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Stock Market Reaction to Terrorist Attacks and Political Uncertainty: Empirical Evidence from the Tunisian Stock Exchange

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ABSTRACT

Political uncertainty and terrorist attacks have shown a remarkable surge around the world. These events creates uncertainty by increasing the risk to invest in some countries and this adversely affects stock markets, and can lead to lower economic growth, increased cost to companies, and negative affects to the society. This study examines the impact of political instability and terrorist attacks on the Tunisian stock market using data for two sub-periods: the pre-revolution period and the period during the revolution. Using an EGARCH model, empirical evidence shows that both types of events (political and terrorist) affect the performance and volatility of the Tunindex market especially after the revolution. Indeed, political events and those linked to terrorist attacks reduce returns and increase the volatility of the stock index. However, the effect of these events on the behavior of the stock market was lower for the period before the revolution.

Keywords: Political instability, Terrorism, Stock Market Return, Volatility, Emerging Market
JEL Classifications: G11, G12, G14, C58, F31

1. INTRODUCTION

The stock market is the leading indicator of a country's economic strength. It provides an estimate of future economic actions. History shows that it has always been a good predictor of upcoming dejection of the economy. Many studies have demonstrated a strong link between stock market returns and economic activity (Fisher & Merton, 1984, Barro, 1990, Fama, 1990). Indeed, financial markets are widely regarded as essential to stimulating economic growth. Political events and terrorist events are crucial factors influencing the functioning of a country's stock market, as many studies have argued.

In the contemporary world, the subject of political stability is so important that the political power of all countries tries to solve the problem connected with it. It is necessary to note that stability is necessary for the value required for development in all spheres of social life. Positive changes are not possible in the event of destabilization and degradation.

Political instability shocks, also referred to as "elite instability" by Morrison and Stevenson (1971) and Fosu (2002) are the events of political instability, the peculiarity of which is that they are at the same time the most destabilizing and allow a possible continuity of the exercise of power after their occurrence. These are especially events called coups d'état, often referred to as successful, abortions or attempts. Barro (1991) measures instability by the "number of political agitations" including the number of "military hits." Alesina et al. (1996) retain as a measure of political instability the "propensity of the change of government" including unconstitutional revisions (including coups d'état).

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Political events have an adverse effect on the confidence of domestic and foreign investors as stock market volatility increases, leading to uncertainty of expected cash flows (Kongprajya, 2010). Political events include the introduction of government policy, government elections, civil war, political action by pressure groups, peace talks, government budget, corruption rate etc.

Moreover, terrorist attacks have had a markedly negative influence on the economy of any country in the short term. Almost all macroeconomic variables such as gross domestic product (GDP), employment, domestic investment and foreign direct investment are strongly influenced by terrorist attacks or the threat of such attacks (Abadie & Gardeazabal, 2003; 2008, Enders et al. 2006). This is because when terrorist events unfold, widespread uncertainty creates a confidence that prevents domestic and foreign investors. Government spending is also increasing to improve the security situation against the potential threats of terrorism. As a result, investment declines and the level of unemployment also increases, which ultimately reduces GDP. Most studies have revealed that the main purpose of all terrorist activities is to hinder the economy of any country to convince the government of its demands (Enders & Sandler 2008, Abadie & Gardeazabal, 2008).

Many empirical studies have examined the effect of political risks on certain industries or on the stock market in the country, but much of these works have focused on policy issues in developed countries and fewer studies are done in the context of emerging or developing countries. Indeed, as a result of dramatic political events such as the Arab Spring, the ramifications on the stock markets, especially on regional stock markets, are doubtful because the signal they send has clear implications.

Although these revolutions aim to promote democracy and help improve economic capacities, they could influence investor behavior because of the loss of confidence in local and regional stock markets. Several studies have examined the effects of the Arab Spring on economic performance as well as on the social or political environment (e.g. O'Sullivan et al., 2012, World Bank, 2011). Yet, 7 years later, it remains relatively unclear whether, and to what extent, recent political unrest has affected the global financial market.

Our contribution is related to our concentration on the reaction of stock markets in an emerging country. Our attention is justified by the fact that developed countries have well-established financial markets and strong institutions. As a result of terrorist attacks, governments in these countries are rapidly responding with a package of measures to alleviate shocks, while effective economic and financial institutions (with appropriate tools and resources) implement such policies and measures. However, in the case of developing countries, institutions are generally weak and financial markets are unstable, which can lead to excessive market reaction and ineffective implementation of government policies and actions after the terrorist attacks.

In this article, we examine the change in Tunisia. The Tunisian stock exchange (TSE) was established on 1969. The role of the stock market during this period in the financing of the economy remained limited or even insignificant because of the predominance of the State and the banks in the financing of the economy. This has resulted in significant levels of monetary creation and inflation. A reform of the financial market began in 1988 with the aim of creating a modern legal framework to enable the financial market to contribute to the financing of the economy and to reach the best international standards. The period between the Tunisian revolution of 14 January 2011 and the following years has witnessed numerous political and terrorist events. These events have affected the national economy as a whole by affecting outcomes, employment, income and investment decisions, either in real assets or in financial assets on the Tunisian stock market. The violence cost the Tunisian state 10.238 million (2016 PPP) which represents 8.1% of the country's GDP and according to the classification by the Institute of economy and peace, in a report published in 2017, Tunisia was placed in the 69th in terms of the most peaceful country (deterioration of 4 places compared to 2016). This deterioration was a characteristic of the entire MENA region which is the lowest-ranked region in the GPI (global peace index), as demonstrated by the deteriorating impact of terrorism scores for a number of countries, including Jordan, Saudi Arabia, Palestine, Qatar, Libya and Egypt will be further deteriorated in their overall score in 2017. An overview of the Tunisian economic and financial indicators will be presented in detail in this paper.

The main objectives of this article are to estimate the impact of political instability and terrorism events on stock market return and volatility. We will try to answer these important questions and, consequently, clarify the political ramifications as regards tax and monetary policies for the Tunisian economy.

The remainder of this paper is organized as follow: Section 2 outlines the literature review. Section 3 presents an overview of the Tunisian economy and the effect of the revolution. The data and the underlying methodology are exposed in Section 4. Section 5 reports and discusses empirical findings and Section 6 concludes the paper.

2. LITERATURE REVIEW

The impact of political, economic, social, environmental and demographic events on stock markets has been widely discussed in the literature. In fact, previous studies show that there is evidence that events such as wars, political events, monetary policy, energy crises etc., have considerable influence on market behavior. Nevertheless, the increasing frequency of terrorist events around the world has led to a growing demand for research on economic consequences of terrorism. According to International Monetary Fund researchers, Johnston and Nedelescu (2005), terrorist acts inflict direct and indirect economic costs. Direct economic costs are in the shorter term and include destruction of life and property, responses from emergency service providers, restoration of systems and infrastructure, and provision of temporary assistance to life. Indirect costs of terrorism can be considerably larger, affecting the economy in the medium term by undermining the confidence of consumers and investors. Terrorism can also have a long-term cost in reducing productivity due to increased security

measures, higher insurance premiums and increased costs of financial settlements and others counter-terrorism.

Given the importance of financial markets for the overall performance of the economy, a significant trend in the literature has emerged to study the impact of these phenomena on stock markets. The existing literature on the impact of terrorist attacks on stock markets can be categorized into three categories: impacts on stock market returns, impact on stock price and impact on market volatility.

2.1. Market Reaction to Terrorist Attacks

2.1.1. Impact of terrorist attacks on stock market returns

The reactions of equity market returns to terrorist attacks have been studied by measuring the effects of these attacks on firm performance, global stock market indices, sector indices, and industrial indices. Nevertheless, the severity and duration of this impact vary considerably depending on the size of the event and the country in which such terrorist acts took place. Recently, Aslam and Kang (2015), using an event study methodology, find that if the terrorist attacks adversely affect the Pakistan stock market, the impact is limited. They also find that the magnitude of this impact is positively related to the severity of the attack. More recently, Aslam et al. (2016) use the same methodology to test the impact of 410 terrorist attacks on stock returns in five Asian equity markets. They find that although these events have a significant impact on stock returns, the magnitude of these effects varies depending on the country, the type and the severity of the attack. Furthermore, Kollias et al. (2011), using the event study methodology and also the family models of GARCH, study the impact of the attacks of Madrid and London stock exchange. They find that important negative abnormal returns are widespread in the majority of sectors in the Spanish markets, which is not the case in London. In addition, the recovery time is much faster in the latter case. Estrada and Koutronas (2016) assess the regional effect of terrorist attacks using the Economic Impact Model of the Terrorist Attack (EITA), according to which the likelihood and extent of attacks are associated with the economic dynamics of the region. Applying their analysis to the recent terrorist attacks in Paris (November 2015) and Brussels (March 2016), the EITA model suggests that the nature of the attacks, the economic resilience of the French and Belgian economies and the security levels in the two countries are important determinants of the severity of terrorism and its consequences.

Other methodologies have been used, such as the stylized macroeconomic models of the world economy (Abadie and Gardeazabal, 2008), causality testing (Arin et al., 2008) and the global model for determining fixed asset prices (Drakos, 2010). Hobbs et al. (2016) examine the effect on stock performance of 28 terrorist and military events that occurred between 1963 and 2012 and show that stocks perform significantly better in terrorist events than in military events, but the opposite holds true for the next day. Aloui and Nguyen (2014) studied the dynamic behavior of six selected stock markets in the Mediterranean countries, including some MENA countries (Egypt, Tunisia and Turkey). The authors use the global Hurst exponent and Morlet wavelet multi-resolution analysis. Using daily data for the period 2005-2010, the empirical results show that extreme major shocks, such as the terrorist attack of September 11, 2001 and the financial crisis of 2007-2009, have an effect on stock returns. They also note the presence of long-term dependencies in the stock market returns of all the markets studied, with the exception of France. Nikkinen and Vähämaa (2010) analyze the behavior of expected probability density functions around the three attacks to capture the behavior of the stock markets. Hon et al. (2004) test the contagion effect of the September 11th terrorist attacks using a bias-correlation procedure. Baumert et al. (2013) use comparative performance analysis between the impact of the Boston Marathon (April 2013) bombing on stock performance in major international markets and the impact of the September 11 attacks.

In sum, and as Johnston and Nedelescu (2005) point out, markets hate uncertainty, this is why the precipitous reaction of markets to a terrorist attack is initially invariably downward. But the markets have proved extremely resistant to such attacks in the past and, after the initial negative reaction. In addition, investors treat terrorist attacks as one-off events and, therefore, their negative effect tends to be temporary. The same idea was advocated by Mnasri and Nechi (2016) who add that the effects are much greater when countries are integrated into global markets. Also, the reactions of well-developed markets to attacks are slower and decline more rapidly. This implies that investors in these markets have learned to objectively assess the impact of these attacks and not to react in an abusive manner. In addition, many studies conclude that terrorist attacks, after September 11, have led to an increased correlation between global financial markets, suggesting that the benefits of international diversification in times of crisis are greatly reduced.

2.1.2. Impact of terrorism attacks on stock price

Some researchers have been interested in studying the effects of terrorist attacks on firm stock prices. For example, Kolaric and Schiereck (2016) use a case study to analyze the impact of the terrorist attacks of Paris 11/13 and Brussels 03/22 on stock market prices of 27 European and North American airlines. Their results suggest that both events had a significant short-term effect on the valuation of airlines in the sample. Apergis and Apergis (2016) study the impact of the same attacks of Paris 11/13 on the big companies of the defense industry of the whole world. The results show that these attacks have a positive effect on the stock market returns of the companies in the sample since the cumulative abnormal returns tend to increase. However, Chen and Siems (2004) examined the reaction of the stock market to 14 terrorist and military attacks over the period 1915-2001. The authors have shown that terrorist and military attacks have a significant effect on equities and generate important immediate consequences on stock markets around the world. The results, however, show that the effect of these events was only short-term and that the stock markets absorbed the terrorist shocks, which generally leads to a rapid readjustment of stock prices. Drakos (2004) investigated a single sector and analyzed the Beta alteration of 13 airlines in the US and the rest of the world in the post 9/11 phase. He noted that equity prices have fallen by 30% on average for non-US companies. While, stock prices have declined on average by 53% for US companies. The authors conclude that the risk associated with the stocks of airlines has increased following this attack.

For its part, Baumert (2009) examined the terrorist event of 11 March 2004 in Madrid and its effect on the market. The study verified that the attack size (in terms of number of deaths and injuries) and also the alleged perpetrators of ETA against Al Qaeda were the two main reasons that significantly affect the market. On the other hand, investors have a tendency to act through rational behavior, despite their excessive reactions on the market. The author deduced that except the stocks directly related to this terrorist attack that have suffered very heavy losses. Brounen and Derwall (2010) identified stock market reactions to major terrorist events. It should be interpreted that the impact of these events and their effects on the stock markets is slightly negative, without taking into account the attack of September 11, 2001 which has shown harmful and long-term consequences. Mnasri and Nechi (2016) indicate that, overall, the results show that terrorism negatively affects the stock market prices of listed companies. Moreover, the impact is greater on companies operating in developed and more democratic countries.

2.1.3. Impact of terrorist attacks on stock market volatility

As we have just seen, the impact of terrorist attacks on stock returns has received considerable attention in the literature. In addition, some studies have attempted to investigate the impact of terrorist attacks on market volatility. For example, Bentes (2016) adopts the Fractionally Integrated GARCH (FIGARCH) model to examine the impact of four major global crises, including the September 11 terrorist attacks, on long memory behavior in volatility of gold yields using daily data for the period 1985-2009. The author finds evidence of a long memory in the conditional variance over the entire sampling period, but mixed evidence in sub-sample analysis. Similarly, Barros and Gil-Alana (2009) analyzed the effects of terrorist attacks on the Basque stock market (Bolsa de Bilbao) from July the first 2001 to March the eighteenth 2006. They used long-term regression models and found that violence has a significant negative effect on stock market returns. In contrast, volatility processes are positively correlated with violence.

Drakos (2004), Carter and Simkins (2004) and Choudhry (2005) examined the extent to which the September 11, 2001 attacks changed the risk by using Beta as a measuring instrument. They calculated the market volatility for the general and sector indices corresponds to each stock. Specifically, according to size difference, geographic location and sector, they compared the Beta in the period before and after the attacks of 11/09 which contains 20 US companies. Their results revealed that the impact varies according to the characteristics of each company.

Arin et al. (2008) revealed very pertinent results about the impact of terrorist events on stock markets. These authors used data from six different countries (Indonesia, Israel, Spain, Thailand, Turkey, and United Kingdom) to take into account volatility and not just stock markets returns. They found that the impact of this kind of events is significantly greater in emerging markets. Gul et al. (2010) estimated the impact of terrorism on financial markets in Pakistan over 2-year period. Using the ordinary least squares method (OLS), they found that terrorist attacks have a negative impact on Pakistan's financial markets and economy. The work of Nikkenen and Vahamaa (2010) focuses on the reaction and comparison of the FTSE 100 index after the attacks of 11 September 2001 in the United States and those of 11 March 2004 in Madrid and 7 July 2005 in London. Their research has shown that these attacks transform the expectations of investors down and also the increase in uncertainty vis a vis the stock markets.

Suleman (2012) used the GARCH model to measure the impact of terrorism news on returns and volatility. The results show that terrorist attacks increase the volatility of the KSE100 index and the financial sector index. These types of news have more impact on the volatility of the financial sector compared to other sectors. However, the author has not found significant results on the impact of news of the terrorist attack on oil and gas and on industry.

Nguyen and Enomoto (2009) use the GARCH model to determine the effect of seven international terrorist attacks on the stock markets of Iran and Pakistan. They found that the attacks in Indonesia, Madrid, London and Iraq had significant negative effects on the market returns volatility. The September 11 terrorist attack showed a negative and significant reaction on Tehran and on the Karachi stock markets.

Chesney et al. (2011) combine a GARCH approach with an extreme value theory (VET), with 25 countries and an 11-year time interval. The authors conclude that about two-thirds of the terrorist attacks considered lead to a significant negative impact on at least one stock market (the Swiss market being the most sensitive and the American one - except 9/11 being the least sensitive). Moreover, their study shows that the most sensitive sectors are insurance and airlines, while the least sensitive is the banking sector. Essaddam and Karagianis (2014) use volatility events study approach to examine the impact of 44 terrorist attacks on the volatility of equity returns of US companies operating in and out United States over the period 1995-2010. Their results show that the impact of terrorist attacks on the return volatility of American companies' stock lasts at least 15 days. They also find that firms in rich and/or more democratic countries experience a greater variation in the volatility of their stock market returns compared to firms in developing countries. Essaddam and Mnasri (2015) refined the evaluation methodology of Essaddam and Karagianis (2014) by proposing a bootstrap method using a set of 28 events (terrorist attacks) in 17 countries. Their results show that abnormal volatility begins on the day of the attack and remains significant for a number of days.

Mnasri and Nechi (2016) study the size effect and long-term effect of terrorist attacks on the volatility of stock returns in 12 MENA countries using the event study approach. Their study consists of the originality of the method used to test financial integration in the MENA region. In fact, in order to trace the effects of terrorist attacks on the volatility of financial markets, they evaluate their methodology for studying events using two different test methods. The first test is parametric and leads to the assumption that the underlying assumptions for calculations of the theoretical p values are satisfied, while the second test is based on an improved bootstrap technique that overcomes the

disadvantages of parametric tests and techniques of the traditional bootstrap. Although the results of the two tests lead to the same conclusion that terrorist attacks have a positive and significant impact on financial market volatility, the semi-parametric test is more robust and provides a better approximation of the empirical distribution of statistical tests in The context of volatility event models. Moreover, evidence of the regional financial integration of the MENA markets suggests that the risk of terrorism poses a threat not only to the stability of local economies but also to cross-border economies.

2.2. Stock Market Reaction to Political Uncertainty

Before we begin to talk about the effects of political uncertainty on the financial market, we begin with a definition of the term political uncertainty. Indeed, previous research uses the notion of political risk, political uncertainty and political instability without distinguishing between the three. According to Sionneau (1996), it was between the 1950s and 1970s that a number of American authors from firm or university (Wharton, Harvard, Columbia, etc.) conceive the notion of Political risk and make the distinction between "political uncertainty" and "political risk." According to Rummel and Heenan (1978), "Political uncertainty describes an unmeasured, subjective doubt about a political environment." In other words, every element which in the political business environment raises "doubt" (regulatory measures taken by States, or events triggered by various social groups: terrorism, strikes, revolutions - which may affect the activity of an enterprise, etc.).) but lends itself to the measurement or the calculation of probabilities, is a matter of political risk and, conversely, any element which, in this environment, gives rise to "doubt" but is subjective and does not lend itself to measurement, falls within the realm of uncertainty.

Robock (1971) chooses to confirm the study of political risk by introducing the idea of discontinuity into the economic environment, distinguishing between political risk and political instability and by establishing a difference between macro and micro-political risk: He believes that political risk exists from the economic point of view when discontinuities, which are difficult to anticipate, occur in the economic environment due to political changes. However, these discontinuities will only constitute a political risk for a firm if they significantly affect the profitability of its projects. In the second case, Robock assumes that an unstable political situation is not necessarily synonymous with political risk: he quotes the example of Italy, which in 36 years sees 40 governments without the foreign trade in this country suffers significantly. Recently, Abessolo (2003) states that political instability is a heteroclite concept, defined as the manifestation of several factors that do not fully overlap and must be taken into account simultaneously. It covers two distinct categories: regular changes in political power while respecting legal forms, and political changes through violence (Alesina et al., 1996). More recently, Sidamor et al.(2016) indicate that political stability is a qualitative state of public development, defined as public order, which dominates the system of connections and relationships that reflect the community and the succession of goals, values and ways to achieve them. Consequently, stability is the ability of socio-economic actors to resist to internal and external influences that disrupt the system. In this sense, stability is seen as the most important mechanism for supporting the life and development of the social system. The content of the concept of stability can be conceptualized as follows: stability is firmness, coherence, the ability of a system to function while maintaining its structure and equilibrium.

The effects that global events have on stock prices have intrigued financial economists for decades, especially after recent dramatic increases and declines in stock markets. So, in times of political and civil unrest, it is not uncommon for stock markets to experience increased levels of volatility, as major political events signal a potential policy shift that may cause changes in market valuation (Karolyi, 2006). Many researches examine political events and test their impact on market volatility and find that political uncertainty is directly related to market volatility.

For example, Alexakis and Petrakis (1991), Chan and Wei (1996) and Brooks et al. (1997) empirically show that the dissemination of news about politics and the socio-political events that have taken place have affected the volatility of the stock market in Greece, Hong Kong and South Africa respectively, using ARCH/GARCH models. For their part, Leon et al. (2000) tests the volatility of the stock market in Trinidad and Tobago during a period characterized by political uncertainty and show a significant "calm" of markets once political stability is achieved. Perotti and Oijen (2001) studied the indirect impact of the privatization policy of emerging economies on the development of the stock market by resolving political risk. The authors show that political risk is very important in emerging markets. They argue that a pro-privatization program is a major political test that consistently resolves uncertainty about political commitment to a market-based policy as well as regulatory and private property rights. Their analysis also shows that changes in political risk in general tend to have a strong effect on the development of the local stock market and abnormal returns in emerging economies, suggesting that political risk is a price factor.

Another aspect of empirical research has examined the impact of accidental events, such as political party breakdowns or tragic deaths (Faccio and Parsley, 2009); corporate donations to political parties (Jayachandran, 2006; Snowberg et al., 2007; Shon, 2010) on stock market returns. The results of these studies show that the impact of these events results in an abnormal change (an improvement or a decrease in stock returns) in the valuation of the market of the participating firms during the week of the event (Snowberg et al., 2007, Shon, 2010,). Other authors argue that these yield differentials may constitute a violation of the semi-efficient form of market efficiency (Belo et al., 2013) and show that in models that allow risk to change in relation to political cycles, the "presidential puzzle" can be explained (Sy and Zaman, 2011). On the other hand, other authors indicate that the political considerations of investors change according to the country-specific environment and generalizations are not likely to capture the complexity of the international political landscape (Bialkowski et al., 2007, Dopke and Pierdzioch, 2006). So the results for some countries can not be easily generalized in the international context.

Mei and Guo (2004) examine the impact of political uncertainty on financial crises based on a sample of 22 emerging markets. In examining political electoral cycles and using a combination of probit analysis and regression of commutation, the authors show that most financial crises occurred during political election periods and also show significant volatility markets during these periods. According to the authors, policy is important in emerging markets and institutional investors should take this into account when investing in emerging financial markets during political election periods.

Amihud and Wohl (2004) study the relationship between the fall of Saddam Hussein and market expectations about stock prices, oil prices and exchange rates. Expectations are obtained from the prices of negotiated contracts that promised a fixed amount if Saddam was out of power on the expiry date of the contracts. The results show that during the war, an increase in these expectations had significant positive effects on stock prices. Moreover, an increase in the likelihood of the fall of Saddam has strengthened the US dollar against the euro and lowered oil prices.

Based on a sample of the 27 OECD countries, Białkowski et al. (2008) have tried to see if national elections cause high stock market volatility. They noticed that during the week surrounding the elections, the increase in volatility can easily reach a double level. Abdelbaki (2013) states that there is no doubt that Arab Spring revolutions in Tunisia, Egypt, Libya, Yemen and Syria affect macroeconomic variables and stock markets in the national economy. The author studied the impact of political and economic instability and the external events associated with the 2011 Egyptian Revolution on stock market performance using newly developed techniques of co-integration of chronological data; Vector Error Correction Model (VECM). The results suggest that political instability plays an important role in the management of stock markets. However, economic instability came second.

Chau et al.(2014) examine the impact of political uncertainty (caused by civil uprisings in the Arab world known by the Arab Spring name) on the volatility of the main MENA stock exchanges. By distinguishing traditional and Islamic stock indices, the authors indicate that these two investment groups react heterogeneously to the recent political crisis. More specifically, the results show a significant increase in the volatility of Islamic indices during the period of political unrest, while the uprisings have had little or no significant effect on the volatility of conventional markets. This difference is confirmed by further analysis in a multivariate GARCH model. Moreover, regardless of its impact on volatility, little evidence suggests that MENA markets have become more integrated into international markets after the political revolution. In general, these results are robust to model specification and consistent with the notion that political uncertainty contributes to financial volatility.

For their part, Wang et al. (2014) studied the impact of the uncertainty of economic policies on the investments of Chinese listed companies during the period 2003-2012. The results revealed that companies tend to reduce their investment when economic policy uncertainty increases and vice versa. In turn, Rahim and Masih (2014), study the time varying volatility and back links of Moroccan Islamic stock indices with the market and regional indices, especially in times of political unrest. The authors used the Dow Jones developed market indices and emerging market indices to represent market-based indices, while Dow Jones Europe Islamic and Dow Jones Asia Pacific Islamic were used to represent regional indices. In order to detect the variable nature of these co-movements, the MGARCH-DCC has been adopted and applied to daily data covering the period from June 2007 to December 2012.

Results show that Moroccan Islamic investors can benefit from portfolio diversification in the developed markets and the Asia-Pacific market especially during periods when there is no political unrest. According the authors, the results are essential to understand the role of political uncertainty on the stability of the stock market and are of great interest to investors, especially Islamic ones. In addition, Tang and Abosedra (2014) examined the impacts of tourism, energy consumption and political instability on the economic growth of 24 countries in the MENA region. The authors applied the static panel data approach and the GMM model. The results show that energy consumption and tourism contribute significantly to economic growth and that political instability hampers the process of economic growth and development in the MENA region. The authors add that trying to solve political instability problems would further encourage the arrival of international tourists and stimulate economic growth more and more.

Günay (2016) analyzes the impact of political risk on the Turkish stock market during the period 2001-2014. Several empirical methods have been used to obtain breaks and regimes in the volatility of the BIST100 index. According to the results, while the number of breaks has increased in recent years, the risk level of recent periods is much lower than that of the first plans and the trend of the level of risk for all the schemes shows a negative slope. In total, the Turkish stock market responds to political events, but not as significantly as in the past.

Little research has been done on the impact of political uncertainty stemming from civil uprisings (eg the Tunisian revolution) on the stability and characteristics of stock market cycles. So, Jeribi et al. (2016) study the impact of political uncertainty (resulting from the Tunisian revolution) on the volatility of the main sector in stock market indices of the Tunisian Stock Exchange. The authors apply the fractionally integrated exponential generalized autoregressive conditional heteroscedasticity model (FIEGARCH). This model is applied to the daily yields of nine sector indices and the Tunisian benchmark index (TUNINDEX) compared to three sub-periods (before, during and following the Tunisian revolution). The results obtained suggest that the impact of shocks throughout the revolutionary period on construction, industries, consumer services, financial services, financial sector indices and TUNINDEX return volatilities were found to be permanent, while its persistence on other indices is transitory.

For his part, Trabelsi (2017) examines the impact of political uncertainty caused by the Tunisian Revolution on the behavior and characteristics of Tunisian stock cycles in varying periods. More

particularly, the author compares the characteristics of the Tunisian stock market cycles before and after the revolution and uses the Tunisian stock market index. By applying the univariate structural time series methodology to extract the cycle and trend components, the empirical results show that political uncertainty appears to generate unbalanced financial markets and more pronounced stock market cycles. The shock of the Tunisian revolution is very sustained, but temporary, and leads to a deviation of the trend of its original path. Indeed, during the period following the civil uprisings, the amplitude and the volatility of the Tunisian markets of the stock market have greatly increased. But in the long run, the amplitude and volatility of inventory cycles are amortized to a lower level. The author indicates that fluctuations in the prices of financial assets are influenced by political events in addition to common financial and economic factors.

3. OVERVIEW OF THE TUNISIAN ECONOMY AND EFFECT OF THE REVOLUTION

The Tunisian revolution is often seen as a drama that reaches the capital as well as several regions of the country. This makes the problem of its dissemination particularly interesting. The process began in the small town of Sidi Bouizid following the immolation of Mr. Mohamed Bouazizi on December 17, 2010: hundreds of young people protested against the growth of the unemployment rate and accelerated price increases. In addition, most regions are without hospitals worthy of the name, due to under-equipment. This is particularly true for the center-west, the Kasserine and Thala regions, but also for Gafsa, as shown in Figure 1 (the unemployment rate was THE highest in the Sidi Bouzid region).

These protests led to victims (injured and dead): Citizens, prisoners, national security forces and the national army. The first events of the capital, Tunis, took place on December 25th. Then, following the death of Mohamed Bouazizi on January 4, 2011, the clashes with the police in Sidi Bouzid resulted in at least 20 deaths. The protestors of Sidi Bouzid began taking pictures, which were then published on the Web using social media sites. They were targeting the regime itself. Indeed, the undeniable nature of the regime has resulted in a low level of transparency and accountability. Public opinion was monitored closely, and information filtered and censored, including economic data. The political system was based on a centralized administration to influence or intimidate the population through political parties, police, justice, tax administrations, etc.

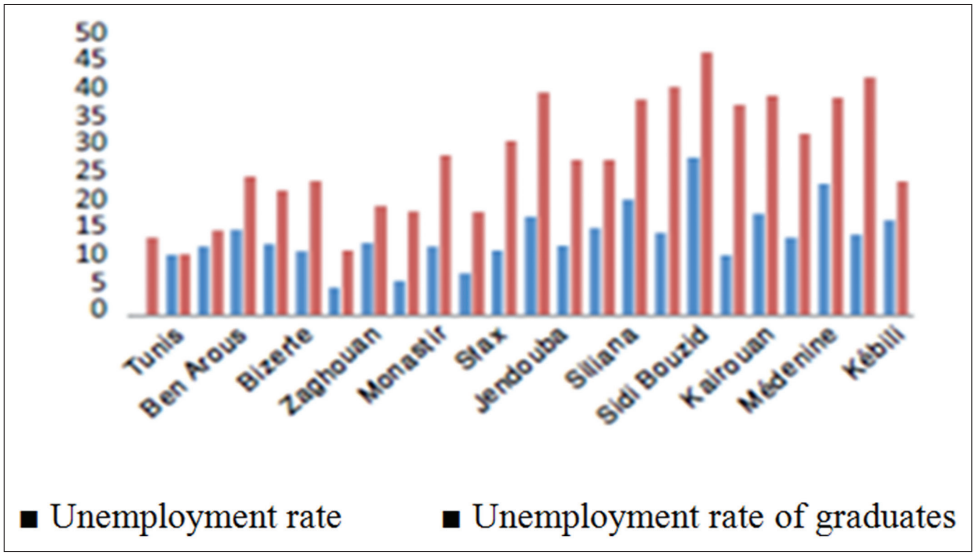
On January 14, 2011, Ben Ali left the country and since the former regime was expelled from power, Tunisia is experiencing a difficult transitional period. Since October 2011, when the Ennahdha party came to power and Tunisia was subjected to political tensions between Islamists and secular forces, whose reforms and the economy were the first victims with a low growth rate or even negative (−1.9% in 2011). The unemployment rate rose from 13% to 15.6%. It even reached 18.3% in 2011, much higher compared to other countries in the same region (e.g. Morocco, Algeria and Egypt) as shown in Figure 2 (Table 1).

The inflation rate has become very high (especially for the years 2012 and 2013) and it is always higher than that of Morocco for example. These figures as well as the social unrest following the revolution imply that Tunisia will face an additional period of institutional and political uncertainty.

Political and economic uncertainty has put a brake on the employment situation and led to a decline in tourism incomes and a lack of visibility for foreign investors who either postponed their projects or withdrew their capital, saving thousands of jobs (Figure 3).

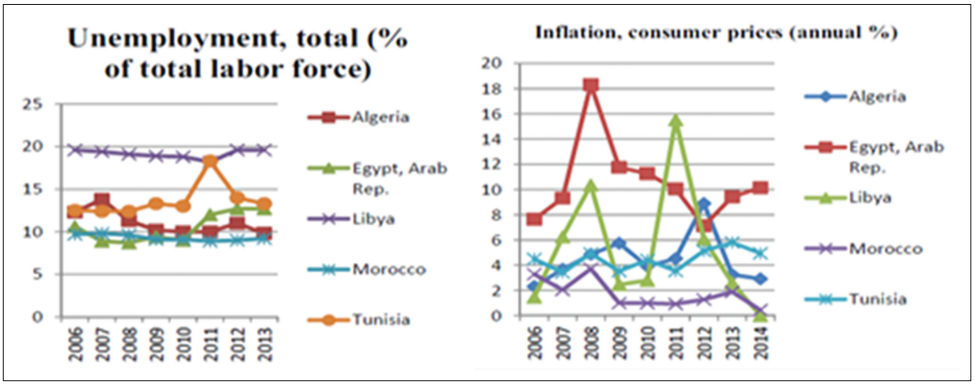
Undoubtedly, the Tunisian revolution seems to have a remarkable impact on the stock markets within the national economy. Indeed, greater political uncertainty imposes additional costs on the loan contract because of the higher cost of bank debt (Francis et al., 2014). Consequently, the post-revolution period was marked by a *wave* of new listings especially for the year 2013 as shown in Table 2.

Figure 1: Unemployment rate in the governorates (%)



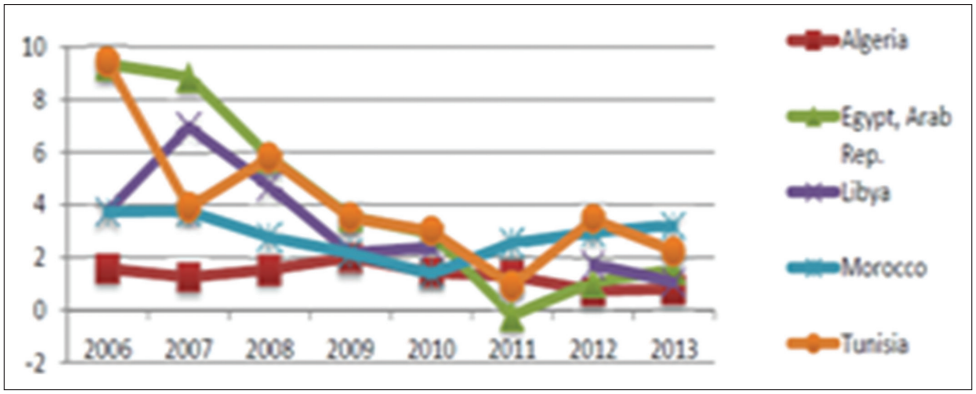
Source: Ministry of Regional Development 2010

Figure 2: Unemployment and inflation rates



Source: World Bank's development indicators (WDI) (November 2015)

Figure 3: Chart foreign investment, net inflows (%GDP)



Source: World Bank's development indicators (WDI) (November 2015)

From December 2010, when the wave of political protests began, the crisis of confidence returned to the market with a decline in the TUNINDEX, which prompted the financial market council to suspend trading from the 17th to the 30th January 2011, in order to protect the savings invested in securities. In addition, as shown in Table 3, the Tunindex recorded 4 years of consecutive declines after 8 consecutive years of increases.

Before the revolution, the volume of trade recorded a high growth rate of + 15% and + 25% for market capitalization in 2010. However, after the revolution, they seem to have a negative growth rate of -18% for Volume of exchanges and −5.4% for market capitalization, despite the emergence of several IPOs, as shown in Table 3. This decline, which is synonymous with a weakening of investor confidence, was mainly attributable to the economic situation and security crisis in Tunisia: degradation of sovereign rating, escalation of terrorism, political assassinations (in particular during the year 2013 characterized by the murder of two politicians (Chokri Belaid in February 2013 and Brahmi in July 2013) and the assassination of 8 soldiers in an ambush on 29 July of the same year), political instability, the delay in the drafting of the constitution and the ensuing institutional uncertainty about the transition process etc. By contrast, in 2013, foreign ownership in the market capitalization increased by 1.53 points to 22.04% (Figure 4).

In spite of a difficult economic situation, the year 2014 saw a strong improvement in the TUNINDEX which closed the year at + 16.17% compared to 2013. This contributed to the success of the legislative elections of the month of October 2014, which resulted in a new political landscape. Indeed, the index performed

Table 1: Evolution of the main economic indicators in Tunisia

Economic indicators	Growth rate (%)	Unemployment rate (%)	Inflation rate (%)
Year			
2010	3.50	13	4.4
2011	−1.90	18.3	3.5
2012	4	17.6	5.1
2013	2.9	15.9	5.7
2014	2.8	14.8	4.8
2015	1.1	15.2	4.1
2016	1.3	15.6	4.2

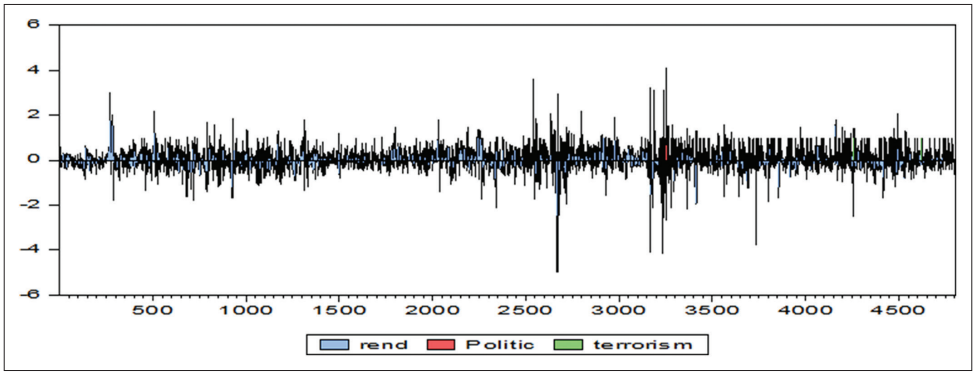
Source: Developed by the authors with reference to the annual reports of the BCT

Table 2: Evolution of admissions on the stock exchange

Admissions on the stock exchange	2010	2011	2012	2013	2014	2015	2016
Main market	55	55	55	62	65	66	67
Alternative market	2	3	4	9	12	12	12
Total	57	58	59	71	77	78	79
Variation	6	+1	+1	+12	+6	+1	+1

Source: Developed by the authors on the basis of the annual reports of the BVMT

Figure 4: Evolution of the market return, political events and terrorist events



Source: World Bank's development indicators (WDI) (November 2015)

Table 3: Stock market performance

Performance indicators	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 (%)
Variation TUNINDEX	+19.13	−7.63	−3.02	−4.33	+16.17	−0.94	+8.86
Volume of trade	+15.4	−18	−6.6	+32.6	+16	+54	−31
Market capitalisation	+25	−5.4	−4.7	+2.3	+23	+2.92	+8.24
Foreign holding in stock market capitalization	20.1	20.2	20.5	22	24.1	25.58	24.45

Source: Developed by the authors on the basis of the annual reports of the BVMT

its best and the market capitalization achieved a positive change of more than 23%. The Market capitalization held by foreigners has increased by 2.06 points in 2014 compared to 2013.

The terrorist attacks in 2015 paralyzed several economic sectors, mainly the tourism sector, which remains one of the pillars of the Tunisian economic model. The growth rate of the Tunisian economy in 2015 is limited to 1.1% against 2.8% in 2014. The TUNINDEX has thus experienced a slight decrease of 0.94% after which it takes again colors and ends the year 2016 with a rise of 8.86% and a remarkable growth of market capitalization of + 8.24% reflecting the renewed confidence of investors after the success of the main political meetings, the two legislative and presidential elections, and the and the setting up of a new government. Market capitalization held by foreigners represents in 2016, 24.45% against a share of 25.58% in 2015. The inflation rate stood at 4.2% in December 2016, down sharply from the same month of 2014 and 2013 (4.8% and 5.7%, respectively), but a slight increase compared to 2015 and the growth rate has increased slightly from 2015 (+ 1.3%) but is still low compared to 2010 (3.5%).

In sum, the figures show a busting situation that is difficult to justify economically, but which marks a cautious return of investors to the market. The evidences that emerge from this reading of the impact of the main terrorist events on the Tunisian market must be supported by empirical tests.

4. METHODOLOGY

The aim of our study is to analyze the effect of political events and terrorist events before and during the revolution, from 02/01/1998 to 16/12/2010 and from 17/12/2010 to 25/05/2017 on the main index (TUNINDEX) based on the EGARCH model.

Table 4: Descriptives statistics

	Stock market return	Political events	Terrorist events
Mean	0.036209	0.015202	0.013953
Maximum	4.108117	1.000000	1.000000
Minimum	−5.004404	0.000000	0.000000
Standard deviation	0.516792	0.122368	0.117306
Skewness	−0.254637	7.924409	8.287689
Kurtosis	13.86503	63.79626	69.68579
Jarque-Bera	23666.56	789803.0	944741.1
Prob.	0.000000	0.000000	0.000000

4.1. Data

In order to test the variation of the index in time presented by the return following the occurrence of political events and terrorist events, we select the daily return for TUNINDEX as a dependent variable, collected from the Tunisian Stock Exchange:

$$R_{mt} = Ln(\frac{Pt}{P_{t-1}})*100 \quad (1)$$

Political events have been collected from electronic journals such as (space manager, leaders, web manager reports of the World Bank, etc.) and Terrorist attacks have been gleaned from the Global Terrorism Database which documents all incidents of terrorism across the globe since 1970. The number of events is equal to (198) events ((73) relating to terrorism and (125) political events) (Appendices for selected events).

4.2. Descriptive Statistics

The descriptive analysis of a time series is based essentially on the analysis of flattening coefficients (kurtosis) and skewness asymmetry. The latter can be combined in a Jarque-Bera (JB) statistic to test the normality of a distribution (Table 4).

We note mainly that for the series of profitability, political events and terrorist events, the null hypothesis of normality is rejected.

We first observe that the Kurtosis coefficient is very high and largely different from 3. This phenomenon of excess kurtosis confirms well the strongly leptokurtic character of series of stock returns. Second, the coefficient of Skweness is different from 0, we note that this coefficient for the series of return is negative; this indicates that the distribution of each series is spread to the left. This illustrates the presence of asymmetry, which may be an indicator of non-linearity. As a result, series of return, political events and terrorist events do not follow a normal distribution, which is a general feature of financial series.

4.3. Stationary Tests

According to the graph, it appears that the series are all stationary since they show no tendency and converge towards their averages over the long term and are characterized by an instability that varies with time with periods more or less volatile. To confirm this, we must test the null hypothesis of absence of unit roots by testing the nullity of the parameter φ using student statistics, thus the results of ADF and PP are presented in the Table 5.

From the stationary table, ADF, PP tests on stock market return, political events and terrorist events series, we note that all the series used are stationary in level.

4.4. Estimation of the EGARCH Model

GARCH models are mainly used to model and predict volatility. But, unlike the ARCH and GARCH models, according to Nelson (1991) the EGARCH model, allows to capture peripheral shocks in the estimation of the uncertainty and also allows the treatment and the distinction of the positive shocks of the negative ones. This model has several advantages: it makes it possible to distinguish the asymmetry of the reaction from the stock market return to the signs of the shocks. It has another advantage over standard GARCH, it does not require any restriction of non-negativity on the parameters in order to guarantee the positivity of the conditional variance, and allows the modeling of the stock marker return, and its uncertainty in logarithm, which avoids the effect of absurd values in the estimation of the results. According to the researchers, the negative relationship between conditional return and conditional variance means that the intensification of volatility is due to the negative shock of profitability where value tends to rise in response to "bad news" (lower than expected), and to decline in response to good news (higher than expected). Moreover, the EGARCH model makes it possible to account for the asymmetry which depends not only on the positive or negative sign but also on the amplitude of the shock. In our study, the EGARCH model is used to analyze the relationship between return and excess volatility which is defined by the following regression:

Mean Equation

$$r_{xi,t}=\varphi_0+\varphi_1 r_{i,t-1}+\varphi_2 Dummy+\varepsilon_{xi,t} \quad (1)$$

Variance Equation

$$\log\left(h^2_{xi,t}\right)=\xi+\alpha_1 g_{x,1}\left(Z_{xi,t-1}\right)+\beta\log\left(h^2_{xi,t-1}\right)+\alpha_2 Dummy \quad (2)$$

$$g_{xi,t}Z_{xi,t}=((Z_{xi,t-1}-EZ_{xi,t-1})+\delta Z_{xi,t-1} and\ Z_{xi,t-1}=\varepsilon_{xi,t-1}/h_{xi,t-1} \quad (3)$$

X_i= stock return index
φ_{i0}= Constant

$\varphi i_2, \alpha i_2$= Coefficients
ξ,β,δ = Conditional variance parameters
β_i = Last period effect on conditional variance
α_1= Contribution of the previous period in the explanation of information related to residuals, affecting the volatility of the period.
δ_i = Distinctive effect between bad news and good news. Negative coefficient means that bad news have greater effect on volatility.

The dummy variables are the following:
ev_pol: Political events as a dummy variable, it takes 1 in case of event's occurrence and 0 otherwise.
ev_terro: events related to terrorism as a dummy variable, it takes 1 in case of event's occurrence and 0 otherwise.

5. RESULTS AND INTERPRETATIONS

5.1. Testing the Coefficients

The verification of the stationary of the series of returns on the stock market al.ows us to analyze certain simple and partial correlograms which allow us to derive an order p equal to 1 and an order q equal to 1. This result gives us 3 processes which are AR (1), MA (1) and ARMA (1,1). Appendix 1 shows that the coefficients of AR(1), MA (1) and ARMA (1,1) before revolution, and the coefficients of AR(1) and MA(1) after revolution are significant.

5.2. Residual Tests

In order to verify the adequacy of the model, we proceed in the same way by analyzing the residual correlogram of the three processes. The AR (1), MA (1) and ARMA (1.1) models have some advantage, more precisely the probabilities assigned to autocorrelations are considerably higher than 0.05 to a large order

Table 5: Stationary tests

Variables	ADF		PP		Critic value	
	With constant and trend	With constant	With constant and trend	With constant	With constant and trend	With constant
Market return	−50.85071	−50.85530	−50.97329	−50.97824	−3.959950	−3.431530
Political events	−45.35159	-	−70.81721	-	−3.410741	−2.861946
Terrorist events	−45.76042	-	−66.75970	-	−3.127160	−2.567029

of delay. As the Q statistic for this order is less than the value χ^2 (32), hence the acceptance of the null Box-Pierce hypothesis (no autocorrelation), AR (1), MA (1) and ARMA (1.1) are the most appropriate models.

5.3. Heteroskedasticity Test

The residue graph of ARMA (1,1), AR (1) and MA (1) can give us a preliminary idea of the presence or absence of heteroskedasticity, due to the existence of volatilities, it suggests that an ARCH process could be adapted to the modeling of this series. The study of the heteroskedasticity of the conditional variance is found from the correlogram of the squares of the residuals. Correlograms show that all the probabilities are greater than 0.05, hence the acceptance of the null hypothesis of homoscedasticity. This result is confirmed by the Box-Pierce method, because the value of Q (32) is greater than that of χ^2 (32).

5.4. The Square Residues Correlogram

The Q Ljung-Box statistic indicates a correllogram whose terms are significantly different from zero; an ARCH specification is therefore to be retained. The critical probabilities of the Q statistic are greater than the 5% level, and all terms of the correlogram are within the confidence interval. Thus, the Ljung-Box statistic (LB 32) calculated with 32 delays makes it possible to detect the autocorrelation of the series. Under the hypothesis (H0) of joint nullity of the first 32 autocorrelations, this statistic follows a χ^2 (32).

5.5. Test ARCH

The ARCH test provides the following results (Table 6):

For our series, the results confirm the existence of an ARCH effect. Therefore, we find more than one candidate model for this modeling, which are AR (1), MA (1) and ARMA (1, 1) and EGARCH (p, q) but the most appropriate one is the one that verifies the minimum of AIC, SC and HQ criteria, and maximizes the likelihood log.

The estimates of the different models give the results (Appendix 2).

5.6. Main Results

Following the estimation of the EGARCH model, after having estimated the coefficients to have the most suitable process and after testing the heteroskedasticity of the errors, based on the information criteria and the likelihood log, we proved that the model MA (1,1) -EGARCH (1,1) is the most appropriate model to explain the relationship between the return of the Tunisian stock index "Tunindex," its volatility and the political events before the revolution. Thus, our results show that political events have no significant effect on either the performance of the "Tunindex" or its volatility. This is explained by the coefficients of the political events variable in the equation of mean and variance which is negative but not significant for the pre-revolution period. Indeed, during the period preceding the 2011 revolution, most of the political events included in our study concern the presidential elections. However, the results of these elections are generally known in advance since the policy in Tunisia was dominated by the regime of the Constitutional Democratic Rally. So these events do not matter to investors and do not affect their behavior, hence this neutral relationship between political events and the returns/volatility of the stock index. Moreover, this result can be explained by the fact that during the pre-revolution period, speeches on the "stability and security of Tunisia" were emphasized on the basis of numerous techniques, such as the choice of comparative and periods, the systematic forgetting of past performances, the appropriation by the administration and the central power of social dynamics, the elaboration and obscuration of data, the use of secrecy, rumors, the absence of press and critical analysis, the selectivity of the information used and its staging, dressing according to international fashions and rhetoric and difficulties in accessing information (Hibou, 2005).

Table 6: Heteroskesdicity ARCH test

Heteroskedasticity Test: ARCH (pre-revolution)			
F-statistic	978.3462	Prob. F (1,3209)	0.0000
Obs*R^2	750.2292	Prob. Chi-square (1)	0.0000
Heteroskedasticity test: ARCH (post revolution)			
F-statistic	727.2461	Prob. F (1,1586)	0.0000
Obs*R^2	499.2408	Prob. Chi-square (1)	0.0000

On the other hand, the ARMA (1,1) EGARCH (1,1) model is considered the most appropriate model to explain the causal relationship between the return of the Tunisian stock index, its volatility and terrorist attacks before the revolution. Thus, these events have a negative and significant effect at 5% level on the return on stock prices. But, terrorist attacks do not have a significant effect on yield volatility. This is expressed by the negative coefficient (−0.406751) but not significant. These results can be explained by the fact that the two major terrorist events that were included in our study during the pre-revolution period were the terrorist attack on the Ghriba synagogue in Djerba in 2002 and the Soliman affair in 2007. These two events had a considerable echo negatively affecting the performance of the stock market. But the effect was not considerable on its volatility. Indeed, this is due to the silence of mass media during these two events and the Tunisian authorities present the explosion (concerning the first event) as an accident. The local press defended also this thesis for several days after the event. Similarly, the Minister of the Interior and the media reported (for the second event) that there was an exchange of shots between the security forces and members of a band of dangerous criminals linked to an international drug trafficking network, while both were terrorist attacks that had been camouflaged in the media and official information was parsimonious at the time of President Ben Ali.

Moreover, we have found that the MA (1) -EGARCH (1,1) is the most appropriate model to explain the relationship between the Tunisian stock market return, volatility and the political events after the revolution. Thus, our results show that these events have negative but not significant effects on price behavior. This is verified by the coefficient of these events in the mean equation which is negative (−0.043793) but with a low probability (0.5756). Nevertheless, these political events have a positive and significant impact on the volatility as shown by the positive coefficient (1.179914), with zero probability (0.0000). Concerning the events linked to the terrorist attacks, we chose the AR (1) -EGARCH

(1.1) model which shows that terrorist attacks have negative and significant effects at 5% level on price behavior as shown by negative and coefficient (−0.127007), with an almost zero probability (0.0468). Moreover, these events have positive and significant effects at 1% on volatility, as shown by the coefficient for terrorist events (0.381891) in the variance equation with zero probability.

All in all, we can see from the empirical results that political instability and terrorist attacks (after the revolution) have more weight and greatly affects the stock market through their impact on investor behavior. The latter remain more concerned about the economic outlook, considering among other things indicators and aggregates, confidence indices, unemployment statistics.etc. So despite the fact that the BVMT, is not very large in size, but could still be a stable market and managed to resist certain events that occurred internationally, for example, the global economic crisis of 2008-2009. Nevertheless, we noticed the sensitivity of the Tunindex to events linked to political instability and terrorist attacks during the revolution. Indeed, the period of the so-called "Arab Spring" is characterized by political instability and a significant number of terrorist attacks that have affected not only Tunisia but also several countries around the world.

Thus, this negative impact on stock market return and positive impact on volatility can be explained by the lack of own and external resources, by sterile political and social debates, and by the fact that the government has not been able to find the necessary support measures. Investors seem to be concerned about these one-off events by adopting a neutral attitude in the short term. What is important to investors is the effective implementation of the decisions of the authorities in place to minimize the structural effects of such acts and thereby reduce the economic, political and social risks may result. In addition, several sectors, including the banking and leasing sectors, are currently facing recovery difficulties because of these attacks (particularly in the tourism sector), whereas air transport is directly affected, recording the quasi-bankruptcy of one of listed companies.

All in all, the Tunisian stock market is sensitive to the political climate and financial investors, in the face of political instability and financial reluctance, have a preference for liquidity and adopt an anti-risk behavior.

In addition, the depreciation of the dinar, the return of inflationary pressures, the widening of the external deficit and the lack of visibility adversely affected the performance of the stock index. Let us note that the confidence of the Tunisians in their armed forces is increasing continuously and unfortunately it is less so in relation to the political, economic and legislative power represented by the ARP. Indeed, essential laws that should provide the executive with the necessary legal and financial means to prevent terrorism, corruption and tax evasion have taken several months to be voted with endless committee meetings, could be found in a few days. All those involved in the management of the country must be more interested in "public affairs" than in individual and private interests.

In sum, there is no doubt that Arab Spring revolution in Tunisia, Egypt, Libya, Yemen and Syria affect macroeconomic variables and stock markets in the national economy and our results confirm those of Suleman (2012), Essaddam and Mnasri (2015), Mnasri and Nechi (2016) and Jeribi et al.(2016) who show that terrorist attacks have a positive and significant impact on financial market volatility.

Also and in general, our results are consistent with the notion that political uncertainty contributes to financial volatility and confirm those of Abdelbaki (2013) and Chau et al.(2014) who suggest that political instability plays an important role in the management of stock markets. Our results confirm those of Trabelsi (2017) who shows that during the period following the civil uprisings, the amplitude and the volatility of the Tunisian markets of the stock market have greatly increased indicating that fluctuations in the prices of financial assets are influenced by political events in addition to common financial and economic factors.

6. CONCLUSION

In the world, terrorist attacks and political crises have recently struck all continents, Europe, Asia, Africa etc. Indeed, these events have an impact on the psychology of investors and any change in their behavior is reflected in stock prices. Increasingly aggressive during the crisis period, investors will react in an unfavorable manner, and eventually they will liquidate their shares, and consequently the emergence of the panic effect. Given the growing importance of Tunisia's image throughout the world in general and in the Arab world in particular, this research examines the effect of the protests and revolutionary demonstrations that triggered in Tunisia within the framework of the so-called "Arab spring" on the Tunisian stock market. More specifically, this paper investigates the effect of the dramatic political turmoil and terrorist attacks in Tunisia, on the returns and volatility of the principle index in the TSE. The sample consists of the returns of tunindex for period before and during the revolution, from 02 January 1998 to 16 December 2010 and from 17 December 2010 to 25 May 2017. The E-GARCH model is used to achieve the research objective. Interestingly, the empirical findings of the E-GARCH model indicate that political events have no significant effect on either the performance of the "Tunindex" or its volatility for the period pre revolution. Nevertheless, these political events have a positive and significant impact on the volatility for the post revolution period. Also, terrorist attacks have a negative and significant effect on the return on stock prices and a positive effect on volatility.

The results obtained show a high sensitivity of the stocks returns during periods of disturbance. These results add to the current debate on the impact of Arab Spring on stock market returns and volatility and have implications to international investors, portfolio and risk managers, who wish to invest in TSE. Moreover, the Tunisian revolution provides economists with raw material or another dimension of research and study. Therefore, to face the future challenges ahead, we must examine and evaluate the phases of political and economic uncertainty and their repercussions on the Tunisian economy in order to avoid and reduce the negative consequences on the economy in the future, to design

the appropriate policies in order to promote the stability of stock markets, and attract potential investors to invest in it. It should be noted, however, that within the limitations of this study, we may consider other factors that may affect the returns and volatility of stock prices, such as changes in the exchange rate, fluctuations in the price of oil and the influence of political instability of other neighboring countries over Tunisia.

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APPENDICES

Appendix 1

Stock market return-political events (pre-revolution)
AR (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.036352	4.061571	0.0000
ϕ_1	0.291166	8.647980	0.0000
ϕ_2	0.020294	0.056418	0.9550
ξ	−1.450934	−2.006495	0.0448
α_1	0.010000	2.279900	0.0226
δ	0.010000	4.167461	0.0000
β	0.010000	0.020132	0.9839
α_2	0.000000	0.000000	1.0000
R^2		0.084640	
Adjusted R^2		0.083783	
Standard error of regression		0.484443	
Sum squared resid		752.6351	
Log likelihood		−2211.809	
Mean dependent var		0.051278	
Standard deviation dependent var		0.506108	
Akaike info criterion		1.383251	
Schwarz criterion		1.400276	
Hannan-Quinn criter		1.389354	
Durbin-Watson stat		2.040830	

Stock market return-political events (pre-revolution)
ARMA (1,1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.036352	3.167824	0.0015
ϕ_1	0.291166	2.142058	0.0322
ϕ_2	0.020294	0.056150	0.9552
ξ	−1.450934	−1.984148	0.0472
α_1	0.010000	2.249191	0.0245
δ	0.010000	4.180656	0.0000
β	0.010000	0.019920	0.9841
α_2	0.000000	0.000000	1.0000
R^2		0.084427	
Adjusted R^2		0.083285	
Standard error of regression		0.484575	
Sum squared resid		752.8098	
Log likelihood		−2212.117	
Mean dependent var		0.051278	
Standard deviation dependent var		0.506108	
Akaike info criterion		1.384066	
Schwarz criterion		1.402983	
Hannan-Quinn criter		1.390847	
Durbin-Watson stat		2.051396	

Stock market return-political events (pre-revolution)
MA (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.010882	2.106753	0.0351
ϕ_1	0.462675	8.614171	0.0000
ϕ_2	−0.053255	−0.438219	0.6612
ξ	−0.460867	−25.56866	0.0000
α_1	0.402184	26.74785	0.0000
δ	−0.011672	−1.173984	0.2404
β	0.913369	119.5627	0.0000
α_2	−0.525887	−1.637070	0.1016
R^2		0.084784	
Adjusted R^2		0.083928	
Standard error of regression		0.484405	
Sum squared resid		752.5162	
Log likelihood		−1698.463	
Mean dependent var		0.051278	
Standard deviation dependent var		0.506108	
Akaike info criterion		1.063508	
Schwarz criterion		1.080534	
Hannan-Quinn criter		1.069611	
Durbin-Watson stat		1.971420	

Stock market return-terrorist events (pre-revolution)
AR (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.011611	2.102521	0.0355
ϕ_1	0.416881	13.62907	0.0000
ϕ_2	−0.254642	−2.013033	0.0441
ξ	−0.453922	−25.50907	0.0000
α_1	0.400486	26.84282	0.0000
δ	−0.011075	−1.125284	0.2605
β	0.916925	123.8548	0.0000
α_2	−0.416064	−0.754543	0.4505
R^2		0.085358	
Adjusted R^2		0.084502	
Standard error of regression		0.484253	
Sum squared resid		752.0446	
Log likelihood		−1696.602	
Mean dependent var		0.051278	
Standard deviation dependent var		0.506108	
Akaike info criterion		1.062349	
Schwarz criterion		1.079375	
Hannan-Quinn criter		1.068452	
Durbin-Watson stat		1.963467	

Stock market return-terrorist events (pre-revolution)
MA (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.011166	2.146410	0.0318
ϕ_1	0.459207	8.576694	0.0000
ϕ_2	−0.248743	−1.946914	0.0515
ξ	−0.454704	−25.58732	0.0000
α_1	0.400368	26.89662	0.0000
δ	−0.010894	−1.105751	0.2688
β	0.916411	123.3440	0.0000
α_2	−0.404039	−0.744745	0.4564
R^2	0.084933		
Adjusted R^2	0.084077		
Standard error of regression	0.484365		
Sum squared resid	752.3936		
Log likelihood	−1697.550		
Mean dependent var	0.051278		
Standard deviation dependent var	0.506108		
Akaike info criterion	1.062940		
Schwarz criterion	1.079966		
Hannan-Quinn criter	1.069043		
Durbin-Watson stat	1.971874		

Stock market return-terrorist events (pre-revolution)
ARMA (1,1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.013759	2.278215	0.0227
ϕ_1	0.340727	12.09109	0.0000
ϕ_2	−0.271819	−2.251261	0.0244
ξ	−0.452987	−25.25003	0.0000
α_1	0.400118	26.64013	0.0000
δ	−0.011024	−1.125915	0.2602
β	0.917268	124.3670	0.0000
α_2	−0.432541	−0.790463	0.4293
R^2	0.087112		
Adjusted R^2	0.085973		
Standard error of regression	0.483864		
Sum squared resid	750.6020		
Log likelihood	−1694.424		
Mean dependent var	0.051278		
Standard deviation dependent var	0.506108		
Akaike info criterion	1.061616		
Schwarz criterion	1.080533		
Hannan-Quinn criter	1.068397		
Durbin-Watson stat	1.970244		

Stock market return-political events (post -revolution)
MA (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.000537	0.065333	0.9479
ϕ_1	0.376832	3.977523	0.0001
ϕ_2	−0.043793	−0.559836	0.5756
ξ	−0.783112	−15.14210	0.0000
α_1	0.456876	12.81543	0.0000
δ	−0.053140	−2.363895	0.0181
β	0.775785	34.24558	0.0000
α_2	1.179914	15.43649	0.0000
R^2	0.091834		
Adjusted R^2	0.090114		
Standard error of regression	0.512074		
Sum squared resid	415.3557		
Log likelihood	−858.0686		
Mean dependent var	0.005944		
Standard deviation dependent var	0.536833		
Akaike info criterion	1.092026		
Schwarz criterion	1.122462		
Hannan-Quinn criter	1.103332		
Durbin-Watson stat	1.842948		

Stock market return-political events (post-revolution)
AR (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.000829	0.094593	0.9246
ϕ_1	0.329329	5.849269	0.0000
ϕ_2	−0.045249	−0.576715	0.5641
ξ	−0.784257	−15.08823	0.0000
α_1	0.457175	12.76091	0.0000
δ	−0.052994	−2.354763	0.0185
β	0.775251	34.18150	0.0000
α_2	1.179955	15.43893	0.0000
R^2	0.091929		
Adjusted R^2	0.090209		
Standard error of regression	0.512047		
Sum squared resid	415.3121		
Log likelihood	−858.1689		
Mean dependent var	0.005944		
Standard deviation dependent var	0.536833		
Akaike info criterion	1.092152		
Schwarz criterion	1.122588		
Hannan-Quinn criter	1.103458		
Durbin-Watson stat	1.844910		

Stock market return-terrorist events (post-revolution)
AR (1)-EGARCH (1,1)

Statistic	Coef.	t-statistic	Prob.
ϕ_0	0.003738	0.386960	0.6988
ϕ_1	0.306736	5.666318	0.0000
ϕ_2	−0.127007	−1.987931	0.0468
ξ	−0.748976	−12.86501	0.0000
α_1	0.518465	13.09199	0.0000
δ	−0.075284	−3.761973	0.0002
β	0.790243	34.65723	0.0000
α_2	0.381891	4.456004	0.0000
R^2	0.091028		
Adjusted R^2	0.089307		
Standard error of regression	0.512301		
Sum squared resid	415.7241		
Log likelihood	−903.7271		
Mean dependent var	0.005944		
Standard deviation dependent var	0.536833		
Akaike info criterion	1.149530		
Schwarz criterion	1.179966		
Hannan-Quinn criter	1.160836		
Durbin-Watson stat	1.835584		

Appendix 2

Political events	Terrorist events
2010: 28 December 2010: President Ben Ali addresses the people and promises solutions 2011: Januray 14, 2011: Ben Ali and his wife flee to Saudi Arabia. Januray 27, 2011: Constitution of a new government. Several symbols of the old regime are set aside. March 9, 2011: Dissolution of the RCD and authorizations for the creation of new parties. December 12, 2011: Moncef Marzouki President December 22, Presentation of the new government led by Mr Jebali 2012: June 11, 2012: Curfew from 21H00 to 05H00 for a period of 4 days in eight governorates of the country. June 18, 2012: The Tunisian General Labor Union launches a dialogue initiative bringing together political forces and civil society components. October, 182012: Death of the secretary general of the UTAP Regional Union and regional coordinator of Nidaa Tounes at Tataouine Lotfi Nagdh during violent clashes in front of the Union headquarters following a demonstration organized by the League To protect the revolution in the region 2013: February 6, 2013: Assassination of Chokri Belaid, General Coordinator of the Party of Unified Democratic Patriots and leader of the Popular Front February 11, 2013: Formation of a political and electoral front comprising "Nidaa Tounes," the Republican Party, Al-Massar, the Socialist Party and the Patriotic Democratic Labor Party. July 25, 2013: Assassination of the constituent and general coordinator of the popular movement, Mohamed Brahmi 2014: January 29, 2014: The non-political government of Mehdi Jomaa is formed. The Islamists are withdrawing from power. 2015: March 20, 2015: President Béji Caid Essebsi announces on the occasion of the Independence Day that a national reconciliation must be made with the businessmen of the former regime accused of corruption. October 6, 2015: The Tunisian Minister in charge of relations with the Parliament presented his resignation, for the lack of "will" in the fight against corruption 2016: January 22, 2016: A new political body has been set up within Nidaa Tounes April 04, 2016: The earthquake of "Panama papers" touches Tunisia. The electronic media Inkyfada began to reveal the series of a dozen names of Tunisian personalities. August 03, 2016: Youssef Chahed, new head of government after the eviction of Habib Essid. 15 December 2016: Assassination of the engineer Mohamed Zouari. The Palestinian Islamist movement Hamas announced that the Tunisian engineer killed was one of its leaders, accusing Israel of the murder and promising revenge. 2017: 19 January 2017: The state of emergency was extended by 1 month throughout Tunisia.	2011: May 18, 2011: Clashes of Rouhia. The first confrontations between the army and the forces of law and order on the one hand, and armed individuals on the other hand, take place 2012: February 2, 2012: Violent clashes take place in Bir Ali Ben Khalifa December 6, 2012: Fernana clashes December, 10 2012: Attack of a patrol in Feriana 2013: February 6, 2013: Assassination of Chokri Belaid May 2, 2013: Mohamed Sboui, police commissioner, was found dead in Jbel Jelloud, in the governorate of Ben Arous July 25, 2013: Assassination of Mohamed Brahmi October 30, 2013: 22-year-old Mohammed Issaoui commits suicide bombing on the beach of the Riadh Palms hotel in Sousse, triggering a belt of explosives 2014: February 4, 2014: Operation of Raoued: the end of the hunt for Gadhgadhi May 27, 2014: Attack on the home of the interior Minister in Kasserine July the 1st, 2014: Death of 4 soldiers following the explosion of a mine in Mount Ouargha 2015: March 18, 2015: Two armed attackers attacked the Bardo Museum, adjacent to the seat of the assembly. About 20 people were killed 2016: March 07, 2016: Terrorist attack on Ben Guerdane: Civilians and security agents killed, several terrorists killed 2017: March 11, 2017: A police officer died and two of his colleagues were injured in a terrorist attack in Jenoura (Delegation of Kebili South)