Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 6, 10114-10125

# Herding Behavior In Tunisian Stock Markets During COVID-19 Pandemic

**Kamel Bel Hadj Miled**

*College of Science and Arts – Sajir , Shaqra University, Saudi Arabia*
*Laboratory of Management of Innovation and Sustainable Development (LAMIDED), University of Sousse, Tunisia., E-mail:* kamelbenmiled@gmail.com

## Abstract

This study, highlights the presence of herd behavior in the Tunisian stock market during the coronavirus epidemic. We used two different empirical methodologies to detect the presence of mimetic behavior in the Tunisian financial market before and during the COVID-19 pandemic. The first is Based on the investigation of Christie and Huang [1995], and Dimerer and Kutan [2006], using Cross-Sectional Standard Deviation (CSSD). The second models is developed by Chang Cheng and Khorana [2000], using a non-linear regression specification by the "Cross-Sectional Absolute Deviation" (CSAD) method. We show that the dispersions of equity returns tend to decrease during periods of extreme market movements. The results obtained are consistent with the absence of mimetic behavior on the Tunisian stock market during the coronavirus epidemic. The last technique is explored by the price-volume and Yield-volume relationship through the study of Granger causality. The results obtained confirm the absence of herd behavior on the Tunisian stock market.

**Keywords:** Herding behavior; Tunisian stock markets, Covid-19

**JEL:** G10; G14; G40

## 1- Introduction

The worldwide spread of the SARS-CoV-2 virus in early 2020, known as COVID-19, and the second wave that followed this fall has continued to disrupt global economic and financial activity. This health crisis is therefore plunging the world economy into uncertainty which can lead to changes in the expectations of stock market players and impose a significant impact on individual investment behavior; however, few studies explore the effects of COVID-19 on investment behavior in financial markets (Mnif, Jarboui and Mouakhar 2020). Behavioral mechanisms have a primary role in the emergence of "smart money" to qualify rational investors, and "noise traders" allow irrational investors. Mimetic can be interpreted as a rational or irrational form of investor behavior.

Pioneering research spanning the field of behavioral finance suggests that price deviations from their fundamental values emanate from the interaction of these two categories of investors. This behavioral perspective of finance follows on from the work of Lee, Shleifer, and Taler [1990,1991], Hirshleifer [2000], Barbaris and Thaler [2003], Gemmil and Thomas [2002], Shleifer [2000], Aktas and al [2004], and Orlean [1999,2007]. These authors show that "messy traders" create an additional risk to limit the arbitrage process. Indeed, arbitrageurs (or smart money) define their interventions when they cannot adequately anticipate the change in the feelings of noises traders. This amplifies the divergence between the observed price and its fundamental value and consequently excessive volatility. Mimetic was the covid 19 pandemic several stakeholders faced the risks of unexpected change in investor behavior, especially noises traders.

**Covid-19: the first exogenous crisis in the history of economic thought**

The economic crisis linked to the Covid-19 health crisis affects stock exchanges and financial markets. There has been a significant drop in stock market indices on the leading stock exchanges, of the order of 20% since January 2020, following the Covid-19 pandemic and its negative consequences on the world economy. According to a study by the Institute of International Finance (IIF), as of April 2, the drop in world stock markets since the start of the year represents a loss of value of $ 18 trillion, or 6.5 times France's GDP for the year 2019. On the other hand, all sectors are affected by the fall in stock prices. Of course, we find more particularly banks (impact of policies), insurance (compensation for victims), travel and leisure (containment measure) as well as industry (fall in investments). Finally, concerning the unlisted, a study by KPMG dated April 9 shows that the expected rate of return on equities (i.e. the discount rate) would drop from 8% to 8.5% as a result. of the pandemic. This means that the valuation of a company automatically drops by 5.9%, at constant financial figures before and during Covid-19 pandemic.

The announcement of the emergence of a new variant led to the fall of the flagship CAC 40 index of the Paris Bourse, it fell 4.40% to 6764.80 points at 08:22 GMT. London lost 3.31% and Frankfurt more than 3.19% soon after opening. The European stock markets ended very sharply, Paris having fallen for its part by 4.75%. The flagship CAC 40 index fell 336.14 points to 6,739.73 points, canceling all its gains since the beginning of the month. This is his worst session since March 18, 2020, when the first confinement was introduced in France. The variant, called "Omicron", or B.1.1.529, has the potential to spread very quickly, scientists say. They are also unaware of whether the vaccines currently available are effective against him. While several countries, including France, the United Kingdom, Italy, and Germany, have already banned the arrival of travelers from southern Africa, the President of the European Commission called on all States this Friday afternoon member to suspend flights to this region and other countries already affected by the variant. The stock market values linked to tourism or travel, already severely affected by the pandemic, were already the most affected, the risk continuing their tumble in the coming days. At the opening this Friday morning, the aircraft manufacturer Airbus dropped 12% and the German airline Lufthansa more than 14%.

In Tunisia, the COVID-19 crisis adds new constraints to investment in the stock market. The repercussions of the current crisis cast a shadow over the outlook for listed companies at least over the next two years (period 2020-2021). The epidemic is also having a significant impact on the behavior of investors who are inclined to wait and see their big purchases and postpone their investment program. The purpose of this paper is to empirically examine from a behavioral finance perspective the possible presence of herd behavior in the Tunisian stock market during the COVID-19 pandemic to understand investment behavior in financial markets in these conditions.

On this basis, the second section will present an overview of the literature dealing with the different mimetic measures in the financial market. The third section will report the empirical methodology adopted (sample presentation, test and comments) to test and explain the presence of herd behavior in the Tunisian stock market. The conclusion, which is the subject of the fourth section, will take up the main lessons learned from the empirical study carried out as part of this paper.

## 2- Literature review

In general terms, «mimetic " can be defined as a set of individual behaviors with correlations. However, many investors may buy the same securities for the simple reason that, acting independently, they have received correlated information. Therefore, the notion of mimetic involves both systematic and erroneous decision-making on the part of a group. Intuitively, an investor acts by mimetic when he is ready to make a given investment while ignoring the decisions of other investors but changes his mind when he sees that the latter has given up on that investment. There are several explanations for why the decisions of their peers influence rational investors. First, the latter is likely to have private information on the performance of the proposed investment, and their findings reveal this information. Second, it is interesting for a fund manager to imitate other managers when his method of remuneration is based on a benchmark return. Finally, investors may have an intrinsic preference for conformism. A distinction should be made between "intentional mimetic" and "fallacious mimetic ". The latter behavior occurs when a group has the same objectives and the same set of information and each member makes similar decisions independently. There are some fundamental elements that this form of mimetic can build on. For example, an unexpected rise in interest rates has the effect of reducing the attractiveness of equities: all rational investors may then be led to reducing the share of these securities in their portfolio, without their behavior being able to be , referred to as mimetic. Mimetic is intentional when investors deliberately mimic the behavior of their peers. Mimetic can also be irrational, especially when investors adopt a dynamic investment strategy (positive reactivity or positive feedback), i.e., when they buy stocks that have recently performed better than the reference index. This form of mimetic behavior is not rational under the efficient market hypothesis since market prices reflect all the available information.

Several research papers on institutional investors have developed alternative measures for speculation, the best known of which are; Lakonishok, Shleifer, and Vishny (1992) with the measure "LSV", Grinblatt, M., Titman, S., & Wermers (1995) with the use of "PCM", Christie and Huang (1995) with the measure of the transverse dispersion of yields, Hwang (2001) also uses the transverse dispersion but differs from it by a measure relating to factors (betas), Rama Cont, referring to the volume.

## 2-1: LSV measurement

Several empirical works have used this statistical method of mimetic developed by Lakonishok, Shleifer, and Vishny [1992]; these authors define mimetic as the average tendency of investors to buy or sell particular securities at the same time. This measurement is based on the transactions carried out by a set of individuals over time. Formally, the LSV mimetic measure is defined as follows:

$$H(i,t) = \left| Ip(i,t) - p(t) \right| - AF(i,t)$$

With

- H (i, t) the measure of mimetic relative to a faction i at time "t"
- p (i, t) = B (i, t) / (B (i, t) + S (i, t)) is the proportion of investors in the group who buy shares i.
- B (i, t) and S (i, t) the number of investors who buy (sell) shares “i” at time "t"
- p (t) the average of p (i, t) over all the shares “i” which at least one investor has traded in the group.
- Finally, AF (i, t) denotes the adjustment factor: AF (i, t) = E [I p (i, t) -p (t) j] where the expectation is calculated under a null hypothesis d 'absence of mimetic, so that B (i, t) follows a binomial distribution with parameter p (t).

If N (i, t) = B (i, t) + S (i, t) is high enough, the adjustment factor is zero. Values of H (i, t) significantly different from zero can be interpreted as a sign of mimetic behavior.

However, the mimetic measurement by the LSV method [1992] is insufficient at three levels:

a) First, it only uses the number of investors present on either side of the market, without taking into account the number of shares bought or sold.

b) Second, it does not make it possible to identify inter-temporal negotiation profiles. For example, the LSV measure can be used to test whether mimetic on a particular title persists over time, and to study whether [H (it) / H (i, tk)] = E [H (i, t)], but this measure cannot tell us about the securities (i) that investors continue to mimic. In addition, the choice of the investment category (i) and the time interval (t) during which the data is observed is significant.

c) Finally, the frequency with which investors trade security is essential for choosing the time interval.

## 2-2: The PCM measurement

Wermers [1995] proposed a new measure of mimetic that considers both the direction and the intensity of investor trading activity. This measure is known as portfolio change (PCM) in correlated trading. It assesses the extent to which the portfolio shares assigned to various stocks by different investors move in the same direction. The PCM is defined as following;

$$Pt,T^{I,J} = \frac{1}{\sigma t J^{t}} + \frac{1}{N} \sum_{N=1,t}^{n} \Delta W_{n},t^{I}\, \Delta W_{n},t-\tau^{J}$$

• Represents the variation of the share of security n in the portfolio I during the period [t-1, t].

• Is the variation of the share of security n in portfolio J during the period [t-t-1, t-t].

• Nt: Is the number of shares located at the intersection of the basket of negotiable securities of the portfolio I during the period [t-1, t] and the basket of negotiable securities of portfolio J during the period [tt-1, tt ].
• Finally, is the mean of the cross-sectional standard deviations product. It is defined as follows;

$$\sigma t J^{t} = \frac{1}{T}\sum_{t}^{T} = 1\,\frac{1}{N_t}\left(\frac{1}{N}\Delta \mathcal{W}\mathrm{n},\mathrm{t}^{\mathrm{I}}\ 2\,\frac{1}{N}\Delta \mathcal{W}\mathrm{n},\mathrm{t} - \tau \mathrm{J}2\right)^{1/2}$$

## 2-3: The measure of Christie and Huang

The measure of Christie and Huang [1995] is based on a measure of the transverse dispersion of yields:

$$CSSD = \sqrt{\frac{\sum_{i=1}^{N}(Rit - Rmt)2}{N-1}}$$

With;
- Rit is the return on asset i at time t.
- Rmt is the market return.

In the case of mimetic, the returns will tend to align with the market return, and an unusually low dispersion should be observed. Other more recent measurements propose adaptations of this dispersion to consider variations in volatilities over time, distributions of betas in a multi-factor model (Hwang measure).

Christie and Huang [1995], in their study on the relationship between volume and mimetic, show that this following behavior on a particular asset, the result of coordinated action, must be accompanied by a significant increase in volume. Cross-sectional dispersion measurements must therefore be negatively correlated with volume. We will see the importance of volume in Cont's model, as well as in other works, namely Blume, Easley and O'Hara [1994], Rossi, and Tauchen [1992] in their analysis of the relationship between volume and performance, find that there is a close relationship between the volume and the quality of information conveyed by past price movements.

## 2-4: The measure of Hwang

Like the three other measurements, LSV, PCM, CH, the measure of Hwang [2001] is also a measure of transverse dispersion. However, Hwang's measure differs by an act relating to factors (betas). In a linear multi-factor model, the returns of the asset (i) at the time (t) can be expressed as a function of market returns, and the various factors assumed to be uncorrelated with each other:

$$r_{it} = \alpha_{it} + \beta_{imt} r_{mt} + \sum_{k=1}^{k} \beta_{ikt} + \varepsilon_{it}$$

Relative measurement is undoubtedly more exciting and relevant for groups that assess their performance in relative terms against a benchmark, most often represented by the market itself or sector indices.

# 3: DATA AND METHODOLOGY

## 3-1 DATA

In this study, we use stock returns of thirty companies included in the Tunisian stock market index (BVMT-index). BVMT index includes 87 firms on Tunisian Stock Market. In order to get a continuous and significant data, we have retained only 30 companies with most available data and quotations. All data were extracted from Tunisian stock exchange market. The data set used in this study consists of daily closing price data from 1st January 2017 to the to 31st December 2021 and was divided into two sub-periods: The pre-pandemic period -1st January 2017 to 18thJuly 2019 and the in-pandemic period 2nd September 2019 to the 31st December 2021. This data has been collected from the Tunis Stock Exchange Market (BVMT).

## 3-2 METHODOLOGY

Academic research has gone to considerable effort to understand participants' behavior in the financial market and the impact of these behaviors on asset prices. Different models have been proposed in the economic literature for studying these behaviors, most of which are based on the idea that investors ignore their own private information and watch the investment decisions made by others. The study by Christie and Huang [1995] and Chang Cheng and Khorana [2000] and recently by Dimerer and Kutan [2006] on the Chinese market is mainly based on the argument which indicates that the presence of mimetic behavior minimizes the deviation of individual returns relative to the returns of the market as a whole and therefore the dispersion tends to decline. Therefore, while investors tend to agree with the general market opinion, individual returns do not stay far behind market returns.

In this part, we develop two empirical methodologies to detect the presence of mimetic behavior in the Tunisian financial market before and during the COVID-19 pandemic. The first is based on the investigation of Christie and Huang [1995], and Dimerer and Kutan [2006], the latter measuring the potential influence of herding behavior on the price by examining the price and the dispersion of returns using Cross-Sectional Standard Deviation (CSSD) as a measure of proximity to the market mean. The second is based on the study by Chang Cheng and Khorana [2000] using a non-linear regression specification by the "Cross-Sectional Absolute Deviation" (CSAD) method.

### 3-2-1: The investigation of Christie and Huang [1995], and Dimerer and Kutan [2006]

These authors suggest that investors ignore their own beliefs in favor of market consensus during "Stress Market" times. They offer CSSD (Cross-Sectional Standard Deviation) to detect herd behavior in the market.

CSSD is defined as follows:

**CSSD =** $$\sqrt{\frac{\sum_{i=1}^{N}(Rit-Rmt)2}{N-1}} \qquad \textbf{I(1)}$$

With;

Rit: Design the observed performance of firm i;

$$R_{it} = IN\left(\frac{R_t}{R_t - 1}\right)$$

Rmt: Design the cross-sectional average of N portfolio returns.

$$R_{mt} = \frac{1}{N}\sum_{i=1}^{N} R_{it}$$

Christie and Huang [1995] and Demirer and Kutan [2006] postulate that dispersion quantifies the degree to which individual asset returns gravitate to market portfolio returns; therefore, if investors follow the average market opinion (mimetic or gregarious behavior), the returns will not deviate too much from the total market return, which will lead to a reduction in dispersions compared to the average. Thus, if the returns are not widely dispersed compared to the average, the CSSD will be below; on the other hand, the higher this deviation, the more the level of CSSD increases accordingly.

Consistent with Christie and Huang [1995] and Dimerer and Kutan [2006], the mimetic behavior test is appropriate to examine the level of dispersion during periods of extreme market movement.

More precisely, it is a question of testing the following regression:

$$CSSD_t = \alpha + \beta^L D_t^L + \beta^u D_t^U + \varepsilon_t$$
**I(2)**

DtL = 1: If the market return on date "t" is located at the lower end of the distribution and will take the value 0 otherwise.

DtU = 1: If the market yield at date "t" is located at the extreme upper end of the distribution and will take the value 0 otherwise.

Dummy variables are designed to capture the differences in investor behavior in an extreme rise and fall from the market average.

The coefficient (α) measures the average dispersion of the sample in the two ends (rise and fall) of the distribution of returns. The presence of negative estimates of reflecting a herd behavior manifested by investors, on the other hand, positive estimates, indicate the absence of this mimetic behavior.

According to the work of Dimerer and Kutan [2006], the market returns will be calculated at the threshold of 1% and 5% of the extreme tails of the distribution, even for Christie and Huang [1995], the extremes of fall and rise in price movements are estimated using 1%, 2%, and 3%.

In our sample, we chose a threshold of 5% because we assume that this threshold will give us better results. So we will retain the criterion of 5% to the right and to the left of the distribution of returns.

From a statistical point of view, this translates into the following confidence interval:

$$P[\bar{R} - t\frac{\alpha}{2}\frac{\sigma}{\sqrt{N}} \le R \le \bar{R} + t\frac{\alpha}{2}\frac{\sigma}{\sqrt{N}}] = 1 - \alpha = 95\%$$

$$\sigma = \frac{1}{N}\sum_{t=1}^{723}\sigma_t$$

$$\bar{R} = \frac{1}{N}\sum_{t=1}^{723} R_{mt}$$

N = 723
The value read on the table, for α = 0.95 → t α / 2 = 2.576
IC = [0.0010 - 2.576 * ; 0.0010 + 2.576 * 0.0316 ]
IC = [-0.0020 ; 0.0011]
The variable Dummy $Dt^L$ is assigned the value 1 for all returns that lie to the left of the lower bound of the confidence interval and the value 0 otherwise. We grant the Dummy variable $Dt^U$ the value 1 for all the returns which lie to the right of the confidence interval and the value 0 otherwise.

### 3-2-2: Investigation by Chang Cheng and Khorana [2000]

The work of Chang, Cheng, and Khorana [2000], has been considered as a second precursor to the detection of gregarious (mimetic) behavior by cross-sectional standard deviation tests and, at the same time, a critique of the work of Christie and Huang [1995] and Dimerer and Kutan [2006].

Cheng Cheng and Khorana [2000] focus on the results of the regression estimation of these latter authors, which should be commented with caution due to the non-normality of the yield distribution. They postulate that the tendencies of investors to follow market behavior by ignoring their own information during periods of average price change induce a linear and increasing relationship between dispersion and market returns. They add that this relation can become non-linear, increasing or even decreasing. Chang Cheng and Khorana [2000] proposed a new measure of mimetic behavior to overcome these criticisms. This is the Cross-Sectional Absolute Standard Deviation (CSAD). They show that if investors mimic, then a non-linear relationship is inferred between the absolute cross-sectional standard deviation of returns and the average market return during periods of market movement.

The absolute value of the deviation (Absolute Value of deviation, AVD) of the return on security "i" at date "t" with respect to the market return is defined by the following equation:

**AVD = I $\beta_i$ - $\beta_m$I Et I $r_m$ - $r_f$ I II(1)**

By taking the arithmetic mean of the "AVDs" of all the titles, it is possible to have a Proxy of the expected absolute transverse standard deviation denoted by E (CSAD).

With

$$E(CSAD)t = \frac{1}{N}\sum_{i=1}^{N}|\beta i - \beta m|Et|rm - rf|$$

**II(2)**

Or

$$(CSAD)t = \frac{1}{N}\sum_{i=1}^{N}\left|Rit - \bar{R}mt\right|$$

**II(3)**

The derivation of this relation compared to the expected return of the market, makes it possible to have:

$$\frac{\partial E(CSADt)}{\partial E(rmt)} = \frac{1}{N}\sum_{i=1}^{N}|\beta i - \beta m|$$

**II(4)**

$$\frac{\partial^2 E(CSADt)}{\partial E(rmt)} = 0$$

According to Chang Cheng and Khorana [2000], the mimetic behavior is verified in case the relation between the indicator E (CSADt) and the expected return of the market will be nonlinearly decreasing, on the other hand, the presence of a standard deviation positive absolute transverse and linearly correlated to the expected return from the market (Rmt) is an indicator of the absence of mimetic behavior between investors. So the study of herd behavior is due by the study of the relationship between CSAD and Rmt.

Our work is started by calculating the absolute transverse standard inserts of the returns following formula II (2). Then, it is a question of reverting these total transverse returns on the average and square returns. In this case, the presence of a negative and statistically positive y2 indicates the presence of mimetic behavior.

Formally, it is a question of estimating the following regression

**$CSAD_t$ = α + yt │ Rmt │ + $Y_2$ $Rmt^2$ + ϵt II(5)**

This regression, like that of Christie and Huang [1995] and Kutan [2006], identifies mimetic behavior, in which participants follow aggregate walking behaviors with opinions based on collective market actions. Therefore, the increase in CSAD is expected to be less proportional for extreme values of Rmt.

The coefficient y2 will capture the non-linearity between CSAD and the yield. This quadratic relation suggests that the CSAD reaches its maximum when: Rmt = -yl / 2y2

### 3-2-3 Granger causality test on torque (volume; price)

To understand this notion of causality, let Xt and Yt denote two variables having the following information sets

$X_t^{(t)}$ = {X1, X2……. $X_1$}

Yt(t)= {Yl, Y2….. Yt}

According to Granger, these two variables can technically take the following four forms;

(i) Xt does not cause Yt if and only if:

Prob (Yt / Ωt) = Prob [Yt / (Ωt - Xt (t)] where (Ω t - Xt (t)) represents the informational set Ωt excluding Xt (t)

(ii) Xt causes Yt if and only if

Prob (Yt / Ωt) = Prob [Yt / (Ωt - Xt (t)]

Xt instantly causes Yt if and only if:

Prob [Yt + 1 / (Ωt - Xt + 1, (t))] = Prob (Yt + 1 / Ωt).

Likewise; Yt instantly causes Xt if and only if:

Prob [Xt + 1 / (Ωt - Yt + 1 (t))] = Prob (Xt + t / Ωt).

To detect the causal relation between these two variables (Xt and Yt), it is necessary to test: The null hypothesis Ho: Design that Xt does not cause Yt, against the hypothesis HI: Xt causes Yt in the sense of Granger.

Formally, these assumptions are presented as follows:

H0:

$$y_t = a_0 + \sum_{j=1}^{q} a_j y_{t-1} + \varepsilon_t$$

H1:

$$y_1 = b_0 + \sum_{j=1}^{q} b_j y_{t-1} \sum_{j=1}^{p} c_j x_{t-j} + \varepsilon_t$$

The causality test statistic is presented as follows:

$$F = \frac{(SCR_r - SCR_U)/P}{SCR_U/(n-k-1)}$$

Or SCRr: Sum of the squares of the residuals of the constrained model

SCRu: Sum of the squares of the residuals of the unconstrained model.

P: number of delay

n: number of observations

k: number of independent variables

Under H0, we have F follows a Fisher law and is compared to F * (k, n-k-1).

When F> F *, we reject the null hypothesis, and we, therefore, accept the causality between the two variables.

We consider that it is useful and relevant in the context of this paragraph to analyze the relationship between returns and trading volume. The role of transaction volumes in the formation of returns has been demonstrated by many authors (Tauchen and Pitts [1983], or Karpoff, [1987], The existence of this relationship can be based on theoretical considerations (Copeland [1976], or Epps and Epps [1976], for the link between volume and volatility; Epps [1975], or Araújo Mello, R. (1987) for the relationship between volume and yield), but for the most part, the approach adopted by most of the work on this subject remains empirical (Karpoff [1987]. Most of these studies have shown the existence of " a positive correlation between the volume and the absolute value of the return (or the volatility of the return) in most markets. Within the framework of this part, we test the possible existence of a mimetic behavior manifested through the causality test in the sense of Granger [1969] between volume and yield.

Formally this causality results in:

$$R_t = \alpha_0 + \sum_{j=1}^{J} \ell_j R_{t-j} + \sum_{k=1}^{K} \beta_k V_{t-k}$$

$$V_t = \mu_0 + \sum_{n=1}^{N} \delta_n V_{t-n} + \sum_{p=1}^{P} \phi_p R_{t-p}$$

Or;

Rt: Refers to the returns of the portfolio

Vt: Refers to the volume of the portfolio

The returns can be determined by using the weighted average of the returns of the firms constituting our sample. The choice of appropriate delay is dictated by the minimization criterion of the Akaike and Schwartz criteria

## 4. EMPIRICAL RESULTS

### 4.1 Summary Statistics

Table 1 shows the average daily returns descriptive statistics and the absolute and straightforward transverse standard deviations of these returns covid 19 pandemic in Tunisia. As shown in this table, the average of the daily market returns, the CSAD and the CSSD, and the kurtosis coefficient are positive. Due to the excess kurtosis, the two series are non-normal (at the 1% threshold) using the Jarque-Bera statistics. The Standard deviation of average returns is an indicator of the volatility of the Tunisian market; it is equal to 0.207%, before the covid 19 pandemic and 1.11% during the covid 19 pandemic. However, if we compare this result with that found by Demirer and Kutan [2006] on the Chinese market, we see a gap between the two values. Indeed, returns on the Chinese market are characterized by high volatility, with a standard deviation (2.0261%) in the financial and insurance sector. Therefore, if the returns are not widely dispersed from the average, the CSSD will be low; on the other hand, the higher this deviation, the more the level of CSSD increases accordingly.

**Table (1) Summary statistics**

| | **Before COVID-19 pandemic** | | | **During COVID-19 pandemic** | | |
|---|---|---|---|---|---|---|
| | CSSD | Rmt | CSAD | CSSD | Rmt | CSAD |
| **Mean** | 0.007373 | 0.001616 | 0.0014 | 0.01113 | 0.002341 | 0.00110 |
| **SD** | 0.00207 | 0.001271 | 0.0040 | 0.011177 | 0.005687 | 0.0015 |
| **Skewness** | 2.081182 | 2.481448 | 3.1132 | 7.853332 | 7.181348 | 1.5041 |
| **Kurtosis** | 26.5126 | 34.26164 | 26.9179 | 91.15834 | 80.06181 | 9.4003 |
| **J-B-test** | 18773.19* | 31816.45* | 149289.3* | 243811.8* | 186983.5* | 466.17 |

Note: * denotes significance at the 1% level

## 4.2 Cross sectional standard deviation

Table 2 summarizes the regression results for herding behavior during COVID-19 pandemic. the average dispersion measured by the coefficient"α" is positive and statistically significant.

**Table (2): Regression of $CSSD_t$**

| | **Before COVID-19 pandemic** | **During COVID-19 pandemic** |
|---|---|---|
| | CSSD | CSSD |
| $\alpha$ | 0.0077 (69.94)* | 0.012 (23.63)* |
| $\beta^L$ | -0.0026 (-1.744)* | -0.0022 (-1.14) |
| $\beta^U$ | -0.0017 (-4.466)* | -0.0022 (-1.76)* |
| **R-squared($R^2$)** | 0.0414 | 0.0124 |
| **Adjusted R-S** | 0.037 | 0.01 |

NOTE: * DENOTES SIGNIFICANCE AT THE 1% LEVEL

The "βL βU" estimates are all negative and significance at the 1% level, showing the decrease in the transverse standard deviation during periods of gait movement. These results verify the presence of mimetic behavior among Tunisian investors. This hypothesis confirms the propositions of Christie and Huang [1995] and Dimerer and Kutan [2006] as well as Chang cheng and khorana [2000]. These authors show that negative estimates indicate that the deviation of individual returns from the average market return tends to decrease, which implies that investors tend during this period to align with the average behavior of all operators. Finally, it should also be noted the weak explanatory power of the model.

## 4.3 Cross section absolute deviation

The Regression of the dispersion of returns on market returns gives the following results:
CSADT = $\alpha + y_1 \left| R_{mt} \right| + y_2 R^2_{mt} + \epsilon_t$

**Table (3): Regression of CSADt**

| | **Before COVID-19 pandemic** | **During COVID-19 pandemic** |
|---|---|---|
| | CSAD | CSAD |
| □ | 0.005241 (42.45058)* | 0.008133 (41.3079)* |
| **$y_1$** | 0.612868 (11.8176)* | 0.812118 (19.2327)* |
| **$y_2$** | 13.33872 (3.552)* | 11.72767 (18.08411)* |
| **R-squared($R^2$)** | 0.833164 | 0.41602 |
| **Adjusted R-S** | 0.83301 | 0.413 |

NOTE: * DENOTES SIGNIFICANCE AT THE 1% LEVEL

It emerges from this table that the model's explanatory power is high, exceeding 83% (k2 = 0.833164). In addition, R-squared (R2) is very close to 1, which verifies the significance of the model. The quadratic term coefficient is positive and statistically significant at the 1% threshold and the coefficient of the absolute value of the performance of the market, which indicates the existence of a non-linear relationship between the absolute cross-sectional standard deviation and market performance. These results suggest the absence of mimetic behavior and suggest that investors do not follow average market opinion.

This regression displays an average level of dispersion in a market characterized by an almost zero return but statistically significant, equal to 0.005241 (t - statistic: 42.45058) with a positive yl coefficient and statistically significant equal to 0.612868 (t- statistic: 11.8176). At the end of these two tests, it seems that the analysis of gregarious behavior, by referring to the techniques of transverse standard deviations, leads to opposite conclusions. On the one hand, the presence of mimetic behavior in the case of the regression test carried out by Christie and Huang [1995] and Demirer and Kutan [2006], on the other hand, the rejection of this hypothesis within the framework of the regression of Chang Cheng and Khorana [2000].

Under these conditions, we think that it is helpful to refine our empirical investigation on herd behavior by studying the relation price volume of transactions. Indeed, it was previously presented that under certain conditions; the investor abandons their source of information to follow the behavior of other agents blindly.

Two primary trading indicators in the stock market are stock performance and trade volume. These factors are jointly determined by the same market dynamics and may contain relevant information about the security. Yields are widely studied to forecast and analyze historical price information, while there are few interpretations of the past trading volume. According to Blume, Easley, and O'Hara [1994], in their analysis of the relationship between volume and yield, volume indicates the quality of information conveyed by past price movements. Vaillant, Rossi, and Tauchen [1992] have shown that market intelligence has more advantages by studying the common dynamics of stock prices and trade volume than focusing only on the varied uni-dynamic stock prices. The study of the price-volume relationship has been the subject of numerous research papers and econometric techniques, the best known of which is granger causality [1969].

### 4.4 Granger Causality Test

The causality test in the sense of Granger is linear. It is relevant in the study of price-volume variables. Indeed according to this author, a variable Xt is called Granger caused by Yt; if the forecast of Xt based on knowledge of current and past information from Yt and Xt is better than the forecast based on knowledge of current past information by Xt.

## Principle of the causality test

. The results of the causality test on the two couples: Price volume and Yield-Volume applied on the Tunisian stock market are given in tables 3 and 4;

**Table (4): Causality in the sense of Granger [1987]: Price-Volume**

| | Lags :2 | |
|---|---|---|
| | **Before COVID-19 pandemic** | **During COVID-19 pandemic** |
| Null Hypothesis | F-Statistic | F-Statistic |
| V does not Granger Cause P | 3.7631* | 5.78876* |
| P does not Granger Cause V | 1.14787 | 1.70322 |

**NOTE: * DENOTES SIGNIFICANCE AT THE 1% LEVEL**

In this table, we can notice that the null hypothesis: "the price is not caused by the volume" is rejected at the 1% threshold. On the other hand, this assumption is verified on the contrary case; one can say that there is a unidirectional causality. The existence of this volume-price causal relationship indicates that a variation in volume can explain, by itself, a price variation. This result can be interpreted, as already mentioned, as evidence of the existence of mimetic behavior among investors. Therefore we can establish that the transaction volume allows conveying information favorable to the emergence of herd behavior. To move in this direction, we suggest, according to Karpoff [1987], to redo the Granger test [1987] on the volume-yield relationship.

In this table, we can notice that the null hypothesis: "the volume does not cause the yield," is rejected before and during Covid-19 pandemic. Even in the reverse direction (the yield does not cause the volume "is positive and insignificant. This result is consistent with the absence of gregarious behavior before and during the Tunisian covid 19 pandemic. Our results are similar to the results found by Boubaker and Bouattour (2008) and Naoui and Khaled (2010), Wyème et al. (2013), who also presents no evidence of herd behavior in TSE.

## 5. Conclusion

The modeling of mimetic behavior constitutes the object of several works; the first model was that of Bikhchandani-Hirshleifer and Welch (BHW) (1992), who had the merit of introducing the notion of information cascade. Then we find Artus and Kaabi [1994], who have considered Bayesian modeling of mimetic behavior. They developed the idea of a mimetic chain initiated by BHW [1992]. The empirical study carried out within the framework of this chapter tested the existence of imitative behavior covid 19 pandemic Tunisian utilizing two econometric techniques. The first technique, suggested by Christie and Huang [1995], Demirer and Kutan [2006], and Chang Cheng and Khorana [2000], is based on the calculation and the test of absolute and straightforward transverse standard deviations to be able to explain the behavior of investors, covid 19 pandemic the Tunisian. The results obtained with this first test show, on the one hand, the existence of mimetic behavior using the Simple transverse Standard Deviation tests and, on the other hand, the absence of this behavior uses the Absolute Standard Deviation tests. It is absolute during periods of strong fluctuations in stock prices. The second technique explores the price-volume and Yield-volume relationship through the study of Granger causality. The results obtained confirm the absence of herd behavior covid 19 pandemic the Tunisian.

It should be noted that the study of mimetic behavior through the price-volume relationship has the disadvantages of only handling quantifiable variables; in our case, we have the volume and the price. This study, therefore, cannot reliably take into account the subjective rating of operators, non-quantifiable variables. The study of behavioral finance theory and information efficiency in this context is now essential insofar as it allows us to understand the perverse effect of the emergence of "noise traders" or, in general, to understand the anomalies unexplained by traditional finance better. Other means have been proposed for the measurement of mimetic behavior, namely the LSV method, which requires consultation of the order books to identify the number of buyers and the number of sellers, the "PCM" method, also the technique of the transverse dispersion but differs from it by a measure relating to factors (betas). The use of such a measure is then considered for subsequent work.

## Reference


1. Aktas, O., Prozorovski, T., Smorodchenko, A., Savaskan, N. E., Lauster, R., Kloetzel, P. M & Zipp, F. (2004). “Green tea epigallocatechin-3-gallate mediates T cellular NF-κB inhibition and exerts neuroprotection in autoimmune encephalomyelitis”. The Journal of Immunology, 173(9), 5794-5800. https://doi.org/10.4049/jimmunol.173.9.5794
2. Barberis, N. and Thaler, R. (2003) A Survey of Behavioral Finance. Handbook of the Economics of Finance, 1, 1053-1128. https://doi.org/10.1016/S1574-0102(03)01027-
3. Blume, L., Easley, D., & O'hara, M. (1994). Market statistics and technical analysis: The role of volume. Journal of finance, 49(1), 153-181.
4. Boubaker, A., & Bouattour, B. (2008). Détection du comportement mimétique sur le marché boursier tunisien. Revue Tunisienne d’Economie et de Gestion, 26 (2008), 293-319.
5. Chang, E. C., Cheng, J. W., & Khorana, A. (2000). An examination of herd behavior in equity markets: An international perspective. Journal of Banking & Finance, 24(10), 1651-1679.
6. .
7. Christie, W. G., & Huang, R. D. (1995). Following the pied piper: Do individual returns herd around the market?. Financial Analysts Journal, 51(4), 31-37.
8. Copeland, T. E. (1976). A model of asset trading under the assumption of sequential information arrival. The Journal of Finance, 31(4), 1149-1166.
9. Dimerer and Kutan.(2006) Long term metachronous testicular tumor: A case report. Yeni Üroloji Dergisi, 12(2), 56-58.
10. Epps, T. W. (1975). Security price changes and transaction volumes: Theory and evidence. The American Economic Review, 65(4), 586-597.
11. Epps, T. W., & Epps, M. L. (1976). The stochastic dependence of security price changes and transaction volumes: Implications for the mixture-of-distributions hypothesis. Econometrica: Journal of the Econometric Society, 305-321.
12. Gallant, A. R., Rossi, P. E., & Tauchen, G. (1992). Stock prices and volume. The Review of Financial Studies, 5(2), 199-242.
13. Gallant, R., P. Rossi, and G. Tauchen, (1992), Stock prices and volume, Review of Financial Studies, 5, 199-242.
14. Gemmill, G., & Thomas, D. C. (2002). Noise trading, costly arbitrage, and asset prices: Evidence from closed-end funds. The Journal of Finance, 57(6), 2571-2594.
15. Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica: journal of the Econometric Society, 424-438.
16. Grinblatt, M., Titman, S., & Wermers, R. (1995). Momentum investment strategies, portfolio performance, and herding: A study of mutual fund behavior. The American economic review, 1088-1105.
17. Hirshleifer, J. (2000). The macrotechnology of conflict. Journal of Conflict Resolution, 44(6), 773-792.
18. Hwang, S. W. (2001). Homelessness and health. Cmaj, 164(2), 229-233.
19. Karpoff, J. M. (1987). The relation between price changes and trading volume: A survey. Journal of Financial and quantitative Analysis, 22(1), 109-126.
20. Lakonishok, J., Shleifer, A., & Vishny, R. W. (1992). The impact of institutional trading on stock prices. Journal of financial economics, 32(1), 23-43..

21. Mnif, Jarboui and Mouakhar 2020. “How the cryptocurrency market has performed during COVID 19? A multifractal analysis »Elsevier public health emergency collection.

22. Naoui, K., & Khaled, M. (2010). Apport de la finance comportementale à l'explication de la volatilité excessive des prix des actifs financiers. Revue Libanaise de Gestion et d'Économie, 3(4), 65-99.

23. Orléan, A. (2007). Les croyances et les représentations collectives en économie.

24. André Orléan, (2007). « Croyances et représentations collectives en économie », Annuaire de l'EHESS . http://journals.openedition.org/annuaire-ehess/18352

25. Shleifer, A. (2000). Inefficient markets: An introduction to behavioural finance. Oxford University Press. https://EconPapers.repec.org/RePEc:oxp:obooks:9780198292272

26. Shleifer, A., & Thaler, R. H. (1991). Investor sentiment and the closed-end fund puzzle. The journal of finance, 46(1), 75-109.

27. Tauchen, G. E., & Pitts, M. (1983). The price variability-volume relationship on speculative markets. Econometrica: Journal of the Econometric Society, 485-505.

28. Wyème. B & Olfa. C (2013). Herding Behaviour before and after the Tunisian Revolution. International Journal of Multidisciplinary Sciences and Engineering, 4(10), 16-20.