted from a poll conducted by Market Vane. This agency includes only very pronounced opinions of individual and institutional investors by weighting each opinion on a scale called (B) from 0 to 8 where 0 and 8 represent respectively a perfect optimistic or a pessimistic sentiment.

To carry out our empirical study, our database measuring sentiment of American investors covers the period from 1879 to 2013[1].

b. Selection of econometric proxies for investor sentiment

To select among the proxies that directly measures investor sentiment, the one that best represents changes in investor sentiment, we will proceed in two stages:

The first is to regress the S & P500 stock index on its lagged value. The latter is assumed to integrate all economic information explaining changes in investor sentiment. The first regression is expressed as follows:

Regression (1) $: indice_t = \gamma_0 + \gamma_1 indice_{t-1} + Résidu_t$ (1.2)

- The second is to regress the residuals from the first regression, which are supposed to reflect all information not justified by fundamentals, on each of the considered proxies in order to select the best sentiment proxy that best explains fluctuations of investor sentiment, i.e. residuals.

This second regression is as follows:

Regression (2): Residu $_t$= $\beta_0 + \beta_i \,\mathrm{proxy}_t + \varepsilon_t$ (1.3)

Where;

$Residu_t$ is the residual of the first regression at time (t)

$Proxy_t$ is the considered sentiment proxy at time (t)

The results of the significance of the parameters of the first regression on the most used American stock index, namely S & P500, over the 2001- 2013 period are summarized in the following table:

Table 1 : Results of tests of significance of the parameters of the first regression on the S & P 500 Index.

$$indice_t = \gamma_0 + \gamma_1 indice_{t-1} + \mathrm{Re}\,sidu_t$$

Dependent Variable: SP500_
Method: Least Squares
Date: 05/29/14 Time: 00:08
Sample (adjusted): 2001M03 2013M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002247	0.003576	0.628269	0.5308
SP500_(-1)	0.190828	0.078401	2.433986	0.0161

R-squared	0.037513	Mean dependent var	0.002592
Adjusted R-squared	0.031181	S.D. dependent var	0.045048
S.E. of regression	0.044340	Akaike info criterion	-3.380970
Sum squared resid	0.298834	Schwarz criterion	-3.341529
Log likelihood	262.3347	Hannan-Quinn criter.	-3.364949
F-statistic	5.924288	Durbin-Watson stat	1.995246
Prob(F-statistic)	0.016093		

The results indicate that much of the fluctuation of the American S & P500 is explained by its lagged values, hence the high significance of the coefficient γ_1. These results corroborate those of Bandopadhyaya (2006).

[1] Extracted opinions from syrveys conducted by UBS and Gallup are eliminated from our database because they do cover only a short period (since 1994) by contrast to other data that exist since 1989

Our second step is to select one of the two proxies measured by the surveys the one that best explains investor sentiment, i.e., the second regression. These two proxies are calculated using monthly frequencies. They are rated AAII and II.

The results of this second regression are summarized in the table below:

Table 2 : Results of the regression of residuals on SENTII

$$\text{Residu}_t = \beta_0 + \beta_1 SENTII + \varepsilon_t$$

Dependent Variable: RES_SP500
Method: Least Squares
Date: 05/29/14 Time: 00:15
Sample (adjusted): 2001M03 2013M02
Included observations: 144 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.011740	0.006366	-1.844285	0.0672
SENT_II	0.000551	0.000265	2.079891	0.0393

R-squared	0.029564	Mean dependent var	-0.000979
Adjusted R-squared	0.022730	S.D. dependent var	0.045017
S.E. of regression	0.044503	Akaike info criterion	-3.372744
Sum squared resid	0.281229	Schwarz criterion	-3.331497
Log likelihood	244.8376	Hannan-Quinn criter.	-3.355984
F-statistic	4.325947	Durbin-Watson stat	2.101589
Prob(F-statistic)	0.039333		

Table 3 : Results of the regression of residuals on SENTAAII

$$\text{Residu}_t = \beta_0 + \beta_1 SENTAAII + \varepsilon_t$$

Dependent Variable: RES_SP500
Method: Least Squares
Date: 05/29/14 Time: 00:15
Sample (adjusted): 2001M03 2013M02
Included observations: 144 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.005823	0.003962	-1.469570	0.1439
SENT_AAII	0.000702	0.000226	3.107842	0.0023

R-squared	0.063687	Mean dependent var	-0.000979
Adjusted R-squared	0.057093	S.D. dependent var	0.045017
S.E. of regression	0.043713	Akaike info criterion	-3.408540
Sum squared resid	0.271340	Schwarz criterion	-3.367293
Log likelihood	247.4149	Hannan-Quinn criter.	-3.391780
F-statistic	9.658682	Durbin-Watson stat	2.116367
Prob(F-statistic)	0.002277		

The tables (above) indicate that the sentiment proxy AAII is the most appropriate proxy that explains the variations that are not explained by fundamentals, in our case investor sentiment.

III. The Impact of Change in "Noises Traders" Sentiment on Both Future Returns of Financial Assets and their Corresponding Volatilities

Concrete markets are clearly not perfect markets. Certainly there are "noises traders", investors who react to advice from interested dealers or prophecies of "gurus", and even apply "recipes" (popular models) with no economic basis. However, there are also "reasonably rational" investors who have both a pretty good idea of the nature of the fundamentals and how these latter impact changes in prices, and who also react not always consistently with incoming new information. DeBondt and Thaler (1985) show that most investors react to good news too optimistically and to bad news too pessimistically. Adjustment takes place more or less quickly depending on the degree of market efficiency. To put it in statistics jargon, this way of presenting these tendency constitutes the "weak form" of the efficiency hypothesis. The interaction between these two types of investors may explain the difference between price and its fundamental value, the subject of our paper. Such interaction would argue that asset prices are determined by a confrontation between rational investors and "noises traders." (De Long, Shleifer, Summers and Waldman, 1990).

To test this simple approach is to consider the pioneering models that face rational investors with noises traders".

a) "Noise trader" risk in the model of Delong et al (1990)

The authors examine two periods (1 and 2) and two assets: a risk-free asset and a risky asset. They assume that the risk-free asset provides an interest rate noted (r), while the risky asset generates the same dividend per unit of held assets and its total offer is assumed to be equal to unity for each period. In period 2, investors are supposed to consume all their wealth.

Delong et al (1990) propose a utility function:

$$\mu = -e^{-(2\gamma)^{w}} \tag{2.1}$$

This utility is an increasing function of wealth w but it negatively correlates with investor risk aversion, which is defined by the parameter γ. Rational investors are fully aware of the probability distribution of the price of the risky asset in $(t+1)$ while being in (t).

The model of Delong et al (1990) also considers two types of investors:

- Rational investors, denoted i, which are in $1-\mu$.
- Noises traders, denoted n, which are in μ with $0<\mu<1$.

The expected utility of a rational investor, i, is expressed by the following equation:

$$E(U)=c_0+\lambda_t^i(r+P_{t+1}-(1+r)P_t]-y(\lambda_t^i)^2({}_t\sigma_{t+1}^2) \tag{2.2}$$

Ignorance of noises traders of the probability distribution of the price of the risky asset results in a random variable that follows a normal identically and independently distributed law.

$$\rho_t \to N(\rho^*,\sigma_\rho^2)$$

with

ρ^* Average noises traders' optimistic or pessimistic sentiment, according to the negative or positive sign of this term.

σ_ρ^2 A term that measures changes in individuals sentiments.

"Noises traders' maximize their expected utility from the following relationship:

$$E(U)=c_0+\lambda_t^n\left[r+{}_tP_{t+1}-(1+r)P_t\right]-y(\lambda_t^n)^2({}_t\sigma_{t+1}^2+\lambda_t^n(\rho_t)) \tag{2.3}$$

Noises traders' expected utility is obtained by adding a term $(\lambda_t^n(\rho_t))$ to rational investors. According to Delong et al (1990), the additional term $(\lambda_t^n(\rho_t))$ reflects noises traders' mispricing of the expected return following the detention of a λ_t^n unit of risky assets.

Maximizing the past two expected utilities allows us to determine demand for risky assets of the two categories of investors.

The demand for risky assets of a rational investor i is given by:

$$\lambda_t^i=\frac{r+{}_tP_{t+1}-(1+r)P_t}{2y(\sigma_{P_{t+1}}^2)} \tag{2.4}$$

While the demand for risky assets of noises traders is equal to:

$$\text{At } \lambda_t^n=\frac{r+{}_tP_{t+1}-(1+r)P_t+\rho_t}{2y(\sigma_{P_{t+1}}^2)} \tag{2.5}$$

Demands for risky assets by both rational investors' and noises traders allow us to note that these demands are, first, proportional to the expected returns and, second, inversely proportional to the estimated variances, i.e. if they are risk averse, the two categories of investors limit their requests for risky assets.

b) Equilibrium price in the presence of "noises traders"

Equilibrium is achieved when the total demand for the risky asset is equal to its total supply.

Formally, equilibrium is given by the following relationship:

$$\mu(\lambda_t^n)+(1-\mu)\lambda_t^i=1 \qquad (2.6)$$

Substituting λ_t^i and λ_t^n by their expressions, we get the expression of the equilibrium price:

$$P_t=\frac{1}{1+r}\left[r+{}_tP_{t+1}-2y_t({}_t\sigma_{Pt+1}^2)+\mu\rho_t\right] \qquad (2.7)$$

The authors speculate that the variable P_t is a stationary process that follows the same law from one period to another and equilibrium is stable[2]. In this analytical framework, we have:

$${}_tP_{t+1}=P_{t+1}=P_t \qquad (2.8)$$

Thus, equilibrium price of the risky asset is a function only of the exogenous factors:

$$P_t=1+\frac{\mu(\rho_t-\rho^*)}{1+r}+\frac{\mu\rho^*}{r}-\frac{2y}{r}({}_t\sigma_{P_{t+1}}^2) \qquad (2.9)$$

The authors point out that the gap between ρ_t *and* ρ^* is a key element in the equilibrium price of the risky asset. Indeed, the only variable term in this last expression of equilibrium price is ρ^*, which measures the sentiment that summarizes the expectations of "noises traders" of the price of the risky asset.

As long as equilibrium is stable over the period, then we have:

$$\sigma_{P_t}^2=\sigma_{P_{t+1}}^2={}_t\sigma_{P_{t+1}}^2$$

This assumption allows us to determine an expression of equilibrium price which is only a function of exogenous factors and a measure of sentiment that summarizes their expectations of the price of the risky asset:

$$p_t=1+\frac{\mu(\rho_t-\rho^*)}{1+r}+\frac{\mu\rho^*}{r}-\frac{(2y)\mu^2\sigma_p^{\ 2}}{r(1+r)^2} \qquad (2.10)$$

DSSW (1990) interpret this expression of equilibrium prices as follows:

- The first term of the equation indicates that in the absence of "noises traders", the price of the risky asset converges to its fundamental value which is assumed to be 1. Obviously if all investors are rational, efficiency prevails since each is able to price securities correctly, nobody deviates from the good price[3].
- The second term highlights the impact of change in noise traders sentiment on the equilibrium of the risky asset or its fundamental value. The more "noises traders" are optimistic, the more they will tend to buy the risky asset. This excessive optimism is thus reflected in an increase in demand for risky assets that tends to increase the difference between market price and equilibrium or fundamental value.
- The third term shows the systematic price movements of the fundamental value of the security in question, as demand for risky assets is affected by their beliefs or emotions. These latter are obviously not fully justified by economic fundamentals; if they are optimistic, they push prices up bringing the price of the asset beyond the fundamental value of the asset. However, if they are pessimistic the opposite is true.
- The fourth term is considered by DSSW as their own contribution to their model. Indeed, the latter term measures uncertainty about changes in noises traders' sentiment, making assets riskier. When investors are risk averse, they limit their demand for risky assets, resulting, consequently, in a decrease in their price.

Thus, under the action of irrational investors, the price can sustainably deviate from its fundamental value without rational investors (rational arbitrators) being able to fully bring price to its fundamental value because of price risk. In this context, a rational investor called "Smart money" means an investor who not only knows the fundamentals, but also takes into account how the various groups of investors in the market react to price changes and influence them.

However, uncertainty about changes in noises traders' sentiment adds an additional risk to the fundamental risk of the risky assets and consequently it increases its risk. Henceforth, when investors are risk averse, a decrease in demand for a risky asset follows, which tends to increase the deviation between market price and the fundamental value of the security in question.

Thus, the presence of noises traders adds an additional risk called "noise trader risk". The latter is considered endogenous with respect to the fundamental risk which is exogenous and results from a change in economic fundamentals (dividends, expected benefits

[3] Indeed, this result is deduced from the fact that neoclassical finance considers that there is a unique relevant estimation of the fundamental value taking into account available information. For more details see Orléan (2005).

[2] see DSSW page 711

etc ...). The endogenous nature of "noise trader risk" results from the fact that noises traders' demand for risky financial assets is affected by their beliefs or emotions, which are obviously not fully justified by economic fundamentals.

The most important feature of the DSSW model is the existence of unpredictability of the feeling of "noise traders" defined as the demand for risky assets not justified by fundamentals. As arbitrators can in no way predict noises traders' reaction. The disruptive nature of these feelings adds an additional risk to the assets they exchange; a "noise trader risk" or "a sentiment risk". Indeed, noises traders' expectations of asset returns are subject to the influence of their feelings: they overestimate expected returns (compared to rational investors) in some periods and underestimate them in others. Assuming that assets are risky and that all investors are risk averse, prices can diverge from their fundamental values, which explains excess volatility of prices compared to the intrinsic value of assets.

c) Price Volatility in the presence of "noises traders"

According to equilibrium price equation in the presence of "noises traders' expressed by the relationship (2.10) price variance is expressed as follows:

$$\operatorname{var}(P_t) = \operatorname{var}\left[1 + \frac{\mu(\rho_t - \rho^*)}{1+r} + \frac{\mu\rho^*}{r} - \frac{2y}{r} \quad {}_t(\sigma^2_{P_{t+1}})\right] = Var\left[\frac{\mu(\rho_t - \rho^*)}{1+r}\right] = \left(\frac{\mu}{1+r}\right)^2 Var(\rho_t) \qquad (2.11)$$

$$Var(P_t) = \frac{\mu^2 \rho_P^2}{(1+r)^2}$$

The latter relationship allows us to deduce that market price volatility is a function of change in "noises traders" sentiment. Thus, the higher the variability of their sentiment is, the higher the volatility of market price is.

d) Stock returns in the presence of "noises traders"

DSSW also indicate that "noises traders" can obtain higher returns than those obtained by rational investors. DSSW calculate this difference in returns as follows:

$$\Delta R_{n-i} = (\lambda_t^n - \lambda_t^i)\left[r + {}_tP_{t+1} - P_t(1+r)\right] \qquad (2.12)$$

With

$$(\lambda_t^n - \lambda_t^i) = \frac{\rho_t}{2\mu \quad {}_t\sigma^2_{P_{t+1}}} = \frac{(1+r)^2 \rho_t}{2y\mu^2\sigma_P^2} \qquad (2.13)$$

$$\left[r + {}_tP_{t+1} - P_t(1+r)\right] = 2y\sigma^2_{P_{t+1}} - \mu\rho_t = \frac{2y\mu^2\sigma_P^2}{(1+r)} - \mu\rho_t \qquad (2.14)$$

Substituting the last two expressions in the first, we have:

$$({}_t\Delta R_{n-i}) = \rho_t - \frac{(1+r)^2(\rho_t)^2}{2y\mu\sigma_P^2} \qquad (2.15)$$

The expected value of this expression is given by:

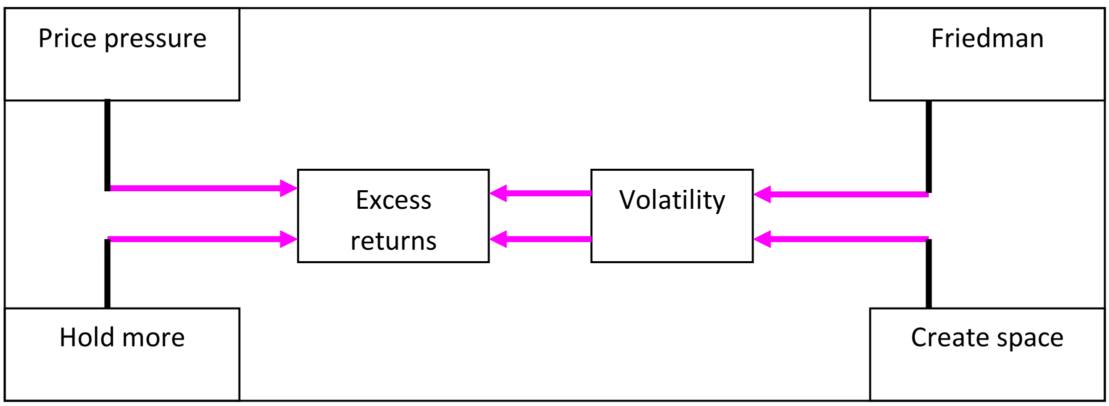
$$E(\Delta R_{n-i}) = \rho^* - \frac{(1+r)^2(\rho^*)^2 + (1+r)^2\sigma_P^2}{2y\mu\sigma_P^2} \qquad (2.16)$$

DSSW distinguish between four behavioral effects that may affect the difference in returns between "noises traders" and rational investors.

- The "Hold more" effect is expressed by the first term of equation (2.16). This effect assumes that as "noises traders" are more optimistic, difference in returns increases.
- "Price pressure" effect is expressed by the first term of the numerator. This effect highlights that as "noises traders" are more optimistic, the more their demand for risky assets increases and therefore it tends to increase their prices. Relative high prices imply, first, estimated low returns and second a low difference in returns.
- The "Friedman" effect: This effect reflects the unpredictability of "noises traders" sentiment, defined as the demand for risky assets not justified by fundamentals. The more noises traders' perception of changes of prices increases, the more the variability of their sentiment increases. Here, we

call for the classic argument, proposed by Friedman (1953). which assumes that irrational investors who buy overvalued securities and sell undervalued securities are necessarily led to disappear in the market since they lose money. Thus, the "Freidman" effect plays a negative role in excess returns; the more the variability of noises traders' sentiment increases, the more their returns decrease.

- The "create space" effect: this effect is measured by the denominator of the second term of the excess returns equation. If the variability of noises traders' sentiment increases, the risk resulting from the difference between the price and its fundamental value increases. The implications of this latter assumption are fundamental because risky arbitration is limited arbitration, hence taking into account investors' risk aversion. It follows then that rational arbitrators cannot eliminate pricing errors and therefore market efficiency is lost. This effect is important as long as the number of "noises traders" and the variability of their sentiment increases in the market.



Source: modified Lee, Jiang, and Indroo (2002) "Stock market volatility, excess return and investor sentiment" Journal of Banking and Finance, vol 26, page 2284.

Figure 1 : illustrates the impact of the four effects on volatility and asset returns.

Figure 1 : The impact of the four effects on volatility and returns of financial assets

It is clear from this figure that the "Hold more" and "Price pressure" effects directly influence expected returns, while the other two effects, namely the "Freidman" effect and "create space" effects, indirectly influence financial assets returns through their influences on noise trades' misperception of the distribution of risky assets price because of their uncertainty. The disruptive nature of noise traders sentiment plays a greater role in assets pricing than knowledge of the distribution of financial asset prices. As arbitrators can in no way predict noises traders' response, this disruptive nature of that sentiment adda an additional risk to the assets they trade (sentiment risk). Indeed, noises traders' expectations of asset returns are subject to their feelings. They overestimate expected returns (compared to rational investor) in some periods and underestimate them in others. If we consider that the exchanged assets are risky and that all investors are risk averse, prices can deviate from the fundamental value of assets. The more sentiment risk is, the more the difference between the price and its intrinsic value is.

This theoretical analysis attests for an excess volatility of stock prices relative to fundamental values. From the two cases, namely investors are not fully rational and arbitration is risky and therefore limited (Shleifer and Summer (1990 P: 19-20)), it follows then that the market ceases to be efficient. Under the action of irrational investors, price can substantially deviate from its fundamental value, without rational arbitrators being able to fully bring the stock price to its fundamental value because of price risk. Moreover, the Noise Trader Approach (NTA) also shows that the Friedman argument (1953) does not hold. DeLong, Shleifer, Summers and Waldman (1990) indicate that noise traders can produce superior returns than those obtained by rational investors. Indeed, the DSSW model (1990), which has been discussed above, provides four effects to explain volatility and financial assets return. On the one hand, the "Hold more" and "Price pressure" effects that reflect the transient impact (short term) of "noise traders" on the difference in returns between them and rational arbitrators mainly results from unpredictability of "noise traders" sentiment. On the other hand, the "Freindman" and "create space" effects highlight the permanent impact (long-term) of "noise traders" on returns, caused by the impact of sentiment risk on returns volatility.

The NTA focuses on market configurations in which noise traders or irrational investors are simultaneously followed by a large number of investors (correlation hypothesis), to the extent that their impact on actual price is real and does not vanish mechanically, unlike under uncorrelated errors configuration.

The "Hold more" effect highlighted by the DSSW model assumes that if "noise traders" are optimistic in average, their demand for risky assets increases. This demand strategy increases market risk and may result in higher returns than those obtained by rational investors. However, as "noise traders" are becoming optimistic, their demand for risky assets tends to increase producing an exuberant increase in prices relative to fundamental values. Consequently, noise traders' over-reaction stimulates a pressure effect on prices, the "price pressure" effect, making assets return to their intrinsic values. The "price pressure" effect plays a negative role on returns, i.e. whatever the feeling of "noise traders", it always tends to deviate the price from its fundamental value. We will try to study the impact of these effects on excess returns of financial assets and volatility in the presence of "noise traders."

DSSW (1990) show that the effect of a change in "noises traders' sentiment on risky assets' excess returns depends on the extent of the" price pressure effect compared to the "hold more" effect. Indeed, if "noise traders" are too optimistic, their demand for risky assets increases and therefore they push prices up by making them deviate from their fundamental values. An increase in demand for risky assets from "noise traders' increases volatility of stock prices in the market, which increases consequently returns of these risky assets.

Adjustment takes place more or less rapidly depending on efficiency degree through the "price pressure" effect. This latter reduces returns of risky assets by reducing the gap between stock prices and their fundamental values. Therefore, this effect has a negative effect on excess returns. However, if "noise traders" are too pessimistic, their demand for risky assets decreases and therefore they push prices downward resulting in a gap between the current and the fundamental value of assets. This lower price generates a "Friedman" effect resulting in a decrease in excess returns. The bigger the impact of the "Friedman" effect is, the lower returns are. Thus, the Friedman effect plays a negative impact on excess returns.

Contrary to the "Friedman" effect, the "create space" effect has a positive effect on excess returns. Indeed, the "NTA" focuses on market configurations in which irrational behaviors are simultaneously hedged by a large number of investors (correlation hypothesis), to the extent that their impact on pricing is real and does not vanish mechanically unlike under uncorrelated errors configuration. This approach strongly disputes the neoclassical claim that makes of arbitration an economic power able to block price deviations caused by the presence of "noise traders". Moreover, the approach notes that current arbitration, as it is actually practiced on a concrete market, is fundamentally different from theoretical arbitration considered by neoclassical theory according to which arbitration is risky and therefore limited as investors are risk averse. This approach thus shows that the "Friedman" effect or Friedman's argument does not hold. It is the "create space" effect that prevails over the "Friedman" effect and therefore irrational investors can generate greater returns than those obtained by rational investors (DSSW: 1990).

e) Impact of "noises traders" on asset prices evolution

In this section, our interest is to test the impact of "noises traders" sentiment on excess returns and their volatilities using the model of Lee Jiang and Indro (2002). Changes in asset prices are the result of the interaction of the four different effects, namely, on the one hand, the "Hold more" and "Price pressure" effects, reflecting investor sentiment effect (optimistic or pessimistic), have a direct impact on excess returns. On the other hand, the "Friedman" and "create space" effects reflect change in investor sentiment caused by uncertainty about the distribution of changes of financial assets prices. This variability in "noises trader" sentiment affects market conditional volatility and therefore leads to abnormal returns, which in turn affect excess returns.

We test the four effects of "noise traders" on the American market. The test will focus on the S & P500 index over the period 2001-2013, expressed in monthly frequencies.

Excess returns are calculated by a three-month Treasury bond also expressed in monthly frequencies. The data were collected from the Datastream database.

In this empirical study, we chose Mvan sentiment index, unlike Lee, Jiang and Indro (2002) who used in an ad-hoc way the sentiment index of Investor Intelligence (II). Our choice is motivated by the results we obtained (see: 1.2.1.2).

i. *Empirical methodology of the test of the four effects of noise traders*

In modern finance, one of the ideas that is widely used to estimate volatility of stock returns is to provide a measure of attached risk. However, this measure is loosely interpreted as long-term volatility, as it seems to be determined by a variety of economic fundamentals of a particular security and is always assumed to be constant throughout the study period. Various studies have shown that return series of financial assets exhibit some heteroscedasticity, which means they are assigned a random value whose variance varies over time. Specifically, as noted by Mandelbort (1963): "... large changes tend to be followed by large changes whatever the sign and small changes tend to be followed by small changes ..." (Mandelbrot 1963, p: 418). Moreover, several authors have highlighted non-normality and thus the leptokurtic character of unconditional return distributions. These latter have indeed thicker tails and sharper peaks than the normal distribution (see for example Fama, 1965). Indeed, these properties of returns distributions have important implications on the evolution of financial assets. The model of time-varying volatility originally introduced by Engle (1982) and then generalized by Bollerslev (1986) was developed to describe returns distributions and thus provide a means to forecast historical volatility of returns.

In standard GARCH models, positive and negative shocks of the same magnitude are assumed to have a systematic effect on conditional volatility. However, various studies have indicated that most financial series are asymmetric, in the sense that negative changes in asset prices are followed by more marked increases in volatility than positive changes of the same magnitude. Many extensions have been made to univariate GARCH processes. We limit ourselves here to present a major extension, namely the threshold GARCH-M model (TGARCH-M) developed by Engle, Lilien and Robbins (1987). This model allows us, on the one hand, to measure the effect of change in time of market conditional volatility of excess returns and, on the other hand, to capture the extreme of conditional volatility of the American market.

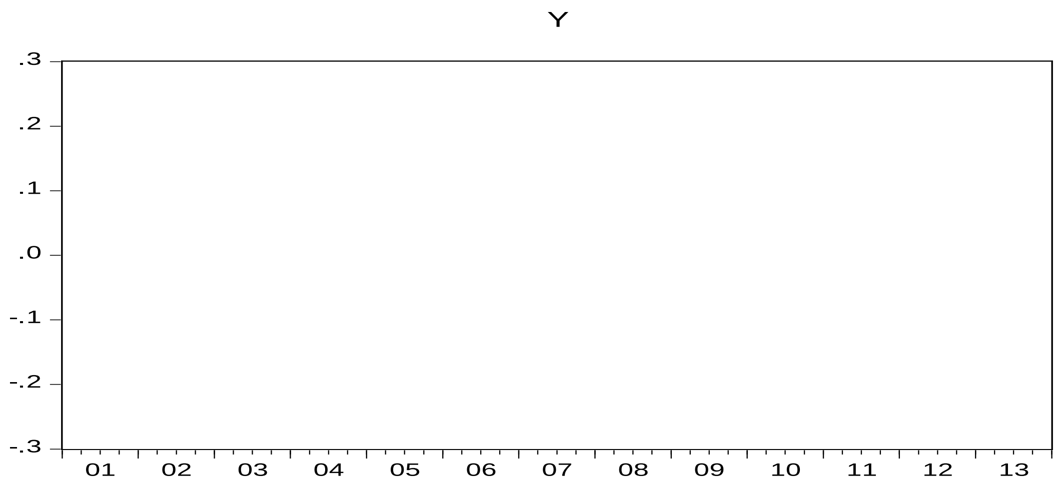
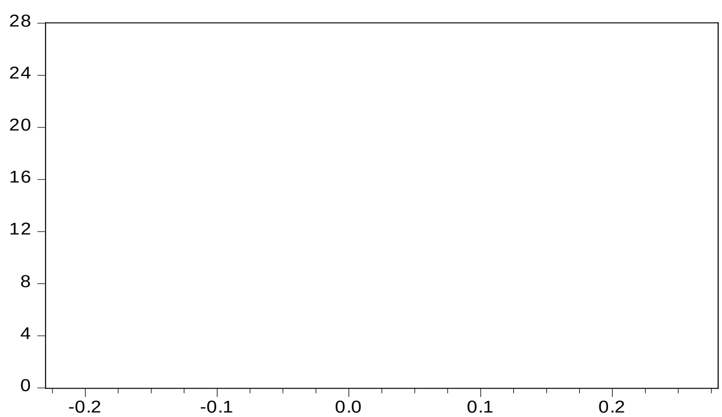


Fig.1 shows changes in returns of the SP500 index over the period 2001-2013. It indicates that returns are highly volatile. We also note that there are volatility clusters. Therefore, volatility changes over time. This observation suggests that we can adopt an ARCH process, especially TGARCH.

Figure 2 : Changes in returns of the SP500 index over the period 2001-2013

Table 4 : Descriptive statistics of returns of the SP500 index



Series: Y
Sample 2001M01 2013M12
Observations 155

Mean	-0.002604
Median	-0.007854
Maximum	0.260201
Minimum	-0.218689
Std. Dev.	0.075935
Skewness	0.340067
Kurtosis	4.476299
Jarque-Bera	17.06318
Probability	0.000197

From the histogram of the returns series, skewness coefficient is different from zero, indicating a presence of asymmetry. The skewness coefficient is positive, reflecting a distribution spread out to the right, i.e. volatilities react to a positive shock than to a negative shock. The Jarque Bera test shows that returns of the SP500 index does not follow a normal distribution, which is a characteristic of financial series. This leads us to estimate a nonlinear model of the ARCH family, especially TGARCH.

Table 5 : Test ARCH

F-statistic	35.87808	Prob. F(1,152)	0.0000
Obs*R-squared	29.40856	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/04/14 Time: 18:14
Sample (adjusted): 2001M03 2013M12
Included observations: 154 afteradjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003064	0.000845	3.628553	0.0004
RESID^2(-1)	0.415989	0.069449	5.989831	0.0000

R-squared	0.190965	Meandependent var	0.005463
Adjusted R-squared	0.185642	S.D. dependent var	0.010225
S.E. of regression	0.009227	Akaike info criterion	-6.520459
Sumsquaredresid	0.012941	Schwarz criterion	-6.481018
Log likelihood	504.0753	Hannan-Quinn criter.	-6.504438
F-statistic	35.87808	Durbin-Watson stat	2.129433
Prob(F-statistic)	0.000000		

With the results of the ARCH test, we can reject the null hypothesis of homoscedasticity in favor of the alternative hypothesis of conditional heteroscedasticity (the probability associated with the TR^2 statistic is zero).

To take account of the ARCH effect, we present conditional variance equation along with the mean equation

Consider the following model:

The model is as follows:

$$\begin{cases} R_{i,t} - r_{f,t} = \alpha_0 + \alpha_1 \sigma_{i,t}^2 + \varepsilon_{i,t} \\ \sigma_{i,t}^2 = \omega_0 + \omega_1 \varepsilon_{i,t-1}^2 + \lambda d_{t-1} \varepsilon_{i,t-1}^2 + \omega_2 \sigma_{i,t-1}^2 \end{cases} \tag{2.17}$$

Asymmetry is modeled by the second equation of the model,

With $d_{t-1} = \begin{cases} 1 & si \varepsilon_{i,t-1} < 0 \\ 0 & si \quad non \end{cases}$

A negative shock $\varepsilon_{i,t} < 0$ has an impact $(\alpha_1 + \lambda)$ on σ_t, while a positive shock influences σ_t, through α_1 only. If the estimation of λ is statistically significant, we conclude that a leverage effect exists. Then, if, a negative or a positive shock impacts asymmetrically conditional volatility. Indeed, Christie (1982), Black (1976) and Shwert (1989) show that a decrease in asset prices generates more volatility than an increase of the same magnitude. To this end, we assume that λ s would be positive indicating asymmetry in conditional volatility of the American market. In other words, positive changes in asset prices are followed by more marked increases in volatility than negative changes of the same magnitude.

The TGARCH-M model is estimated by the likelihood method in the same way as a standard GARCH model.

The estimation results of the M-TGARCH model are summarized in the table above.

Table 6 : Estimation results of the TGARCH-M model for the American market

Dependent Variable: SP500_
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 06/30/14 Time: 00:20
Sample (adjusted): 2001M02 2013M12
Included observations: 155 after adjustments
Convergence achieved after 39 iterations
Presample variance: backcast (parameter = 0.7)

GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) + C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-5.319721	3.330981	-1.597043	0.1103
C	0.012159	0.005199	2.338497	0.0194
Variance Equation				
C	0.000179	0.000104	1.717435	0.0859
RESID(-1)^2	-0.141513	0.079195	-1.786906	0.0740
RESID(-1)^2*(RESID(-1)<0)	0.511684	0.179635	2.848468	0.0044
GARCH(-1)	0.765827	0.104616	7.320385	0.0000

R-squared	0.031603	Mean dependent var	0.001951
Adjusted R-squared	0.025274	S.D. dependent var	0.045606
S.E. of regression	0.045026	Akaike info criterion	-3.623343
Sum squared resid	0.310180	Schwarz criterion	-3.505533
Log likelihood	286.8091	Hannan-Quinn criter.	-3.575491
Durbin-Watson stat	1.829267		

It follows from the above table that a TGARCH-M effect, indicates, on the one hand, a statistically significant impact of conditional variance on excess returns. The parameter α_1 that measures risk premium is statistically significant: The higher conditional volatility of the American market is, the higher excess returns of the S & P500 are. On the other hand, the parameter λ indicates that asymmetry is positive and statistically significant. This parameter is positive, indicating that a positive shock increases more volatility than a negative shock of the same magnitude. Then, we conclude that a leverage effect exists. To understand this phenomenon, Black (1976) indicates that a decline in stock prices compared to bonds of an indebted company leads to an increase in leverage, i.e. indebtedness asymmetrically influences conditional volatility of stock markets.

In line with Black (1976), Nelson (1991) shows that a new market information also asymmetrically influences market conditional volatility. Glosten and Runkle (1993)) indicate that misinformation has more momentum in the market as good news.

ii. *Test of the four effects of "noise trader" on excess returns and conditional volatility of the American market*

To test the four effects of "noise traders" on excess returns and conditional volatility of the American market, we introduce lagged changes in investor sentiment in both the excess returns model to measure the "Hold more" and the "Price pressure" effects and in the conditional variance model to test the "Friedman" and "create space" effects. Like Lee, Jiung and Indro (2002), we use two measures of sentiment risk to test changes in investor sentiment both at the level of excess returns of financial assets of the American market and their conditional volatilities.

The impact of change in irrational investors sentiment $(\Delta S_t = S_t - S_{t-1})$ on excess returns and conditional volatility of financial assets will be estimated by a (TGARCH-M (1)) as a first model. While the impact of change in investor sentiment $\Delta S_t = (S_t - S_{t-1})/S_{t-1}$ in percentage also on excess returns and conditional volatility will be estimated by a second irrational model; "noises traders" (TGARCH-M (2)). Then, the TGARCH-M model in the presence of "noise traders" is expressed as follows:

$$\begin{cases} R_{i,t} - r_{f,t} = \alpha_0 + \alpha_1 \sigma_{i,t}^2 + \alpha_2 \Delta S_{i,t} + \varepsilon_{i,t} \\ \sigma_{i,t}^2 = \omega_0 + \omega_1 \varepsilon_{i,t-1}^2 + \lambda d_{t-1} \varepsilon_{i,t-1}^2 + \omega_2 \sigma_{i,t-1}^2 + \omega_3 D_{t-1} (\Delta S_{t-1})^2 + \omega_4 (1 - D_{t-1})(\Delta S_{t-1})^2 \end{cases} \quad (2.18)$$

with

$$D_{t-1} = \begin{cases} 1 & si \quad \Delta S_{t-1} > 0 \\ 0 & si \quad non \end{cases}$$

$\Delta S_t = S_t - S_{t-1} = VSAAII =$ absolute variance : change in « noises traders » sentiment model (1)

$\Delta \mathrm{S_t} = \frac{\mathrm{S_t} - \mathrm{S_{t-1}}}{\mathrm{S_{t-1}}}$ $\Delta S_t = \frac{S_t - S_{t-1}}{S_{t-1}} = TRSAAII =$ relative variance : change in « noises traders » sentiment model (2)

Statistical significance of α_2 reflects the impact of the "Hold more" and the "Price pressure" effects on excess returns, while the statistical significance of the parameter α_1 reflects the indirect impact of the "Friedman" and the "create space" effects. Moreover, like Lee study, Indro and Jiang (2002) we have introduced two dummy variables D and (1-D) in the conditional variance model in order to capture an asymmetry in the latter, as a result of a change in irrational investors sentiment. The statistical significance of the parameters ω_3 and ω_4 in the conditional variance process reflects the effect of change in "noises traders" sentiment on the conditional volatility of the American market and describes the interaction between the "Friedman" and the "create space" effects. Thus, the resulting effect on excess returns can be positive or negative depending on which of the two effects prevails. To this end, abnormal or excess returns will be even higher (lower) when the "create space" effect is more (less) than the "Friedman" Effect. Given the uncertainty of noises traders, conditional volatility varies with the change in their sentiment (optimistic or pessimistic) and many studies, particularly that of Kahneman and Tversky (1982), pointed out that individual behavior towards risk frequently deviates from rationality. The results of the impact of sentiment risk on both excess returns of financial assets in the American market and on their conditional volatilities are summarized in the table below.

Table 7 : Results of the four interaction effects both on excess returns of financial assets in the American market and on their volatilities

Relative Variance
Dependent Variable: Y
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 09/06/14 Time: 01:10
Sample (adjusted): 2001M06 2013M03
Included observations: 142 afteradjustments
Convergence achievedafter 38 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*RESID(-1)^2*(RESID(-1)<0) + C(7)*GARCH(-1) + C(8)*DDS(-1) + C(9)*DDS1(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-11.76425	3.434040	-3.425775	0.0006
C	0.053960	0.012690	4.252075	0.0000
TRSAAII	-0.001241	0.000550	-2.257126	0.0240
Variance Equation				
C	0.003416	0.000976	3.501072	0.0005
RESID(-1)^2	0.455470	0.198160	2.298492	0.0215
RESID(-1)^2*(RESID(-1)<0)	-0.658225	0.197928	-3.325573	0.0009
GARCH(-1)	0.117264	0.214196	0.547462	0.5841
DDS(-1)	-4.88E-08	7.88E-07	-0.061952	0.9506
DDS1(-1)	-4.04E-06	1.14E-05	-0.355331	0.7223

R-squared	0.212934	Meandependent var	-0.002129
Adjusted R-squared	0.201610	S.D. dependent var	0.069661
S.E. of regression	0.062244	Akaike info criterion	-2.616619

Sumsquaredresid	0.538530	Schwarz criterion	-2.429278
Log likelihood	194.7800	Hannan-Quinn criter.	-2.540491
Durbin-Watson stat	2.008990		

It is clear from this table that the parameters α_1 and α_2 are statistically significant at the 1%, therefore relative variance of investor sentiment seems to explain excess returns of the S & P 500 index. However, the parameters ω_3 *and* ω_4 are not statistically significant, suggesting therefore that change in investor sentiment (noises traders) does not affect conditional volatility of the American financial market.

Table 8 : Results of the four interaction effects both on excess returns of financial assets in the American market and on their volatilities

Absolute variance
Dependent Variable: Y
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 09/06/14 Time: 01:18
Sample (adjusted): 2001M03 2013M03
Included observations: 145 afteradjustments
Convergence achievedafter 37 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*RESID(-1)^2*(RESID(-1)<0) + C(7)*GARCH(-1) + C(8)*VVS(-1) + C(9)*VVS1(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-6.982040	2.048395	-3.408543	0.0007
C	0.036720	0.008622	4.258710	0.0000
VSAAII	0.000309	0.000383	0.806777	0.4198
Variance Equation				
C	0.003225	0.000920	3.504718	0.0005
RESID(-1)^2	0.293085	0.148169	1.978045	0.0479
RESID(-1)^2*(RESID(-1)<0)	-0.245045	0.210941	-1.161672	0.2454
GARCH(-1)	0.102470	0.170391	0.601383	0.5476
VVS(-1)	5.74E-06	4.96E-06	1.156795	0.2474
VVS1(-1)	-3.85E-06	1.72E-06	-2.236848	0.0253

R-squared	0.078607	Meandependent var	-0.000702
Adjusted R-squared	0.065630	S.D. dependent var	0.075456
S.E. of regression	0.072938	Akaike info criterion	-2.512341
Sumsquaredresid	0.755432	Schwarz criterion	-2.327578
Log likelihood	191.1447	Hannan-Quinn criter.	-2.437266
Durbin-Watson stat	2.140342		

The test results of model (2) indicate that absolute variance has improved statistical significance of the parameters ω_3 *and* ω_4 i.e. when change in "noise trader" sentiment is positive, reflecting an optimism (pessimism), conditional volatility of the American stock market over the period 2001-2013 decreases (increases) leading to a subsequent increase (decrease) in excess returns of the S & P500 index. The empirical results we obtained corroborate the theoretical predictions postulated by Shleifer and Summers (1990: 19-20)) and Delong, Shleifer, Summers and Waldman (1990)). From these two positions, namely "investors are not fully rational and arbitration is risky and therefore limited" (Shleifer and Summers (1990) p: 19-20), it follows then that the market continues to be efficient. Under the action of irrational investors, price can sustainably deviate from its fundamental value, without rational arbitrators being able to fully bring price to its fundamental value because of price risk. Furthermore, NTA also indicates that the Friedman argument does not hold. Noise traders' strategies can generate higher returns than those obtained by rational investors (DeLong, Shleifer, Summers and Waldam (1990)) yields.

Consequently, neither arbitration nor selection can eliminate irrational investors, "noise traders".

Indeed, arbitration seems to be unable to absorb all demand shocks. Unpredictability of investor sentiment may limit willingness of arbitrators to bring price to equilibrium. Not knowing that "noises traders" will react, arbitrators will perceive these potential interventions as risky and limit their funds. For example, suppose that in a given period "noise traders" are very optimistic and they inflate prices. The rational investor, convinced that the market is heavily overvalued, adopts the theoretically appropriate strategy to sell overvalued assets. However, at the end of the contract, it is possible that "noise traders' are more optimistic and drive a much larger increase in prices, which will result in a significant loss to arbitrators. Conversely, if "noise traders" are pessimistic about future returns causing a significant fall in prices, the arbitrator buys undervalued stocks anticipating their future increase. Similarly, the investor bears risk upon selling the stocks. "noise traders" are more pessimistic and thus cause a much greater decrease in prices. The disruptive nature of "noises traders' sentiment limits the willingness of arbitrators to act against them, therefore prices can deviate significantly from their fundamental values. This adds an additional risk to the market, known as "noise trader" risk or sentiment risk. Furthermore, NTA shows that the Friedman argument (1953), which assumes that irrational investors who purchase overvalued securities and sell undervalued securities are necessarily led to disappear in the market as they lose money, does not hold.

These results support studies indicating that investor sentiment is an important factor in financial markets (Lee, Shleifer and Thaler (1991), Shiller (2000) and Shleifer (2000)).

IV. Conclusion

The approach of "noise traders' claims that stock prices are fixed through a dynamic relationship between them and rational arbitrators (Shiller (1984), Shleifer and Summers (1999)). In other words, investor sentiment is involved in the process of generating returns. According to proponents of behavioral finance, in addition to fundamental innovations and macroeconomic variables, investor sentiment may induce co-movement of prices. Indeed, arbitration seems to be unable to absorb all demand shocks. Unpredictability of individual investor sentiment can limit the willingness of arbitrators to bring price to equilibrium. Not knowing that "noises traders" will react, the arbitrator will perceive these potential interventions as risky and limit their funding in response to irrational investors. The disruptive nature of "noises traders' sentiment limits the willingness of arbitrators to act against them, therefore price may deviate significantly from its fundamental value. This adds an additional risk to the market, known as "noise trader risk" or sentiment risk.

In this paper, we reported an empirical study in two parts:

- In the first part, we conducted econometric tests to identify the sentiment measure that best reflects variations not explained by fundamentals. As part of this empirical study, we used two measures of sentiment, based on sample surveys. The tests show that the sentiment index of SENTAAII is the most appropriate proxy that explains variations unexplained by fundamentals in the American market.
- In the second part, inspired by the work of DSSW (1990), we tested the impact of "noise trader" risk, both on excess returns and on their volatilities. To this end, we used a TGARCH-M model which, like Lee, Jiang and Indro (2004), examined the relationship between market volatility, excess returns and investor sentiment.

Our results on the American market show, first, that change in investor sentiment has a significant effect on excess returns (the results of model (1)). On the other hand, change in sentiment has a significant effect on conditional volatility of the American stock market that causes an increase (decrease) in excess returns (the results of model (2)).

Following these results, we can conclude that the presence of "noises traders' in the market helps explain excess volatility of stock prices relative to their fundamental values, as unpredictability of investor sentiment may limit the willingness of arbitrators to bring prices back to equilibrium. Not knowing that noises traders will react, the arbitrator will perceive their potential interventions as risky and limit their funding in response to irrational investors, leading to a persistent gap between prices and their fundamental values. These results gave birth to alternative theories of prices co-movement. They claim that asset prices are determined by a dynamic relationship between noises traders and rational arbitrators (Shiller (1984), Shleifer and Summers (1999)). In other words, investor sentiment is involved in the process of generating returns.

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