

## Study of the Dynamics of Asset Prices by a Behavioral Approach: Theoretical Foundations & Empirical Investigation

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**[Abstract]** We study according to the work of Statman, Thorley and Vorkink (2004), Glaser and Weber (2004) and Chuang and Lee (2006), the dynamic relationship between the overconfidence of investors and the volume of transactions. This study aims to show, first, that overconfidence is a systematic cognitive bias most investors suffer from and the effect of which can affect the efficiency of financial markets. We test this hypothesis for a sample of 35 Tunisian companies over a period of 2000 to 2010 according to frequency (daily, weekly, and monthly) using a range of econometric tests or tests of Granger causality. Then we applied vector autoregression VAR modeling and impulse response functions associated. We prove the presence of excess confidence in the Tunisian market through a significant relationship Granger returns to the current market volume of transactions. In addition, we can test the hypothesis that overconfidence encourages the volume of transactions. Because these results support the hypothesis of the disposition effect, we argue our study distinguishes the overconfidence of this bias. Following the positive and significant relationship between past market returns and individual trading volume in individual past performance, we can validate the overconfidence hypothesis and distinguish it from the effect of this provision, which allows us to conclude that the exchange market activity is not a simple summation of disposition effecting individual securities.

**[Keywords]** behavioral finance, over-confidence, excessive volatility, VAR market, VAR individual securities, causality, functions pulse responses

### Introduction

The dynamic relationship between stock returns and trading volume was the subject of much research in the financial literature since the 1950s; yield and volume are two main pillars around which revolves the entire stock market (Mahajan & Singh, 2009). With the emergence of the hypothesis of market efficiency in the 70s, the role of price variability has increased considerably. Indeed, the relevance of a financial market is the ability of prices to fully reflect all available information on past, present, and future events. In other words, the market is informationally efficient if all the useful information in the evaluation of listed securities is reflected automatically reflected in the price. So, the market is a vast hub of information. Quality traffic transmission or dissemination of this information depends on the efficiency of the market. In terms of its impact on the characteristic quantities of the economy and its performance, it is in the interest of modern economies to achieve efficiency in the dynamics of stock markets. However, the movements in the stock market cannot be determined only by focusing only on the univariate price dynamics.

The study of stock prices without being associated with trading volume can transmit only vague information about the trading activity of the market (Mahajan & Singh, 2009). It is well established in the literature that prices react to the arrival of new information, and the volume of transactions is considered essential information, which indicates the direction that prices should take. This means that the volume is an important indicator to predict market trends. We can, therefore, conclude that trading volume plays an important role in informing the market. Therefore, according to Harris and Raviv (1993) trading volume reflects the information on changes in prices and the agreement in investor expectations. The study of the joint dynamics between returns and trading volume is, therefore, of paramount importance in that it sheds light on the understanding of the microstructure of the stock markets and highlights the level efficiency of those markets.

In addition, two stylized facts have long attracted the interest of academic researchers in the literature of financial markets: the variation in time of the conditional volatility and the persistence of the volatility

of returns (Gursoy et al., 2008). One argument used by these authors to explain the time variation of the conditional volatility is based on the idea that asset returns are generated from a mixture of distributions, a hypothesis in which the stochastic variable mixture is considered as the arrival rate of market information flows. This implies that the volatility of returns is proportional to the rate of arrival of information, providing an explanation for heteroscedasticity yields observed. Such an explanation suggests, according to Luu and Martens (2003), that changes in daily prices and trading volume are caused by the same underlying latent variable which is the arrival rate of market information. This implies that the performance and volume vary simultaneously in response to new information. In these circumstances, there is a positive contemporaneous relationship between returns and trading volume.

Compared to the persistence of volatility, Lamoureux and Lastrapes (1990) also link the observation of this phenomenon in the mixture of distributions hypothesis and suggest that the persistence of the conditional volatility in stock returns (GARCH effects) reflects a serial correlation in the arrival rate of information. The combination of volatility is also an important property usually observed in financial time series. It is known as a situation where large variations in prices tend to be followed by changes of the same sizes, and small price changes tend to be followed by changes in the same magnitudes. Grouping in the presence of volatile information, squared series yields should be very autocorrelated. In this context, the autoregressive conditional heteroskedasticity in Engle (1982) and its extension, the autoregressive conditional heteroskedasticity widespread Bollerslev (1986) (GARCH) are used to understand these phenomena in stock markets.

In total, whatever the approach, the general consensus in the literature of trading volume and the volatility of returns to date, there is a strong link between the volume of current transactions, performance, and volatility conditional. Because understanding this link could help to distinguish between the different hypotheses on the structure of the market and eventually lead to better forecasting of volatility, further exploration of this relationship is worth pursuing, especially when in the emerging and less developed stock markets of Africa. On this basis, the aim of this article is to provide additional evidence from the relationship between trading volume, returns, and conditional volatility. Our study explores the transaction volumes and yields daily indices of the Tunisian stock market.

### **The Relationship between Overconfidence and the Volume of Transactions: Literature Review**

Different investors who make stock selections in the financial markets generally face difficulties in terms of expectations, and it is for this reason that the bias of over-confidence can take place and will be more pronounced. In this sense, the work of Griffin and Tversky (1992) empirically validated this hypothesis. At this level, a degree of trust is required in order to manage its portfolio that models developed in terms of assessing the financial markets radically integrate the concepts of management capacity, as well as anticipation. In fact, in the context of a traditional financial environment in which the transaction costs are positive, an investor, where it is considered perfectly rational, will react by placing his position if and only if the gain from this transaction will exceed the costs incurred. In an opposite case, by introducing the concept of behavioral finance that financial officers are supposed irrational, we can always find a power position even if these costs are higher than expected gains: the impact bias over-confidence, which is reflected in the erroneous estimate of the profits hoped for. Similarly, this bias can be seen in the fact that an investor will select securities while referring to his private information, which will be overestimated in terms of accuracy and, also, in terms of treatment, by the investor .

To better clarify this behavior remains important for explaining the different financial decisions. We are interested in the study by Odean (1999) where the author compared the profitability of purchases with securities sold by the securities of all individual investors. In fact, the study of the profitability of the choice of investor portfolios has enabled the author to conclude that whatever the period of study, we always distinguish an excess of the cost of securities sold compared to that of the securities purchased. So, it turns out that this decision by investors is not optimal because it produces the same results regardless of the financial system costs (either in the presence or out of transactions costs). So, in addition, the

volume of trade carried seems unjustified, and this can show that over-confident investors overestimate the precision of their information where Odean (1999) leads to two main phenomena: an increase in the frequency of portfolio adjustment either excessive trading securities.

In this sense, Odean is able to detect a remarkable increase in the rate of rotation of investors to an extent of 20% (75.5% to 95.5%) due to a change in the traditional management by another online: this finding seems to support the hypothesis that overconfidence of individual investors explains much of the excessive volume in trade recorded in the financial markets. In the same vein, Barber and Odean (2002) tried, as part of their research, testing all possible links between investor behavior and performance. Investors opt for portfolio management online against conventional management. The purpose of the study is, therefore, to conduct an analysis of the operations performed by a wide range of investors. The study of this problem proves the existence of the bias of over-confidence investors have, and this is manifested especially if they manage to achieve good results before the change in management (traditional to online) because they think that their success came from their competence in terms of anticipation; they attribute failure to bad luck or other factors.

In the same vein, investors believe that their behavior and personal opinions have a very significant impact on the achievement of favorable (Langer & Roth, 1975) events. The fact that an investor makes his choice without a financial intermediary (e.g. telephone conversation) will make him feel more involved and, thereafter, any illusion of control may lead eventually to a higher frequency of exchanges. To test the hypothesis that overconfidence positively influences the volume of transactions positively, Statman, Thorley and Vorkink (2004) conducted a study on the US market that confirmed this hypothesis. Moreover, the work of Glaser and Weber (2004) who studied the same phenomenon, examining the hypothesis that over-confident investors make more transactions than rational investors. They showed a significantly positive relationship between excess CBMs (unrealistic optimism, illusion of control, poor calibration ...) and measures of trading volume of individual investors (number of transactions carried out, turnover...). The authors confirmed the hypothesis that highlights the relationship between overconfidence and trading volume while applying the test of correlation measures, over-confidence (psychological variables), and measures of trading volume (variables economic).

It therefore follows that all individual investors in the financial market remain overconfident (which is in agreement with the results of Barber and Odean, 2002). Also, Glasser and Welber (2004) directly tested the relationship between overconfidence and the volume of transactions via a methodology that examines the relationship between two variables: economic and psychological variables. In the same vein, Wen-I Chuang and Bong-Soo Lee (2006) tested the same hypothesis but examined investor reaction to the publication of the new information; they showed that investors over-react to any private information while they under-react to public information, which leads to an excess in the volume of transactions, which is explained largely by the speed of the reaction with which investors face information (Odean, Daniel, Hirshleifer & Subrahmanyam, 1998; Chuang & Lee, 2006). Therefore, we conclude from the work done that the impact of private information is more pronounced compared to public information. Thus, empirically, the realization of gains on the financial market makes over-confident investors more aggressive in terms of trades made in subsequent periods and vice versa.

The second axiom of research has been dedicated to study the causal relationships Granger (1969; 1988) between trading volume and returns. This study attempted to examine the type of relationship that may exist, as well as impact of overconfidence on the total volume of transactions (depending on economic conditions). In fact, the author has shown that the impact of overconfidence is more pronounced after a period of economic growth according to GARCH. Therefore, it has been shown that self-assignment affects considerably excessive volatility and feeds through complacency. In this regard, we can mention the methodology of a directly administered questionnaire used by Glasser and Weber in 2004 that tests the link between excess confidence-building measures with measures of trading volume. The results are more accurate. Another distinctive empirical review took place in the work of Chodia Lo and Wang (2000) who attempted to address the relationship between trading volume and actual returns; it should be noted that there is little empirical work in previous research that examines the current volume of transactions with past performance: through the methodology in the next section, we will try to deliver,

again, the phenomenon by studying it through the causality test, ADF test of stationarity, estimation of the VAR model, and the impulse response functions in the Tunisian market.

## Methodology and Results

### Sample & Study Data

As part of our research, we try to test the hypothesis of overconfidence as explained by the volume of transactions in the Tunisian stock market. Our study examines the relationship that can occur between stock returns and trading volume in a sample of 35 listed companies that are part of the index TUNINDEX. We focus on daily, weekly, and monthly observations over a period of eleven years (January 2000 to December 2010). In fact, we needed for each share its rate of rotation (this is a measure of the volume of transactions) and its market capitalization\*. The observations are constructed from daily data for the stock market in Tunis (securities exchange of Tunis) [Table 1].

*Table 1. List of Titles Studied (Case of Tunisia)*

Banks	Ser General Store vices	Industry
Amen Bank (AB)	Magasin Général	Air Liquide Tunisia
Arab Tunisian Bank (ATB)	MONOPRIX	Al Mazraa
Arab Tunisian lease (ATL)	Pal Beach	ALKIMIA
ASTREE Company Insurance and Reinsurance	SIMPAR	IFC**
Bank of Tunisia (BT)	TUNISAIR	SIAME
Bank of Tunisia and the UAE Investment (BTEI)	SOTETEL	SFBT***
Attijari Bank	SOTUMAG*	SOTUVER
Bank Habitat (BH)		Tunisia Milk
Internationale Arab Bank of Tunisia (BIAT)		
National Agricultural Bank (BNA)		
Cie Internationale of Leasing (CIE)		
Investment in TunisiaSICAF (PTS)		
Tunisian society bank (STB)		
SPDIT-SICAF		
STAR		
Tuninvest SICAR		
Tunisia Leasing (TL)		
Union Bank for Trade and Industry (UBCI)		
International Union of Bank (UIB)		
General Leasing (GL)		

\*: Tunisian Company MAR GROS

\*\* : Chemical Industries fluorine

\*\*\*: Cooling Company and brewery Tunis

### Modeling and Identification of Variables

*Causality relationship.* We proceed empirically verify the existence of a positive relationship between the values of stock returns and trading volume by applying the Granger causality test in 1969 and 1988. This kind of test is based on the principle that the future cannot cause the present or the past. In other words, past performance  $R_t$  causes the volume of transactions  $V_t$  within the meaning of Granger if the prediction  $V_t$  (with the use of past performance) is more accurate than the prediction without using these returns both in terms of error variance  $\left[ \delta^2 (V_t / \Omega_{t-1}) < \delta^2 (V_t / \Omega_{t-1} - R_t) \right]$  where  $\Omega_t$  is the set of information available. It is also important to mention the existence of other current financial literature that puts the relationship in question another way: ignoring the existence of a significant relationship between trading volume and stock returns. We distinguish the arrival of sequential information (Copeland, 1976),

which proposes a positive relationship and bidirectional causality between the values of the associated returns and trading volume model. We note a relationship of feedback. Our empirical investigation allows us to distinguish the basic assumption of overconfidence and face the alternative hypothesis of the volume of transactions; where the causal bivariate is written as follows:

$$V_t = \alpha_{V_1} + \beta_{V_2} |R_{mt}| + \beta_{V_3} MAD_t + \sum_{j=1}^P a_j V_{t-j} + \sum_{j=1}^P b_j R_{t-j} + \varepsilon_{V_t} \quad (1)$$

$$R_t = \alpha_{R_1} + \beta_{R_2} MAD_t + \sum_{j=1}^P c_j V_{t-j} + \sum_{j=1}^P d_j R_{t-j} + \varepsilon_{R_t} \quad (2)$$

Avec  $V_t$  : Volume weighted market transactions.

$R_t$  : Weighted Efficiency market.

$|R_{mt}|$  : The absolute value of the weighted market returns at time t.

$MAD_t$  : The standard cross-type (daily, weekly and monthly) returns at time t.

Under the test of bivariate Granger causality, formulating hypotheses is such that the rejection of the assumption (or null hypothesis) postulates that values past performance does not cause trading volume  $H_0 : b_j = 0 \forall j$  who favors the hypothesis of overconfidence. The alternative hypothesis translates

$H_1 : c_j = 0 \forall j$ . We suggest that the direction of causality is the volume of transactions to yields. A third scenario may take place by examining this relationship; both coefficients b and c are significant, which is to say the two parameters studied have an impact on each other when we see a causal relationship in either direction. This is universally designated by "relationship feedback relationship" between the values of returns and trading volume corroborates the assumption of sequential information arrival; otherwise, it is the assumption of positive feedback trading.

**VAR Model.** To review and assess the relationship of interaction between trading volume and stock returns, we perform a vector autoregression model (VAR) because this kind of model allows us to describe the dynamics of different relationships that may take place between all variables without taking into account assumptions on the coefficients of these parameters:

$$Y_t = \alpha + \sum_{k=1}^K A_k Y_{t-k} + \sum_{l=1}^L B_l X_{t-l} + e_t \quad (3)$$

Knowing that the vector  $Y_t$  of dimension  $(n \times 1)$  observations for a period t is endogenous variables such as the volume of transactions ( $V_t$ ) and volume yields ( $R_t$ ). Also, we assume another vector of observations  $X_t$  of the same period t with exogenous variables  $e_t$  while is a residual vector dimension  $(n \times 1)$ .  $A_k$  and  $B_l$  are the regression coefficients that estimate relationships between time series of exogenous and endogenous variables while assuming the existence of K number of lags of the endogenous observations and delays in L exogenous observations. This model is to consider a VAR covariance structure that may exist in the vector, which detects residues; a further term is contemporaneous correlation between endogenous variables. Formally, the theories of overconfidence does not allow you to specify a time study between returns and turnover; it is for this reason and before any treatment provided as part of this empirical investigation, it would be wise to determine the optimal number of delay<sup>1</sup>. The empirical part is based on two versions of the VAR model: the first on the market; VAR is the market while the second VAR modeling of individual securities will be applied to each security in our sample.

<sup>1</sup> In this regard, we consider the estimation of all VAR models with the total number of delay to be selected according to the type of data: for example is 12 for monthly data. The number of delay to be used is the one that minimizes both Akaike criteria (AIC) and Schwarz (SC) for each estimation



## a) VAR Market

This first modeling VAR market contains two endogenous variables (trading volume and market performance) as well as two exogenous variables (temporal volatility of returns as noted by  $|R_{m,t}|$  the standard deviation of returns cross by noted  $MAD_t$ ); it is the following entry:

$$\begin{bmatrix} V_{m,t} \\ R_{m,t} \end{bmatrix} = \begin{bmatrix} \alpha_{V_m} \\ \alpha_{R_m} \end{bmatrix} + \sum A_K \begin{bmatrix} V_{m,t-K} \\ R_{m,t-K} \end{bmatrix} + \sum B_P \begin{bmatrix} |R_{m,t}| \\ MAD_t \end{bmatrix} + \begin{bmatrix} \mathcal{E}_{V_{m,t}} \\ \mathcal{E}_{R_{m,t}} \end{bmatrix} \quad (4)$$

The parameters that describe this model are:

$V_{m,t}$ : Volume of transactions described by the weighted market turnover at time t.

$R_{m,t}$ : Yield weighted market at time t.

$|R_{m,t}|$ : Absolute value of the weighted return of the broad market at time t.

$MAD_t$ : The standard deviation of returns cross (daily, weekly, monthly) at time t.

Such a significant and negative relationship between the variables put in question can be explained by the behavior of investors will react in a less intense way to change any negative returns recorded in the financial market which will result in a reduction of the level of confidence. Also, we can attribute this finding to the fear of the various stakeholders in the financial market to realize losses that will cause them to delay the sale of certain securities from their portfolios (Losers). At the end of two applications of the previously proposed alternatives, we distinguish between the hypothesis of overconfidence of Gervais and Odean (2001) that of the disposition effect of Shefrin and Statman (1985) that the first hypothesis postulates that transactions are connected in general, while the second effect is considered as a simple description of the attitudes of investors toward specific securities in their portfolios. The study of the activity of individual securities transactions will allow us to clarify these two theories via the distinction of our basic assumption called the impact of excess through reliance on the trading volume of the alternative reflecting the disposition effect: it is for this reason that we use the second version of the VAR model to each security in our sample consists of 35 stocks listed on the Tunisian stock market.

## b) VAR Individual Titles

VAR modeling on each title contains a case study for our three endogenous variables are the volume of transactions (turnover) of Title i, the return of security i and the market return. We distinguish one exogenous variable; either the temporal volatility of returns in absolute terms  $|R_{m,t}|$ . Formally, we have

$$\begin{bmatrix} V_{i,t} \\ R_{i,t} \\ R_{m,t} \end{bmatrix} = \begin{bmatrix} \alpha_{V_i} \\ \alpha_{R_i} \\ \alpha_{R_m} \end{bmatrix} + \sum A_K \begin{bmatrix} V_{i,t-k} \\ R_{i,t-k} \\ R_{m,t-k} \end{bmatrix} + \sum B_P \begin{bmatrix} |R_{m,t}| \end{bmatrix} + \begin{bmatrix} \mathcal{E}_{V_i} \\ \mathcal{E}_{R_i} \\ \mathcal{E}_{R_m} \end{bmatrix} \quad (5)$$

To judge through overconfidence and the disposition effect, as explanatory factors in the volume of transactions, we will have positive coefficients in the regressions of turnover on individual securities market returns and past on past returns of securities. This version of the VAR individual securities can distinguish two psychological biases in trying to ensure that the disposition effect is not the sole responsibility of explaining the exchange activity.

## Results and Interpretations

*Study of Stationary*

To check the stationarity of the series studied, we try to use the Augmented Dickey Fuller (ADF). The principle of this test is to detect the presence of a unit of a root in the three models. The Granger causality

test should be taken first to check the stationarity of the following parameters: weighted market return  $R_{m,t}$ , weighted rate of rotation of the market ( $T_{m,t}$ ). This analysis will be conducted for a daily horizon, weekly, and monthly. The VAR model in its version of the market requires verification of the stationarity of the series ( $R_{m,t}$ ) and ( $T_{m,t}$ ) on the endogenous and the absolute value weighted market return variables ( $|R_{m,t}|$ ) and standard deviation of returns cross ( $MAD_t$ ) variables reflecting the exogenous. While the application of VAR modeling associated with each share of 35 shares in our sample, verification of the stationarity of the three endogenous variables are ( $R_{m,t}$ ); ( $R_{i,t}$ ) Dividend yield i ( $T_{i,t}$ ) turnover of stock i and a single exogenous variable; or ( $|R_{m,t}|$ ). This analysis will be conducted primarily for a daily horizon. We distinguish the following results from the application tests on the different sets stationarity of variables described below; reported in Table 2.

Table 2. ADF test of Stationarity (Daily Frequency)

Variables	Statistics Calculated ADF	Critical Statistics *		
		1%	5%	10%
$TMP_t$	-15,77925	-3,8527	-3,3368	-3,0989
$RMP_t$	-16,85361	-3,5689	-2,8653	-2,6013
VABS**	-14,96523	-3,8652	-3,3965	-3,1139
$MAD_t^{***}$	-15,33291	-3,8652	-3,3965	-3,1139

\* Critical values for rejection of hypothesis of a unit root. \*\* Absolute value of RMPT.  
 \*\*\* The difference transverse deviation of returns.

The study of the model with constant in the first case studied in a daily context suggests that all variables set epigraphs; are  $R_{m,t}$ ,  $T_{m,t}$ ,  $MAD_t$  and  $|R_{m,t}|$  are stationary in level because the calculated ADF statistics found for each of these series are higher in absolute value to the critical values for all corresponding levels of 1%, 5% and 10%. In individual stock returns and their turnover rate, we find that the stationarity test allows us to assume that these two variables are considered stationary for all securities except TUNISAIR UIB; the volatility of turnover of these actions remains responsible for the non-stationary values detected.

Table 3. ADF test of Stationarity (Weekly Frequency)

Variables	Statistics Calculated ADF	Critical Statistics		
		1%	5%	10%
$TMP_t$	-2,618645	-3,19256	-2,96321	-2,6077
$\Delta TMP_t$	-6,52176	-3,19256	-2,96322	-2,6077

\*TPMT before differentiation. \*\* TPMT after differentiation of order 1.

With a weekly frequency, the data remain stationary for the studied variables  $R_{m,t}$ ,  $MAD_t$  and  $|R_{m,t}|$  while this is not the case for the market rate weighted  $T_{m,t}$  by reference to the calculated statistic that



represents a value of approximately  $-2.618645 >$  critical statistics with different level of significance. It is, therefore, appropriate to apply the first difference in this last series to make it stationary; the technique carried out in this framework assumes a stationary series, as is shown in the attached table.

**Table 4. ADF test of Stationarity (Monthly Frequency)**

Variables	Statistics	Critical Statistics		
	Calculated ADF	1%	5%	10%
$TMP_t$	-1,923658	-3,6952	-2,9101	-2,5949
$\Delta TMP_t$	-6,98624	-3,7012	-2,9296	-2,5951
$MAD_t$	-0,433695	-3,6952	-2,9101	-2,5949
$\Delta MAD_t$	-4,862591	-3,7012	-2,9296	-2,5951
VABS	-1,659848	-2,6215	-1,9624	-1,7923
$\Delta VABS$	-6,896243	-3,7012	-2,9296	-2,5951

In the study of monthly data ultimately we believe  $R_{m,t}$  the still stationary series level while for the other series  $T_{m,t}$ ,  $MAD_t$  and  $|R_{m,t}|$ , we notice that they are non-stationary, for all calculated statistics are higher than the statistics tabulated. By studying the following series using first difference logarithmic, we recognize their stationarity. Once all series used in this empirical investigation are stationary, we will look at the following second step of our methodology as applied using test the Granger causality to test the relationship that may exist between the volume trading and stock returns in order to highlight the psychological bias of over-confidence as a factor and explain the enigma of excessive volatility on the Tunisian stock market.

**Application of the Causality Test**

In the light of the implementation of the causality test in the context of observations, daily and weekly and monthly, we postulate the following results.

**Table 5. Test of Granger Causality [ Frequency daily, weekly and monthly ]**

Daily Frequency			
$H_0 : TMP_t$ does not cause Granger $RMP_t$		$H_0 : RMP_t$ does not cause Granger $TMP_t$	
F-Statistique	Probability	F-Statistique	Probability
0,07145	0,93962	5,901663	0,00291
Weekly Frequency			
0,07878	0,93998	2,36519	0,10423
Monthly Frequency			
0,43031	0,74269	0,08705	0,93682

$RMP_t$  : Weighted market returns.

$TMP_t$  : Rate weighted market turnover.

**Daily study period:** To test the relationship between trading volume and stock returns depending on the model equations [1] and [2] to highlight the bias of over-confidence, we use the test of Granger causality while remaining interested in the probability of occurrence associated with the studied parameters; this will allow us to check if the bias of overconfidence detected among stakeholders on the





Tunisian financial market, explain the dynamics of realized volatility on the stock market, and checks the efficiency of the market in question.

Based on daily observations, the object of the first case considered our causality test, we accept the null hypothesis that the rate of rotation does not cause the Granger performance because the probability associated with this first hypothesis remains insignificant with a value of about 0.93962, a probability that tends to 1. Second, we can assume that the causal relationship between the yield to the rate of rotation is checked referring to the probability associated with the base case with a value considered low; is a probability  $P_b = 0.00291$ . Hence it is a unidirectional causal relationship between the two variables: either returns to the rotation rate and not vice versa. This first empirical validation allows us to conclude that overconfidence remains responsible for the realized volatility for daily frequency.

**Weekly study period:** The application of the causality test for a period of weekly study allows us to recognize the same recommendations given for the observations with a daily frequency. In fact, we note that the probability that the null hypothesis is of the order of 0.93998, which requires us to accept the assumption that the rate of rotation does not cause performance. On the other hand, we assume that the causal return to the rotation rate is significant with a probability of about 0.10423. Therefore, once again, we find the results in favor of the hypothesis of excess similar confidence in previous case.

**Monthly study period:** For monthly observations, the test of Granger causality provides an empirical result that contradicts those developed for the daily and weekly studies. Indeed, the probabilities of the two tests are still considered non-significant with values of 0.74269 and 0.93682 and, therefore, we can deduce that there is no causal relationship between the rate of rotation of one hand and the dividend yield.

Comparing the probability associated with the null hypothesis that the return does not cause Granger turnover is a clear progression in terms of the study period. In fact, the probability increases to 0.00291, 0.10423, then reaches the end at 0.93682, a value close to unity for a monthly frequency. Hence, the application of causality test allows us to conclude that the bias hypothesis of over-confidence can be validated and retained only for short periods (daily and weekly); then it is rejected according to the elongation of the study period (monthly).

### ***VAR Modeling Market***

Before making use of estimates VAR models, we will choose premium above the optimal number of delays to be chosen according to both AIC and SC criteria. Under the VAR model defined, the number of delays to be used is of the order of 1, but in order to further refine the results, it is wise to compare different delays; our empirical investigation is based on two delays. We summarize the different results from the estimation of the VAR market in Table 6. Estimated VAR market (daily frequencies, weekly and monthly).

**For daily observations.** In light of the VAR model estimates in Table 6, we note  $TMP_t$  that the relationship between the current market turnover and noted the performance of delayed market remains significantly positive that the coefficient of the parameter  $RMP_{t-1}$  accepts a calculated statistic the order of 3.11, well above the critical statistic is equal to 1.96. The first observation allows us to assume that the volume of transactions is explained by delayed at 1 while distinguishing the two variables studied are proportional because the mass of transactions recorded a higher volume in terms of a return performance higher market where we can confirm the existence of a significant relationship between the volume of transactions on the one hand, and the market return on the other hand remains in favor of the hypothesis, which states that the overconfidence explains the volume of transactions via the self-attribution bias.

Table 6. Estimated VAR Market Model (Daily Frequency)

Standard errors ( ) with : *** 1% , ** 5 % , * 10 % t - statistics [ ]					
Endogenous Variables	RMPT	TMPT	Exogenous Variables	TIT	RMPT
RMPT (-1)	0,254326 (0,02072)*** [12,2744]	0,009860 (0,0322)*** [0,30621]	C	0,003190 (0,00021)*** [15,19047]	0,000292 (3,1 E-05)*** [9,41935]
RMPT (-2)	0,096922 (0,02011)*** [4,81959]	0,001601 (0,00313)*** [0,51151]	MADT	-0,450452 (0,03227)** [-13,9588]	0,011023 (0,00511)*** [2,15714]
TMPT (-1)	0,169051 (0,14121)* [1,19716]	0,103651 (0,02267)** [4,57216]	VABS	0,187156 (0,05013)** [3,73341]	-0,0086 (0,00765)*** [-1,12418]
TMPT (-2)	0,174952 (0,14785)* [1,18330]	0,155989 (0,02213)** [7,04875]	R <sup>2</sup>	0,267839	0,056018
			R <sup>2</sup> ajusté	0,265674	0,053226
			F-statistique	123,7081	20,06753

Also, by focusing on the relationship between the rate of rotation with those delayed current of order 1 and 2, we derive significantly positive coefficients with statistics calculated, respectively, 4.37589 and 7.65294, vastly superior the critical statistic (1.96). And, therefore, we can assume a second strong positive autocorrelation between trading volume and turnover are delayed  $TMP_{t-1}$  and  $TMP_{t-2}$ .

Turning to the relationship between turnover  $RMP_t$  and delayed levels 1 and 2, we can infer the absence of a significant relationship between these variables as calculated by comparing the statistics with those tabulated, we find that Statistics-t [ $TMP_{t-1}$ ] = 1.14 < 1.96 and also  $TMP_{t-2}$  with a t-statistics about 1.19 < 1.96. So, we can apply at this stage only the performance, which explains the volume of transactions that is in contradiction with the work developed by Statman, Thorley and Vorkink (2004). We emphasize at this point that current research relationship between the turnover rate and the standard deviation of returns transverse  $MAD_t$ , designated is deemed significantly positive for the Student statistic, which is associated with this variable as 2.21 > 1.96, while this relationship is violated for time volatility of returns that t-statistics < t-Review. Previous work, such as of Statman, Thorley and Vorkink (2004); attributes this to the impact of market information. Adjusted element  $R^2$  (Adj R-Squared) allows us to note that only 26.65% of the variables introduced in the model are able to explain market performance while only 5.61% of the variables explain the dynamics of turnover market, which was translated by a high significance of the constant C, or t-statistics = 16.016 >>> 1.96. Hence, we can conclude that there are other variables involved in explaining the volume of transactions. As part of this research, the main interest is to emphasize the role given to overconfidence in explaining the volume of transactions, which will be developed later via a second version VAR on each title but before I take this model econometric technique, it would be wise to consider the VAR market with weekly data.

**For weekly observations.** The application of the VAR model on weekly data, Table 7, provides us with different results compared to those distinguished in the study with a daily frequency. Indeed, the coefficients associated with the relationship between the current turnover rate and the delayed returns remain insignificant statistically because all t-statistics of the first two delays are of the order -1.11 and -

1.777, which are strictly less than the critical statistic. Such a result for weekly data suggests the absence of a significant relationship between overconfidence and trading volume and therefore a violation of the basic assumption.

**Table 7. Estimated VAR Market Model (Weekly Frequency)**

<i>Standard errors ( ) with : *** 1% , ** 5 % , * 10 %</i>					
<i>t - statistics [ ]</i>					
Endogenous V Variables	RMPT	TMPT	Exogenous Variables	TIT	RMPT
RMPT (-1)	0,124449 (0,04532)** [2,746006]	-0,439233 (0,41023)* [-1,07069]	C	0,007661 (0,00136)*** [5,63308]	-0,006201 (0,01265)*** [-0,49019]
RMPT (-2)	0,061908 (0,04692)** [1,31943]	-0,726658 (0,41109)* [1,76763]	MADT	-0,697512 (0,07481)* [-9,32378]	-0,005562 (0,69982)* [-0,007947]
TMPT (-1)	-0,003220 (0,00653)*** [0,493108]	-0,521392 (0,044916)** [-11,60815]	VABS	0,671364 (0,09896)* [6,784195]	0,501102 (0,87202)* [0,57464]
TMPT (-2)	5,3 E-05 (0,00652)*** [0,00812]	-0,243371 (0,04871)** [4,99632]	R <sup>2</sup>	0,169366	0,232161
			R <sup>2</sup> ajusté	0,156844	0,220585
			F- statistique	13,52538	20,05627

We also generalize this finding as to the relationship between the rate of flow rotation and those who delayed checks of the same non-significance between the parameters tested. This result implies that the rate of rotation is judged unable to explain the observed level of performance for a weekly time horizon. These extrapolated results remain inconsistent with the hypothesis of overconfidence postulated, but they support the hypothesis of market efficiency that allows us to say that overconfidence, cognitive bias is detected for periods of short-term (daily time horizon), which is harmonized with the recommendations of Statman, Thorley and Vorkink (2001).

**For monthly observations:** Under the VAR model of the market, for a monthly frequency, we check the results in a weekly context (Table 8). All coefficients of our model implemented are insignificant and, also, values, we note that the horizon over which the model is applied is long, as the VAR market is insignificant. In other words, the relationship between trading volume and values of returns is not verified or detected in the short term. This empirical result can be explained by the fact that the achievement of a positive market return delayed by one order can be treated by investors on the financial market as a sequence of their strong ability to choose the best alternative to investment and the accuracy of their own private which will generate an excessive sense of trust that will be translated by a massive exchange, which explains the high volume of transactions in the short term information.

While later, the various players in the financial market in question will react in a different way while trying to correct their interpretations and expectations to their investments through other factors (such as learning, for example), which explains the absence of overconfidence in the long term and then return to the theory of efficient financial market as investors generally react very quickly without any time to bother to anticipate the consequences their financial decisions in the short term; this is not the case for long periods (to be a weekly or monthly frequency) where they behave objectively in front of all investment opportunities while taking the right decision without present overconfidence.

Table 8. Estimated VAR Market Model (Monthly Frequency)

Standard errors ( ) with : *** 1% , ** 5 % , * 10 % t - statistics [ ]					
Endogenous variables	RMPT	TMPT	Exogenous variables	TIT	RMPT
RMPT (-1)	0,096411 (0,12176)* [0,791811]	0,347931 (1,54367)* [0,22539]	C	-0,000152 (0,00411)*** [-0,036982]	-0,0073111 (0,05569)** [0,131282]
RMPT (-2)	0,068015 (0,11160)* [0,609453]	-0,491259 (1,386925)* [-0,354207]	MADT	-0,005869 (0,00512)*** [1,14628]	0,055976 (0,07031)* [0,796131]
TMPT (-1)	0,001411 (0,00801)*** [0,176154]	-0,586691 (0,11962)* [-4,90462]	VABS	0,000602 (0,00232)*** [0,259482]	-0,017311 (0,03201)** [0,540799]
TMPT (-2)	-0,003594 (0,00872)*** [-0,412155]	-0,473869 (0,14545)* [-3,25795]	R <sup>2</sup>	0,035539	0,298629
			R <sup>2</sup> ajusté	-0,033351	0,248531
			F- statistique	0,155880	5,960910

**The Functions of the Impulse Responses Associated with the VAR Marke** We use the results illustrated the VAR market for a daily frequency in order to elucidate the dynamics of the relationship between market returns and trading volume. In addition, the graphs showing the functions of impulse responses are distinguished convergence of all variables in our VAR model to their equilibrium level zero, which verifies the stationarity of the model studied. The importance given to this econometric technique is summed up in the fact that such functions allow us to develop better results than previously postulated by referring to all the coefficient estimates VAR to detect and illustrate the full impact of shock residue. Of such a shock on the residual influence  $e_{R_{m,t}}$  current and future employee turnover and market performance allow us to test the overconfidence hypothesis values. While it is a shock to have an impact  $e_{V_{m,t}}$  on current and future values of two parameters highlighted.

Responses turnover market vis-à-vis an impact on residues  $e_{R_{m,t}}$  and  $e_{V_{m,t}}$  residues are represented; respectively by Figure 1 Functions impulse responses associated with the VAR market (daily frequency) A]. Figure 1 Features answers to the associated VAR market (daily frequency) pulses B] where the y-axis measures the degree of the positive rate of change in the relative rotational rate of rotation, which is not affected by a shock. In fact, during the first period, the graph (1-B) identifies a positive impact on the rate of rotation of the market generates a response increase of about 0.0008 is equal with a standard type 1.2 E-05 at the rate of rotation of the days that follow, we can see a significant autocorrelation of market turnover during the first four periods.

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

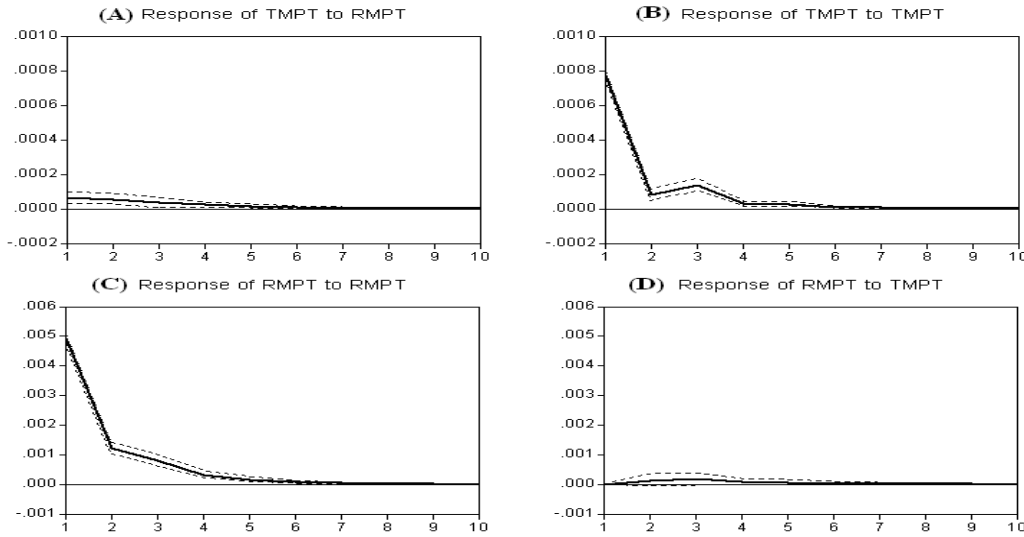


Figure 1. Functions impulse responses associated with VAR market (daily frequency)

Second, Figure (1-A) is to explain the impact of a shock on the market performance. Indeed, an examination of this graph illustrates a positive and persistent response of turnover due to a shock on the market return, which confirms the results developed in the VAR model posit that market returns have an impact significant on through overconfidence among investors and, thereafter, the activity of higher transactions. This conclusion is in harmony with the advanced pat Statman, Thorley and Vorkink (2004) in their empirical validation. Also, the two graphs can tell us that the response rate of rotation is more pronounced for a shock on the turnover as a shock to the market return. On the yield response  $r$  to a shock on the yield and the rate of rotation (Graphics (1-C) and (1-D)), we see via the chart (1-D) that such shock on the turnover during the first period recorded a zero yield, which reflects a stable yield in the following days and, thereafter, we can confirm the causal relationship to yield turnover (consistent with the recommendations generated after studying the market VAR) that is in harmony with the hypothesis of overconfidence in the first period. While the graph (1-C) shows a positive autocorrelation of market returns relationship, such a positive impact on yields will generate a positive response from market return in later days.

In conclusion, we can assume that for a short period like a daily frequency to validate the hypothesis of overconfidence empirically through estimating the VAR market in the first place and then verified by the technical functions associated impulse responses according to the results found in the VAR market with a weekly and monthly; Figure 2 (functions impulse responses associated with the VAR market (frequency weekly, monthly: the functions of the impulse responses are related to better clarify the deductions exploited. The study of the VAR market model has allowed us to verify the existence of excess bias of confidence among investors in the Tunisian daily observations in the context of operation of the puzzle excessive volatility observed even with a relatively low level of significance (value adjusted). View the shortfall and gaps identified for the first VAR modeling, we use the following version on each individual stock VAR model to better refine the interpretations and results used in other stages of research.

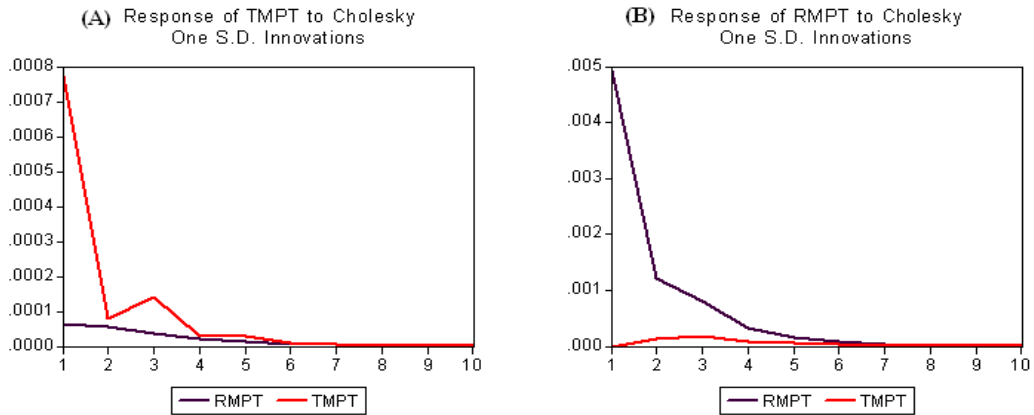


Figure 2. Functions impulse responses associated with VAR market (weekly and monthly frequencies)

**VAR Individual Titles**

In order to conduct this second version of the VAR model of individual securities, we use a sample of 35 Tunisian stock companies listed on the Tunisian stock market BVMT while representing the general index of trading activity in the TUNINDEX Tunisian context. Our objective in the context of this empirical investigation is to elucidate the excess through trust as a transaction engine through a VAR model on each of the 35 stocks studied. The estimated VAR model of individual securities tri-variant that corresponds to the equation [5] is a clear range of detection results against the bias of over-confidence in the context of the Tunisian financial activity. We notice that certain actions suffer from this behavioral bias as the main explanatory cognitive through its transaction volume, while other shares remain in alignment with the assumption of efficient financial markets as they lack of bias. Specifically, only four actions among all the shares in our sample belonging to the Tunisian stock index TUNINDEX have overconfidence; are: Amen Bank (AB) Bank Habitat (BH), General Lease (GL) and Tunisie Leasing (TL).

In light of the results shown in Table 9, we distinguish a coefficient corresponding to the  $RMP_i$  first delay parameter is statistically significant with a statistical value calculated in the range of 1.98661 which is strictly greater than the tabulated critical statistic (1.96) and therefore, we can judge the relationship between the market return and individual turnover rate of that share is significantly positive even in the case where the delayed returns are introduced into the model: what remains favor with the basic assumption of overconfidence. Statistics calculated for the other attached to the coefficient  $R_{i,t}$ ; with two corresponding delays; we distinguish values that are less than 1.96 which implies the absence of a significant relationship between the performance of Amen Bank action and the rate of rotation. So we come to the conclusion; via the results achieved; the rate of rotation of the considered action is fully explained by the market return and then we can accept the hypothesis of overconfidence. Adjusted  $R^2$  who can tell us about the very low explanatory power house with  $T_{i,t}$  a value 0.040250 which indicates that only 4% of the variables in the model are able to explain the retention rate of rotation of Amen Bank (AB) Action.





Table 9. Estimated VAR model (Daily Frequency) Amen Banque

Standard errors ( ) with : \*\*\* 1% , \*\* 5 % , \* 10 %  
t - statistics [ ]

Endogenous variables	TIT	RIT	RMPT	Exogenous variables	TI T	RIT	RMPT
<b>TIT (-1)</b>	0,150123 (0,02193)** [6,845554]	2,901284 (0,69492)* [4,174989]	0,501692 (0,33269)* [1,507986]	<b>C</b>	7.82 E-05 (1.02 E-05)***	-0.000501 (0.00034)*** [-1,47252]	0.001627 (0.0002) ***
<b>TIT (-2)</b>	0,070239 (0,02221)** [3,162494]	0,042392 (0,69982)* [0,060575]	-0,092365 (0,332691)* [-0,277629]	<b>VABS</b>	0.004378 (0.00176)**	0.089621 (0.05563)** [1,611019]	-0.438757 (0.02641)* *
<b>RIT (-1)</b>	0.000965 (0.00072)*** [1,340277]	-0.004112 (0.02253)** [-0,182512]	0.019601 (0.01132)*** [1,73153]	<b>R<sup>2</sup></b>	0.040250	0.016844	0.194816
<b>RIT (-2)</b>	-3.92 E-05 (0.00071)*** [0,055211]	-0.009641 (0.02253)** [-0,042791]	0.029032 (0.01102)*** [2,634482]	<b>R<sup>2</sup> ajusté</b>	0.036937	0.013451	0.192037
<b>RMPT (-1)</b>	0.002923 (0.00154)*** [1,898051]	0.091403 (0.04692)** [1,948060]	0.254432 (0.02129)** [11,95077]	<b>F- statistique</b>	12.14995	4.963651	70.09714
<b>RMPT (-2)</b>	0.001431 (0.00148)*** [0,966891]	0.011320 (0.04632)** [0,244386]	0.092465 (0.02099)** [4,405192]				

It is noteworthy that we found the same recommendations for Habitat Bank shares (BH) and Tunisie Leasing (TL). In fact, these three actions have nicely confirmed the basic assumption of overconfidence and empirical evidence developed with the first version of the VAR model where market through overconfidence is detected and more pronounced in the short term (daily study period) and long term (periods of weekly and monthly studies). Although our general problem of this paper has been to elucidate through overconfidence and its contribution in explaining the erratic price movements of financial assets, but it remains important to note that several other actions in our sample bow to another cognitive bias that is equally important and that the bias studied in behavioral finance; or the disposition effect; resulting in a critical dependency between current transactions being delayed and yields which implies that the volume is mainly explained by the disposition effect: are the following: Al Mazraa, ATL, STB, CTL, General Store, SIMPAR, SOTETEL, SPDIT-SICAFs. Moreover, the results of applying the VAR model to ATL Action proves the existence of a relationship between a statically share the current rate of transactions of action highlighted and yields delayed order 1 on the other hand with a calculated statistic of about 2.84394; is strictly greater than the critical statistic (1.96). Hence, we can deduce that the contribution of delayed returns of ATL major action is in the explanation of its turnover while avoiding the variable market return. For the rest of the acts studied, we note that they do not suffer the impact of cognitive biases discussed, that is to say, transaction volumes remain off the excess effect of trust and disposition effect this allows us to test the hypothesis of efficiency for these actions.

**The Functions of the Responses Associated With the VAR Impulse Individual Titles**

Always take the case of Amen Bank share (AB) affected by the bias excess of confidence, we distinguish the functions of impulse responses associated with the second version of VAR developed [Figure 3: Functions of impulse responses associated with the VAR individual titles]. According to the graphs G, H and I, we note that the functions of impulse responses associated with the VAR model that share portends reactions turnover action Amen Bank impact on the performance of the action itself on the market return  $R_{i,t}$  and finally the individual turnover. While explaining the various graphs that allow us to measure the impact of such a shock on the parameter of interest, we note a significant response rate of rotation of Amen Bank following a shock effect on individual performance while our record a significantly positive response statistically rotation rate  $T_{i,t}$  after the simulation of a positive shock to the market return with a magnitude of about  $1.87 \text{ E-}05$  (either with a gap equal type  $8 \text{ 0 E-}06$ ) during the first period while noting the persistence of the phenomenon observed during the following three periods. The extrapolated results in light of the implementation of the technical functions of the impulse responses are recommended to confirm the application of VAR model that remain in favor of the hypothesis of overconfidence for the action to highlighted.

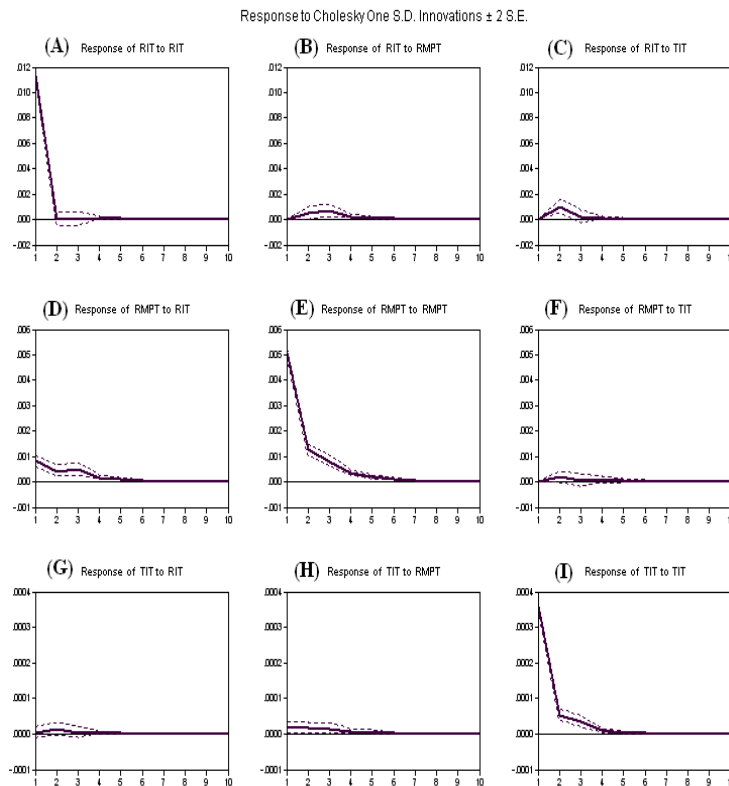


Figure 3. Functions of impulse responses associated with VAR individual titles

On the other hand, we see a positive impact on the variable  $T_{i,t}$  results in a significant and positive response on the rate of rotation while recording for the first time a value of 0.000359 (standard deviation of  $5.6 \text{ E-}06$ ) and is persistent during periods four following which confirms the advantage of auto-correlation of turnover of individual securities. With regard to these results, we can assume that the rate of rotation of Amen Bank (AB) action is explained by the market return and turnover delayed and therefore we can conclude that the excess confidence remains responsible for the volume of transactions, not the disposition effect. We try via graphs A, B and C to detect the responses of individual performance of Amen Bank actions impact on the performance of this action, the market return and its turnover. While



the three graphs D, E and F are considering functions of impulse responses associated with market returns following a shock on the individual performance of the work under review, the performance of the market and individual turnover. We observe in the light of these positive responses graphics variable  $RMP_t$  to shocks on the performance and individual performance while a shock on individual turnover generates a null response  $T_{i,t}$ . However, these results again show an autocorrelation on the one hand between the market yields and secondly, two interdependent categories of performance; that is to say, the market return and individual performance. We attribute this kind of result in the selection of the sample used in the empirical investigation which is limited to 35 companies listed on the Tunisian stock market: we can generalize these results to the Habitat Bank shares (BH), General Lease (GL) and Tunisie Leasing (TL) which predict the existence of overconfidence.

If we take other actions that are not characterized by overconfidence,  $T_{i,t}$  such action ATL, the latter of which is characterized by the disposition effect, we note that the response of the parameter remains negligible due to a shock performance in front of the RMT market face a shock on individual performance  $R_{i,t}$ : this is why we can postulate that only the individual performance comes in explaining the volume of transactions rather than the market return. This result confirms that in the case of ATL action is the disposition effect remains able to explain the excess volatility puzzle, not overconfidence. It should be noted that following a significant positive response after a positive shock  $T_{i,t}$  on the same variable, we observe a positive autocorrelation of individual rates of rotation.

### Conclusion

The fundamental problem posed at the beginning of this research was attached to an attempt to explain the puzzle of excessive volatility as a behavioral perspective. The over-confidence of investors has been suggested as the predominant explanation for this financial phenomenon that they distinguish between market growth and recession and when they reap gains from capital gains, their belief in their abilities amplified by through the self-attribution bias leads them to negotiate too securities markets. Our objective in the context of our empirical investigation was to examine the relationship between the component of the exchange activity over-confident investors and market volatility by considering a sample of 35 Tunisian firms listed for the period January 2000 and December 2010 for three cases of frequencies: daily, weekly and monthly.

The exploitation of the results achieved by all the tests conducted illustrates quite clearly the motivation to consider this bias in the context of the analysis specified the Tunisian stock market. Indeed, the study of causal relationships Granger has allowed us to postulate a first empirical validation that it is the performance that explains the volume of transactions. However, the excessive volatility remains well in part a consequence of the exchange activity Stakeholder-confident while checking an asymmetric nature of volatility dynamics in terms of response to positive and negative shocks. Once through overconfidence is detected on the Tunisian financial market; we made use of an early version of bi-variant VAR model on the market as a whole in order to elucidate the nature of this bias and the volume of transactions and that has allowed us to show that overconfidence has a positive influence the volume of transactions and it is only for a period of daily study. To better refine advantage of previously developed results, we studied a second version of the VAR model on individual securities while connecting three endogenous variables (individual turnover on each action  $i$ , the dividend yield and  $i$  the market return) with a single exogenous variable (the temporal volatility of returns). Some actions of the sample studied were beautiful and well confirmed the basic assumption through a significantly positive relationship between the rate of rotation course of action under consideration and yields delayed while other shares remain off effect of excess through confidence they suffer from the disposition effect verified by another significant positive relationship between the individual and his turnover rate yield. One aspect has been raised very interested in the light of our study is that investors are guided by their psychological leave short-term more than they are long term implying that Tunisian investors react quickly to new information

to correct their expectations for a long period, which explains the absence of the excess through confidence for longer time horizons.

### Annexes

#### *Measurement of Variables*

To test predefined hypotheses, we are invited to identify two endogenous variables and two exogenous. Therefore; examining the relationship between overconfidence and trading volume requires the establishment of two measures that are endogenous variables are yield and volume of transactions. In other words, exogenous or control variables will be presented by the cross-market average deviation and the absolute value of market returns.

#### *Measurement of Endogenous Variables*

The exchange activity in the financial markets has been widely discussed and defined; we distinguish two main measures attached to this parameter: the trade volume and turnover. Therefore, the first step is quantified by the number of shares traded for each share listed on the stock exchange while considering generally the number of shares traded as a proxy for the exchange activity: it is why this index is considered a measure of liquidity for different actors and stakeholders in the financial market. On turnover (turnover), the financial literature offers this variable as being the most appropriate measure to the economic reality of transactions that the first measure implementation varies from one year to another for most institutions financial traditionally due to variation of the shared capital.

Because of the above reasons, some researchers have used as part of their research turnover as a measure relative, not absolute, the exchange Lo & Chang [2000] Statman & Vorkink activity [2004] and Chung & Lee [2006]. We define the rate of rotation of an action  $i$  as follows:

$$T_i = \frac{\text{number of shares traded for stock } i}{\text{number of outstanding shares of stock } i} \quad (i)$$

While the rate of rotation of the market is calculated using two techniques, namely:

- Weighted rate of rotation of the market (noted  $TMP_t$ ):

$$TMP_t = \frac{\sum \text{number of shares traded in rate} \times \text{current stock } i \text{ in } t}{\text{market capitalization}} \quad (ii)$$

Otherwise  $TMP_t = \sum_{i=1}^I W_{i,t} T_{i,t}$ .

Which  $W_{i,t}$  is defined by the market capitalization of stock  $i$  at time  $t$  Devisee by market capitalization in  $t$  by measuring the market capitalization using the following formula:

$$CB_t = (\text{Number of outstanding shares of stock } i \text{ at time } t) * (\text{current stock } i \text{ in } t).$$

As part of our research, we plan to determine the rate of rotation by the first method because our sample of 35 companies listed on the Tunisian stock market does not reflect the totality of the general activity index TUNINDEX Tunisian market. Indeed, the calculation of  $TMP_t$  helps us find the results; priori; real and not biased because TUNINDEX consists of over 35 companies. So to calculate returns, we are asked to specify the returns of individual securities and market (or index TUNINDEX on the companies in our sample).

Moreover, it will be helpful to use weighted market returns (noted  $RMP_t$ ) calculated using a similar method to the determination of the US S & P 500 (Standard & Poor's composite 500). This parameter is defined as the contribution of each financial asset in the portfolio returns on the market with a determined by the ratio of market capitalization to total market capitalization ratio; are:

$$RMP_t = \frac{\sum_{i=1}^N CB_{i,t} \times R_{i,t}}{CBT_t} \tag{iii}$$

With 
$$RMP_t = \frac{CB_1}{CBT} R_1 + \frac{CB_2}{CBT} R_2 + \dots + \frac{CB_n}{CBT} R_n.$$

And  $CB_{it}$  : Number of shares multiplied by the price of the i in period t. Is the market capitalization of stock i in period t.

$CBT_{it}$  : The total market capitalization during the period t.

We note that these two indicators are involved in their composition all financial assets available on the BVMT.

$R_{it}$  : Return of security i in period t.

n: number of shares to be studied (35 companies for our empirical study).

**Measurement of Exogenous Variables**

Exogenous variables to be taken into account in our empirical investigation are respectively the average deviation of the market cross and the absolute value of the market  $|R_{m,t}|$ ; we define:

$$MAD_t = \sum_{i=1}^N W_{it} |R_{it} - R_t| \tag{iv}$$

$$W_{it} = \frac{\text{Market capitalization of stock i}}{\text{Market capitalization}} \tag{v}$$

With  $R_{it}$  : Return of security i in period t.

N: total number of shares in the sample

P: number of lags which has been selected using AIC and SC.

Consideration of control variables and is to review  $|R_{m,t}|$  and  $MAD_t$  discuss the various empirical results of the current relationship between judged positive trading volume and volatility puzzle efficiency values for optical variety of theoretical perspectives: it is for this reason that it is useful to express the market returns in absolute terms to control this contemporary relationship. (Karpoff added the absolute performance at time t in order to control the contemporaneous relationship between trading volume and volatility of returns.)

Referring to the intuition of Ross [1989] which postulates that friction in a market characterized by an absence of arbitrage opportunities, the information flow rate will be increased by the degree of volatility in the prices of financial assets. Subsequent works such as those of Bessembinder & al [1996] have used the absolute value of returns at time t to identify the reflex of the common information flow while  $MAD_t$  for specific information to firms in order to account informational investors. Also, the empirical study of Chuang and Lee [2006] confirms more  $R_{m,t}$  and  $MAD_t$  use as control variables to test and evaluate the causal relationship between Granger transaction volumes and values returns.

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