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► **To cite this version:**

Nesrine Mechri, Salah Ben Hamad, Christian De Peretti. The Impact of the Exchange Rate Volatilities on Stock Market Returns Dynamic: Evidence from Tunisia and Turkey. 2019. hal-01766742v2

HAL Id: hal-01766742

<https://hal.science/hal-01766742v2>

Preprint submitted on 4 Feb 2019

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The Impact of the Exchange Rate Volatilities on Stock Markets Dynamics: Evidence from Tunisia and Turkey

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September, 2018

Abstract:

This research aims to identify the impact of exchange rate volatility on the fluctuations of stock markets prices, considering two countries from MENA zone. Several gaps in the literature have been identified, indeed, previous works used very short periods of study, many important variables were neglected, and all results were contradictory. In this study, we integrate assorted determinants of stock market indices that have not been used simultaneously before, and we spread out our research period up to 15. The GARCH model is employed. The results show that exchange rate volatility have a significant effect on stock market fluctuations.

J.E.L. classification: *F31, F62, F65, G15*

Keywords: Volatility, Nominal exchange rate, MENA, Stock market, GARCH.

1. INTRODUCTION

From long ago, the analysis and explanation of the exchange rate volatility's impact on the factors determining the economic status of countries was the research topic for several finance practitioners in the literature ([Amano and van Norden, 1998](#), [JOHN B. Taylor 2001](#)). However, this question still seems to be debated till today. In particular, various studies have investigated the impact of exchange rate volatility on the dynamics of stock market returns. Similarly, identifying the factors that stimulate stock market returns is very important and of major interest to investors and decision-makers. The present study aims at identifying the impact of both exchange rate and relative prices uncertainty on the fluctuations of stock markets prices, considering two countries that belong to MENA zone, which are Tunisia and Turkey.

Exchange rate volatility has increased dramatically since the introduction of the floating rate regime in the early 1970s. As a result, there is more uncertainty in the relationship between foreign exchange markets and international stock markets.

Hence, the effect of the exchange rate on stock index returns has been studied in several works, namely [Solnik, \(1984\)](#) who proposed that, in the long-run, the stock market and the foreign exchange market are separated, since no proof can be found showing that these two variables are related. this study has been proven later on in part of [Sahadudheen](#) (2013) study who examines the effect of volatility in both rupee-dollar and rupee-euro exchange rates on stock prices in India using daily data from 3-Apr-2007 to 30-Mar-2012. Adopting a generalized autoregressive conditional heteroskedasticity (GARCH) developed in 1982 by Robert F. Engle, and exponential GARCH (EGARCH) model, the study suggests a negative relationship between exchange rate and stock prices in India. Even though India is a major trade partner of European Union, the study couldn't find any significant statistical effect of fluctuations in Euro-rupee exchange rates on stock prices, while the effect of fluctuations in Dollar-rupee

exchange rates on stock prices is highly significant.; [Ozair \(2006\)](#) who investigates the direction of causality as well as short-run dynamics and long-run equilibrium relationship between stock prices and exchange rates using quarterly data for the period across 1960-2004. This study apply techniques of the unit root, cointegration and Standard Granger causality tests to examine the relationship between these two financial variables. The empirical results reveal that there is no causal linkage and no cointegration between the stock prices and exchange rates as suggested under Traditional and Portfolio approaches, [Anshul and Biswal \(2016\)](#).

Yet, Most of those studies have focused particularly on the US and developed markets.

For example, considering data for five European countries (France, Germany, Italy, Switzerland, United Kingdom), the United States of America, Canada and Japan, [Inci and Lee \(2014\)](#) have revealed that exchange rates have a significant impact on the stock prices of these countries developments.

Indeed, in the past, only a limited number of researches have been carried out on the emerging markets and especially in the MENA zone, concluding with contradictory results, in the literature we found on the one hand, [Sevuktekin and Nargelecekenler in \(2007\)](#) and [Oguzhan and Erdal \(2009\)](#) who initiate a positive and two-way causality relationship between the exchange rate and the stock market index in Turkey. On the other hand, [Millimet and Osang \(2007\)](#) argued that there is no direct link between the exchange rate and stock prices, and argued that the exchange rate has an impact on international trade that affects stock prices.

Several gaps in the literature have been identified, indeed, previous works used very specified and short periods of study, a lot of important variables were neglected, and all results were contradictory.

In this article we propose to focus our attention on two countries of the MENA (Middle East and North Africa) which are Tunisia and Turkey. Our research is part of a theoretical

structuring of previous works in the literature that have dealt with the same subject and an empirical analysis of the exchange rates volatility and their impact on the fluctuations of stock market index for two countries in the MENA region. We integrate several determinants of stock market indices (interest rate, inflation rate, gold price, oil price) in our empirical examination that have not been used simultaneously before, and we spread out our research period up to 15 years which includes a lot of events and dynamics in order to reflect better the reality.

Therefore, it will be useful to empirically investigate the relationship between our variables. Firstly, their volatilities are determined using GARCH (1.1) model. Then, our final multiple regression model will be clarified, which examines the impact of exchange rate and relative prices volatilities on stock market fluctuations.

The remainder of this paper is presented as follows: Section 2 reviews related literature which is divided into two parts: literature for general countries and literature specific to MENA zone; Section 3 provides details about our adopted methodology, it illustrates data, describes variables and empirical models (GARCH and multiple regression) used for this study. Section 4 discusses the empirical results for both Tunisia and Turkey and we give some economical explanation to our finding. Finally, Section 5 summarizes the main conclusions of this paper and also highlight the perspectives of our future research.

2. Literature review on exchange rate and stock index linkages

At a time when the dollar was convertible into gold, the foreign exchange market was one of the quietest markets.

However, nowadays the exchange rate is increasingly fluctuating and it is impossible to predict it with certainty in the current (floating) exchange rate system. Indeed, this fluctuation will have major effects on the financial market.

In the literature, several authors have asserted the existence of a relationship between the exchange rate and the stock index. Yet, the results of each study are sometimes different and even contradictory.

2.1 Literature for general countries

On the one hand, among the first works dealing with exchange rate uncertainty is [Aggarwal and al \(1981\)](#), the authors used US monthly data and made simple regressions. The results of this study showed that stock prices and exchange rates are positively correlated. The authors explained this relationship by the fact that the stock market was an efficient information process incorporated into the exchange rate.

On the other hand, [Soenen and Hennigar \(1988\)](#) following [Aggarwal \(1981\)](#) and conducted their study on the American market between 1980 and 1986, they used cointegration test as well as simple regressions. However, these authors found that the influence of the exchange rate on the US stock price was rather negative because they took a larger sample than that of Aggarwal (1981), which can be considered the most accurate because it is closest to reality with a larger and wider sample.

Using Markov Switching (MS) modeling, [Walid Chkili \(2011\)](#) also studied the relationship between these two macroeconomic variables after the subprime crises for four emerging countries (Hong Kong, Singapore, Malaysia, Mexico) by dividing the period into two phases (turbulent and calm). Following the application of the MS-EGARCH model introduced by Henry (2009) in order to investigate the relationship between short term interest rates and the UK equity market he came to a conclusion that the relationship between stock markets and foreign exchange markets is regimetal and that stock price volatility responds asymmetrically to events. In addition, exchange rate changes play an important role in determining the transition between quieter and more turbulent periods in emerging equity markets.

More recently, [Anshul and Biswal \(2016\)](#) conducted a study on the relationship between global prices of gold, crude oil, the USD–INR exchange rate, and the stock market in India. Based on the 10-year daily data, they used the DCC-GARCH models (Dynamic Conditional Correlation, Engle (2002)) to study the relationship between the exchange rate and the Sensex30 Indian stock index, which indicates that there is a correlation between these two variables. Their results showed that a depreciation of the Indian Rupee causes a fall in Sensex30.

During the same year, [Lu Sui, Lijuan Sun](#) aimed to examine the dynamic relationship between local stock market returns, exchange rates, the BRICS zone (Brazil, Russia, India, China, and South Africa). The authors have been able to find significant effects between exchange rates and stock market returns by the VAR model, suggesting that exchange rate volatility can affect the performance of a firm or an industrial sector. Thus, an appropriate exchange rate can stabilize the stock market, especially during the financial crisis.

2.2 Literature specific to MENA zone

Focusing on MENA zone, [Oguzhan and Erdal \(2009\)](#) investigate the causal relationship between stock prices and exchange rates, using data from 23 February 2001 to 11 January 2008 about Turkey. The reason of selecting this period is that exchange rate regime is determined as

floating in this period. The results of empirical study using VAR model (Sims 1980) indicate that there is bidirectional causal relationship between exchange rate and all stock market indices. Yet, this study doesn't explore the period post subprime crises, and used an old and antic model.

The model used by [Parsva and Lean \(2011\)](#) included interest rates, inflation rates and oil prices as the main determinants of stock prices in Egypt, Iran, Jordan, Kuwait, Oman and in Saudi Arabia. Using monthly data from 2004 to 2010, they estimated their model using the Johansen cointegration model and the Granger causality test. They found that, in the long run, all variables are wedged. In the short and long term, there is a two-way causality between stock prices and exchange rates for Egypt, Iran and Oman before the crisis. In Kuwait causality is unidirectional ranging from exchange rates to short-term stock prices. By comparing the pre- and post-subprime period, the authors found that there were not many differences in the behavior of exchange rates and stock returns.

[Charles et al. \(2011\)](#) made a study to investigate the relationship between stock prices and exchange rate movement in seven African countries among Tunisia. They used vector error correction model (VECM) cointegration and impulse response analysis to determine the long- and short-run linkages between stock prices and exchange rates. Cointegration analyses indicate a long-run relationship between stock prices and the exchange rate in Tunisia, where exchange rate depreciation drives down stock prices. A short-run error-correction model also shows similar results.

Yet, the studies that focused on MENA zone, doesn't take into consideration a large sample, which could explain better the impact of the exchange rate's volatility on the stock market's return. Previously, the authors used an old and antic model and they don't integrate several determinants of stock market indices in their empirical examination simultaneously.

In this article, a large sample of 15 years is taken into consideration in order to better reflect the reality we integrate several determinants of stock market indices in our empirical examination that have not been used simultaneously before in research.

3. Methodological issues

Given that the empirical studies of predecessors are most often focused on developed markets, our study can be considered among the few studies that analyze the impact of exchange rate volatility on fluctuations in stock market returns for both Tunisian and Turkish markets that were not studied before. Moreover, we integrate several determinants of stock market indices (Exchange Rate, Interest Rate, Inflation Rate, Gold Price and Oil Price) in our empirical examination that have not been used simultaneously before in research.

3.1 Data Sources and Variable Construction :

The data of this study covers a full sample period from January 2002 to January 2017. Most of studies in the literature were based on monthly data ([Chun Tsai \(2012\)](#), [Naeem Muhammad and Abdul Rasheed \(2002\)](#), [Mohsen Bahmani-Oskooee and Sujata Saha \(2016\)](#)). Similarly to these studies, we used monthly data to clearly detect the change of regime and consequently it will be much easier to interpret the movements of our time series, which include stock market prices returns, exchange rates, inflation rates, interest rates, Gold prices and petrol prices index in Tunisia and Turkey.

The collected time series contain 181 observations per series.

The dependent variable in this paper represents the stock market log-returns.

During our study, we focus on the following stock market indexes:

- The TUNINDEX is considered to be an index of the yield type (dividends are reinvested), which measures the general trend of the market of the Tunis Stock Exchange.
- The Borsa Istanbul 100 index is a weighted capitalization index composed of companies from the Turkish national market (dividends are also reinvested).

In order to achieve our target, we are meant to integrate the independent variables, which seem to be the source of markets volatilities.

- The nominal effective exchange rate: in our study we are interested in analyzing nominal exchange rate volatility, which measures the relative price of two currencies, as used by [Bahmani Oskooee \(2016\)](#) in order to take into account inflationary effects, since the real exchange rate policy consists in periodically adjusting the nominal exchange rate in order to keep the real effective exchange rate constant in order to preserve the competitiveness of the country. This variables is also used by ((Oguzhan and Erdal (2009), Anshul and Biswal (2016))
- Inflation Rate (CPI): Reflects the costs of a basket of goods and services purchased by the average consumer. For our study we collected data on the consumer price index which measures inflation for each country. Numerous authors explored this variable in their paper regarding the importance it reveal for the determination of stock market dynamic (Hatemi.J and Irandoust (2002), Bahamani (2016))
- The risk free interest rate: our data concerning the nominal interest rates with 3 months of maturity. These rates are presented by the central banks of each country. A lot of papers were concerned by this variable (Taulbee (2005), Nicolas Moumni (2006)).
- The gold price: Due to the lack of availability of this data for each country, we have taken into account in our research the world price index of USD / LINGOT gold.

- The oil price index: We used the BRENT which serves as a global benchmark in the equity markets of Western Europe, Africa, the Mediterranean and the Middle East. Brent is considered as the Benchmark that fundamentalists and experts in the field use in order to index well-defined tariffs to oil from the North Sea countries exploiting northwestern Europe (Park and Ratti (2008), Haugom and al. (2014)). It is usually traded at the Intercontinental Exchange (ICE) in London.

All these data are transformed by natural logarithm and they are collected from Data Stream.

$$return_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \quad (1)$$

where:

$P_{i,t}$: is the price index for the market (i) at time (t).

Our model includes, as well as the explanatory variables mentioned above, the volatility of each and every one. Since the volatility is not an observed variable, it is estimated by a GARCH(1,1) model, described below.

3.2 Empirical Models

Under this subsection, we are interested by illuminate the models used for this research, so first we induce the GARCH (1.1) model, which permits us to evaluate the variances of each variables integrated in our final model. Then, the multiple regression model is explained and we represent the regression model adequate with our objective. Finally, we introduce the diagnostic tests used in this paper in order to study the stationnarity and the heteroscedasticity between variables.

3.2.1 Model for the independent Variables Volatilities: GARCH (1,1) Model

Before analyzing the relationship between exchange rate and stock market return, it is first necessary to determine the volatilities of our variables. Therefore, we use the GARCH model which allows us to identify the dynamics of each variable in long term.

Since its development by Bollerslev and Taylor (1986), the GARCH specification (1.1) has proved to be an adequate representation for most financial time series.

By definition, the GARCH model (1.1) is presented in two equations:

The mean equation: which provide the log returns of the stock market indices:

$$\begin{aligned} R_t &= \mu + \varepsilon_t \quad , & (2) \\ \varepsilon_t | I(t-1) &\sim D(0, \sigma_t^2), \end{aligned}$$

where:

R_t : are the stock market indices log-returns at the time t

μ : is the average value of returns

ε_t : are the error terms.

$I(t-1)$: is the information set up to time t-1,

σ_t^2 : is the conditional variance of the error terms.

The variance equation: that depends not only on the volatility of returns but also on past volatilities:

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad , \quad (3)$$

where:

ω : Constant term parameter; $\omega \geq 0$;

α and β are parameters ≥ 0 ;

σ_{t-1}^2 : The passed conditional variance.

3.2.2 Model for the Market Volatility : Multiple Regression Model

This model allows us to estimate the coefficients of each variable as well as their volatilities in order to analyze the long-term impact of these variables on the uncertainty of stock market returns.

The multiple linear regression models can be represented by the following equation:

$$\begin{aligned} \text{Ln}(\sigma_{R_t}) = & \alpha_0 + \alpha_1 \text{Ln}(\sigma_{R_{(t-1)}}) + \alpha_2 \text{Ln}(z_t) + \alpha_3 \text{Ln}(\text{Inf}_t) + \alpha_4 \text{Ln}(\text{Int}_t) + \alpha_5 \text{Ln}(\text{Gold}_t) + \\ & \alpha_6 \text{Ln}(\text{Oil}_t) + \beta_2 \text{Ln}(\sigma z_t) + \beta_3 \text{Ln}(\sigma \text{Inf}_t) + \beta_4 \text{Ln}(\sigma \text{Int}_t) + \beta_5 \text{Ln}(\sigma \text{GOLD}_t) + \beta_6 \text{Ln} \\ & (\sigma \text{Oil}_t) + \varepsilon_t \end{aligned} \quad , \quad (4)$$

where :

σ_{R_t} : the volatility of the returns of stock market indices calculated using GARCH model over our considered period for this study.

$\sigma_{R_{(t-1)}}$: The volatility of returns of delayed stock indexes

z_t : The nominal exchange rate at time t.

Inf_t : Inflation rate at time t.

Int_t : Interest rate at time t.

Gold_t : Gold price at time t.

Oil_t : Oil price at time t.

$\alpha_0, \alpha_i, \beta_j$ are unknown parameters to estimate.

σz_t : the volatility of the nominal exchange rate calculated using GARCH model at the

moment t

σ_{Inf_t} : the volatility of the inflation rate calculated using GARCH model at time t.

σ_{Int_t} : the volatility of the interest rate calculated using GARCH model at time t.

σ_{GOLD_t} : the volatility of the gold price calculated using GARCH model at time t.

σ_{Oil_t} : the volatility of the oil price calculated using GARCH model at time t.

ξ_t : it is the error term that follows the reduced normal centered distribution.

This model was manipulated following an iterative estimation procedure.

The results obtained from each estimation were analyzed, then, the least significant variable were removed in order to obtain a model where all variables are significant.

3.2.3 Specification and diagnostic tests

✓ Unit Root Tests

To avoid the problem of spurious regression, this paper performs two unit root tests for the stock price index, exchange rate and the other relative prices.

In the first step, **Augmented Dickey–Fuller (1979)** was adopted for this purpose.

We used three equations of the Unit root test:

- No constant, no trend:
$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^n \alpha_i \Delta y_{t-i} + \varepsilon_t \quad (5)$$

- Constant, no trend:
$$\Delta y_t = C + \gamma y_{t-1} + \sum_{i=1}^n \alpha_i \Delta y_{t-i} + \varepsilon_t \quad (6)$$

- Constant and Trend:
$$\Delta y_t = C + \gamma y_{t-1} + \delta_t \sum_{i=1}^n \alpha_i \Delta y_{t-i} + \varepsilon_t \quad (7)$$

Unlike the ADF test, the **Hadri test (2000)** is based on the null hypothesis of stationarity. It is a test of the Lagrange multiplier to test the null hypothesis of stationarity of the series $y_{i,t}$ (for $i = 1 \dots N$) against the alternative hypothesis of unit root.

- H_0 : Stationarity, the time series does not have Unit root.
- H_a : No stationarity, the time series have Unit root.

[Hadri \(2000\)](#) considers the following two models:

$$y_{i,t} = r_{i,t} + \varepsilon_{i,t} \quad (8)$$

$$y_{i,t} = r_{i,t} + \beta_i t + \varepsilon_{i,t} \quad (9)$$

✓ **ARCH Heteroscedasticity test :**

ARCH test was introduced by Engle (1982) and based on 2 hypothesis:

H_0 : Homoscedasticity vs H_1 : Heteroscedasticity

4. Empirical results and discussion

In this section, the principal findings of this paper are explored and the results that are obtained using EViews are discussed.

First of all, the Unit Root and the Hadri tests are presented to verify the stationarity of our time series which is an important hypothesis for the multiple regression estimation.

Secondly, we look into the descriptive statistics to describe our sample.

Then, it is fundamental to verify the basic assumptions for the multiple regression model, so the normality are highlighted, as well as the residual heteroscedasticity.

Finally, The GARCH and the multiple regression results are analyzed.

4.1 Results of Unit root tests

The test results shown in Table 1 confirm that all the variables are stationary for Tunisia. While, ADF test on Turkey's time series show that only the stock markets returns index is not stationary.

After obtaining the difference, all variables are confirmed to be stationary.

Table 1: ADF Unit root test results

Test ADF			
<i>Tunisia</i>			
	Level		
	None	With constant	With constant and trend
σ stock market	-2.5303** (0.0114)	-4.9461*** (0.0000)	-4.9367*** (0.0004)
σz	-1.6114 (0.1008)	-3.2743** (0.0176)	-3.2603* (0.0764)
σ Int	-0.4662 (0.5122)	-12.1490*** (0.0000)	-12.1997*** (0.0000)
σ Inf	-2.0569** (0.0384)	-3.3028** (0.0162)	-3.3470* (0.0622)
σ Gold	-1.3953 (0.1512)	-3.2964** (0.0165)	-3.2878* (0.0717)
σ Oil	-4.9316*** (0.0000)	-7.2839*** (0.0000)	-7.2702*** (0.0000)

<i>Turkey</i>						
	Level			First difference		
	None	With constant	With constant and trend	None	With constant	With constant and trend
σ stock market	-1.5302 (0.1180)	-2.2371 (0.1940)	-2.6746 (0.2485)	-12.3450*** (0.0000)	-12.3446*** (0.0000)	-12.3137*** (0.0000)
σz	-4.2632*** (0.0000)	-9.0493*** (0.0000)	-9.0750*** (0.0000)			
σ Int	-3.4731*** (0.0006)	-5.2942*** (0.0000)	-5.2894*** (0.0001)			
σ Inf	-0.1039 (0.6465)	-17.1977*** (0.0000)	-17.1525*** (0.0000)			
σ Gold	-1.3953 (0.1512)	-3.2964** (0.0165)	-3.2878* (0.0717)			
σ Oil	-4.9316*** (0.0000)	-7.2839*** (0.0000)	-7.2702*** (0.0000)			

*Notes: statistical significant at: *10%, **5%, ***1% levels*

MacKinnon (1996) P-values are reported in (.)

σ : volatility

Table 2 presents the results of Hadri's Unit Root test for all our time series.

At a classical 5 per cent significance level, it confirm the results shown by ADF test presented in table1.

Table 2 HADRI Unit root test results (Panel Data)

Variables	Level	1st difference
σ stock market	2.5396 (0.0055)	-1.3318* (0.9085)
σz	-0.2128* (0.5843)	
σ Int	-0.3180* (0.6248)	
σ Inf	0.1597* (0.4366)	
σ Gold	-0.2569* (0.6014)	
σ Oil	-0.8391* (0.7993)	

Notes: statistical significant at: *10%, **5%, ***1% levels

σ : volatility

4.2 Results for ARCH Heteroskedasticity test (residual test)

Table 3 Heteroskedasticity residual test results

TUNISIA	t-statistic	10.4894
	P-value	0.0000***
TURKEY	t-statistic	13.2766
	P-value	0.0000***

Notes: statistical significant at: *10%, **5%, ***1% levels

4.3 Descriptive statistics

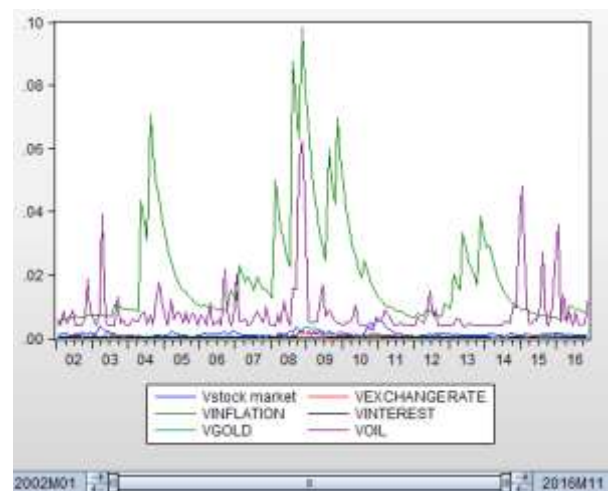
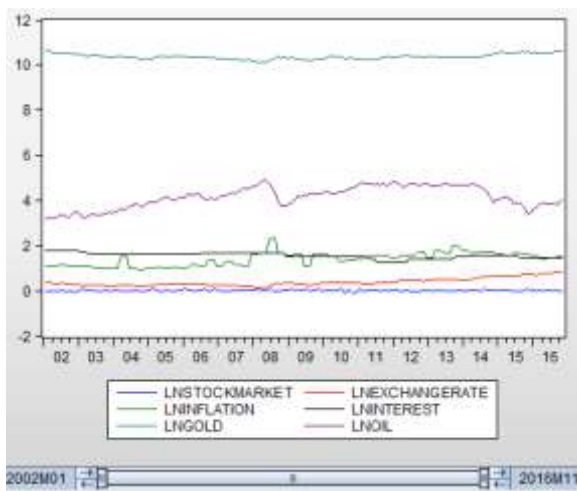
Applied to a sample composed of 181 observations for both countries, the analysis of descriptive statistics proposes to offer an objective representation on the evolution and the risk level of the data used in our empirical study.

We propose to present the graphs of the chronological fluctuations of our variables as well as their volatilities in Figure1.

Table 3 shows the descriptive statistics of data. The presented values are calculated on logarithmic data.

We can conclude from the results drawn in Table 3, that our explanatory variables do not follow the normal distribution.

Tunisia time series



Turkey time series

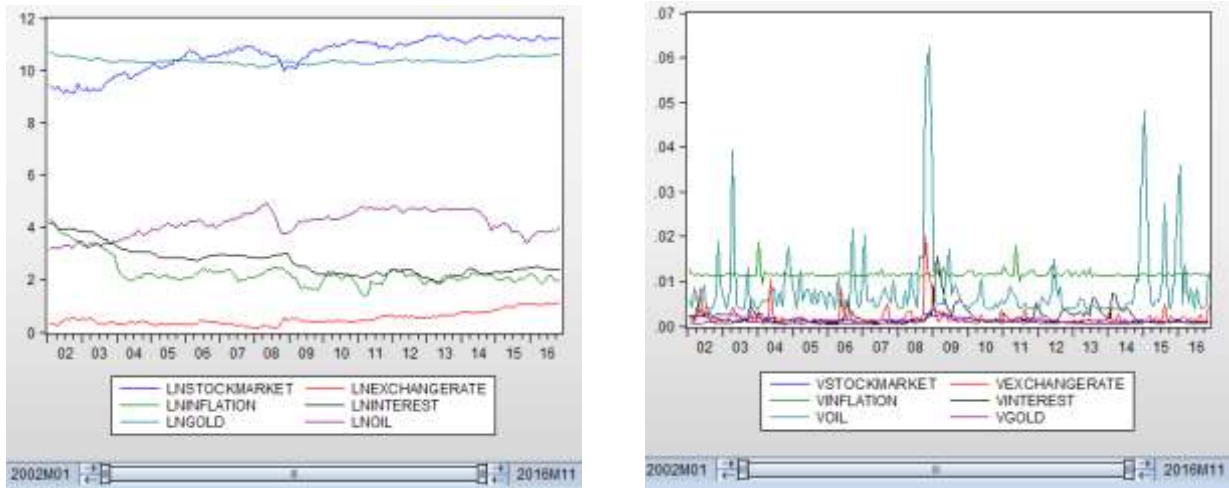


Figure 1: Graphical description of the time series over the study period from January 2002 to January 2017

Table 4 Descriptive Statistics

Variables	countries	Mean	Median	Skewness	Kurtosis
Stock Prices log-returns	Tunisia	0.01 (0.0366)	0.01	-0.16	5.09
	Turkey	10.60 (0.6450)	10.80	-0.89	2.64
Exchange Rate log-returns	Tunisia	0.38 (0.1722)	0.32	1.01	3.08
	Turkey	0.52 (0.2535)	0.44	0.10	3.12
Interest Rate log-returns	Tunisia	1.55 (0.1267)	1.56	-0.46	2.91
	Turkey	2.70 (0.5479)	2.51	0.94	3.13
Inflation Rate log-returns	Tunisia	1.40 (0.3037)	1.48	0.25	2.62
	Turkey	2.28 (0.5415)	2.13	1.86	6.27
Gold log- returns	Global	10.37 (0.1144)	10.34	0.51	2.78
Oil log-returns	Global	4.15 (0.4809)	4.17	-0.36	2.03
σ Stock prices	Tunisia	0.001 (0.0008)	0.001	3.20	15.93
	Turkey	0.001	0.001	1.11	3.09

		(0.0005)			
σ Exchange rate	Tunisia	0.0004 (0.0003)	0.0003	3.13	14.86
	Turkey	0.002 (0.0021)	0.001	5.24	38.49
σ Interest Rate	Tunisia	0.0002 (3.08E-05)	0.0002	-5.10	29.83
	Turkey	0.002 (0.0020)	0.001	3.14	16.86
σ Inflation Rate	Tunisia	0.02 (0.0177)	0.01	0.02	0.01
	Turkey	0.01 (0.0008)	0.01	5.83	46.52
σ Gold prices	Global	0.001 (0.0005)	0.001	3.03	13.73
σ Oil prices	Global	0.01 (0.0088)	0.005	3.82	19.05

σ : volatility

4.4 Results of GARCH modeling:

After applying the GARCH model (1.1) on our time series, we obtained the results shown in the following table (5) for both Tunisia and Turkey.

Table 5: Volatilities Estimations using the GARCH (1,1) model :

Tunisia						
Parameter	Stock market index	Exchange rate	Inflation Rate	Interest Rate	Gold Price	Oil Price
ω	0.0003 (0.1516)	4.30E-05 (0.1335)	0.0097 (0.2210)	9.01E-05 (0.0000)	6.09E-05 (0.2263)	0.0004 (0.2805)
α_1	0.1450 (0.0697)	0.1089 (0.2498)	0.0172 (0.9994)	0.0126 (0.5529)	0.1225 (0.9034)	0.1827 (0.0381)
β_1	0.6685 (0.0002)	0.7925 (0.0000)	0.5792 (0.0667)	0.9086 (0.0000)	0.7640 (0.0000)	0.6286 (0.0000)
$\alpha_1 + \beta_1^*$	0.8135	0.9014	0.5964	0.9212	0.8865	0.8113
Turkey						
Parameter	Stock market index	Exchange Rate	Inflation Rate	Interest Rate	Gold Price	Oil Price
ω	-4.73E-05 (0.1114)	0.0011 (0.0000)	2.0984 (0.0000)	0.0003 (0.1001)	6.11E-05 (0.2202)	0.0004 (0.2805)
α_1	0.0359	0.8150	0.9386	0.4887	0.0669	0.1827

	(0.6003)	(0.0004)	(0.0000)	(0.0000)	(0.4244)	(0.0381)
β_1	0.8912 (0.0000)	-0.0768 (0.5612)	-0.2802 (0.8780)	0.4658 (0.0225)	0.7638 (0.0000)	0.6286 (0.0000)
$\alpha_1 + \beta_1^*$	0.926	0.7382	0.6584	0.9545	0.8307	0.8113

*: A measure of the volatility's persistence.

The results obtained by the GARCH model for the Tunisian data show the presence of the volatility clustering (Mandelbrot (1963) “Large changes tend to be followed by large changes, of either sign, and small changes tend to be followed by small changes.”) and indicate that information on the volatility of the previous period has an impact on the current volatility. The same interpretation can be taken based on Turkey’s Data except that the results in table (5) concerning Turkey show the absence of volatility clustering.

4.5 Results of Multiple Regression Estimation :

The estimation regression method is ordinary least squares (OLS) in this section. The checking points are whether the stock market dynamics are effected by the following prices. Respecting, all the multiple regression’s assumptions, Eviews is used to estimate the model.

- Final model for Tunisia:

$$\text{Ln}(\sigma_{Rt}) = \alpha_0 + \alpha_1 \text{Ln}(z_t) + \beta_1 \text{Ln}(\sigma z_t) + \beta_2 \text{Ln}(\sigma \text{GOLD}_t) + \beta_3 \text{Ln}(\sigma \text{Oil}_t) + \varepsilon_t \quad (10)$$

- Final model for Turkey:

$$\text{Ln}(\sigma_{Rt}) = \alpha_0 + \alpha_4 \text{Ln}(\text{Int}_t) + \beta_2 \text{Ln}(\sigma z_t) + \beta_4 \text{Ln}(\sigma \text{Int}_t) + \beta_5 \text{Ln}(\sigma \text{GOLD}_t) + \varepsilon_t \quad (11)$$

The results are shown in Table 6. Some variables are not significant.

Table 6: Regression results studying exchange rate volatility and relative prices impacts on the stock market returns fluctuations:

Tunisia			
Variables	Coefficients	Standard deviation	P value
σz	2.1486	(0.4495)	0.0000***
σ Int	1.7889	(2.1986)	0.4170
σ Inf	-0.0054	(0.0039)	0.1609
σ Gold	-0.5532	(0.2417)	0.0233**
σ Oil	0.0171	(0.0099)	0.0863*
z	-0.0092	(0.0029)	0.0020***
Turkey			
Variables	Coefficients	Standard deviation	P value
σz	0.0734	(0.0211)	0.0006***
σ Int	0.0328	(0.0195)	0.0949*
σ Inf	-0.0424	(0.0392)	0.2802
σ Gold	0.2170	(0.0814)	0.0085***
σ Oil	0.0067	(0.0058)	0.2530
Int	-0.0021	(0.0008)	0.0123**

*Notes: statistical significant at: *10%, **5%, ***1% levels; σ : volatility*

Results shown in the table (6) indicate that the volatility of the exchange rate significant, which implies that it has impact on stock market dynamics, which proves the results of the study conducted by [Charles et al. \(2011\)](#).

Overall, the volatility of Tunisian stock market prices is defined by the volatility of Exchange rate, Gold and oil prices. Those variables are significant and have an important impact on the dynamic of Tunisian stock market.

On the one hand, manufacturing industries play an important role in Tunisia's economy (textiles, agro-food and electro mechanics) from an extrovert perspective, in fact, large number of the companies are totally or partially exporters. Consequently, it's meaningful that the volatility of the exchange rate influences the stock market prices dynamic. Especially since, after the revolution and the events that shook the Tunisian economy, the decrease in exports level compared to the importation of good was heavily noticed, in other words, the commercial balance has declined since the revolution which damaged the value of the national devise abroad. This down yard have massively harm the stock market in Tunisia which suffer till today.

In the other hand, there is an apparent evidence that in turbulent periods with economic uncertainty, as equity prices fall gold price rises and attention focuses on gold (and other precious metal) as a safe haven. Yet, it doesn't prevent that, lately the demand for gold decrease because of the very high prices of this metal resulting from the depreciation of the Tunisian dinar, which affect the stock market volatility and it approves our empirical results. This results can also be explained by the fact that foreign investors who usually take positions in gold futures to safe guard their investments, can't anymore use that strategy as the gold prices are no longer stagnant which lead them to invest in another country, accordingly the stock market will be damaged.

Furthermore, Tunisia has a reserve of oil that is likely to cover all of its consumption without falling under the obligation to import to meet the needs of its population, however, being manipulated by the United States of America, the price of a barrel of oil has fallen sharply in recent months. Certainly, it is the happiness of motorists who pay less to refuel, but the situation gets worse when oil prices can no longer cover their production costs, so the fluctuation of the oil prices impact the stock market returns dynamics when to the production levels. Bouri, Jain and Biswal (2017) conducted a study to examine the relationship between the gold, crude oil and India price indices between June 2009 and May 2016 using implied volatility indices. Generally, the main results highlight the close links between the implied volatilities of gold and oil and those of the Indian stock market, and more particularly, they pointed out that the volatility of gold prices causes fluctuations in the stock market indices.

We can notice based on finding for Turkey's Data, that it's very closed to those establish for Tunisia. In fact, exchange rate volatility as well as Gold prices volatility are very significant, while interest rate volatility is significant at a level of 10 per cent.

In the main, we can settle that only the volatility of the exchange rate, the volatility of gold prices and the interest rate fluctuation have an influence on the dynamics of the Turkish stock market returns, while other prices are statistically non-significant.

Actually, the decrease in demand for gold because of the very high prices of this metal resulting from the depreciation of the Turkish lira, approves our empirical results.

These findings could be explained by the rising inflationary pressures and the high volatility of the money supply, as well as, the deterioration of the geopolitical situation and the slowdown in the euro area economy.

5. Conclusion and perspectives :

The recent financial literature reveals that the dynamic relationship between exchange rates and stock prices has attracted the attention of economists, financiers and practitioners since both variables play a crucial role in portfolio decisions and economic development.

Since, in the literature, only few works were focused on the MENA zone and several gaps have been identified (previous works used very specified and short periods of study, a lot of important variables are neglected, and all results are contradictory). We choose in this paper to point our attention to two countries that belong to MENA zone and we integrate several determinants of stock market indices (interest rate, inflation rate, gold price, oil price) in our empirical examination that have not been used simultaneously before, and we spread out our research period up to 15 years which includes a lot of events and dynamics in order to reflect better the reality.

The main objective of our paper was to study the impact of exchange rate and relative price volatility on stock market fluctuations over the period 2002-2017.

The GARCH(1.1) is used to measure the volatility of our time series and we have applied the multiple regression to analyze the impact of the exchange rate and relative prices volatilities the stock market fluctuations for both Tunisia and Turkey.

The empirical results show firstly for the case of Tunisia, the volatility of the exchange rate has a significant effect on the fluctuations of the stock market prices. As well as the gold and the oil prices volatility. Yet all the other stock market's determinants were statistically insignificant.

Secondly, based on Turkey's data, we pointed out that the volatility of the exchange rate and the interest rate have a positive impact on the volatility of Turkey's nominal market returns

dynamics, and similarly to Tunisian results, Gold price volatility has an impact on Turkish stock market dynamic as well.

Tunisia was badly hit by the revolution of the Arab Spring 2011, which affect the financial, economic and political instability. Consequently, this turbulent phase influenced the investor's behavior what made the decrease in the exchange rate and relatively it affected the financial market.

Being ranked the leading economic power in the Middle East and the fifteenth in the world in 2010, Turkey lived in prosperity and financial stability until early 2016. In fact, Turkey had strongly suffered not only from political instability but also from a deteriorating of business climate and the fall of the Turkish lira caused essentially by the terrorism and the weak growth in the euro area. These events go by affect negatively on the exchange rate and the interest rate. Thus, Investors on the Turkish financial market are increasingly threatened by the political and economic instability which constitute a danger to their strategic objectives.

It would be essential for the Tunisian and Turkish governments to avoid political turmoil, debt problems, corruption and to control interest rates, as well as to provide a favorable and secure environment for foreign investors because they can affect the volatility of stock market returns which subsequently causes the economic and financial instability of the country. In fact, during our study period there two countries have handled several events which lead to more risky economic environment. As for example, the transitory period that have most marked the Tunisian financial market which is the revolution of 2011, this event was accompanied by waves of demands and protests that led to the end of presidential period of the Dictator Ben Ali. As well, in 2013, Turkey experienced protest movements against the presidential power, the stock market has seen the biggest loss of a day for a decade.

All of this is in perfect accordance with our findings that proved the existence of the impact of:

- ✓ The volatilities of the exchange rate, Gold price and Oil price on the dynamics of stock market returns in TUNISIA.
- ✓ The exchange Rate, Gold Price and interest rate Volatilities on Stock Market Fluctuations in Turkey.

Our paper contributes to the literature by integrating simultaneously 5 macroeconomic variables that define the stock market dynamic, in addition, we explored a large sample of 15 years for both Tunisian and Turkish markets that were not studied in the previous works. As mentioned above, the results prove the existence of the impact of: the exchange rate volatility, the gold price volatility and the oil price volatility on the stock market dynamics in Tunisia. While, Turkish stock market was effected by exchange rate volatility, interest rate volatility and Gold prices volatility. These results are in accordance with previous works in the literature, especially about the relationship that exist between exchange rate and stock market dynamics. Nevertheless, there was not a consensus about the effect that causes the other variables used in our study. That's why we give an overview with extremely convincing argument to prove the existence of a relationship between those macroeconomic variables and the stock market dynamics.

This article can be extended by investigating the spillover effects between exchange rate volatilities and stock markets dynamics for five or more countries among the MENA zone in order to better reflect the reality of these markets while using a multivariate GARCH model (DCC-GARCH for example), or further, we propose to use the Bayesian approach to explore the relationship between stock markets and the most important macroeconomic variables for the case of the Mediterranean Basin.

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