

# Socio-Economic Determinants of Terrorism in Tunisia

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## ABSTRACT

Tunisia has always been affected by terrorism, but since the late 2010s there has been a sharp increase in terrorism perpetrated. The object of this research is to analyze the socio-economic determinants of terrorism using terrorist attacks as a dependent variable and indicators that affect the level of growth in Tunisia such as explanatory variables. The aim of this work is to develop recommendations on how to respond to the state in response to terrorist shocks. The following policy implications were deduced. First, we must increase the level of growth of the country by stabilizing the policy and by controlling governance to show the effectiveness of the results of this study which aims at reducing terrorism and improving the country's economic conditions. Second, in view of the results found in this research, terrorism can stabilize the long-term labor market through investment by putting in place realistic economic policies that are time-bound to encourage the State to create vacancies for the unemployed.

## KEYWORDS

ARDL, Political Stability, Poverty, Terrorism, Wage

## INTRODUCTION

Tunisia has experienced several situations of economic instability following the increase in the number of terrorist attacks, and in turn undergoes a decrease in the growth rate and an increase in the level of unemployment. People find obstacles in settling into a position due to the high level of unemployment. Even when jobs are created, individuals are subject to low wages.

Some argue that the quality of the position fuels terrorism by creating frustration among individuals. Aggressive behavior can often occur when an individual is prevented from achieving his or her goals. It is also plausible that some unemployed people are motivated to join a terrorist organization because they do not have the financial stability to support themselves and their families.

However, terrorists see themselves as fighters for reasons of political conflict. And those who fight against this phenomenon consider themselves terrorists (Europol, 2008, Sick 1990, Silke 2008,

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William 2000). Hence, this phenomenon can be seen as the use of violence by national groups in order to achieve a political objective (Enders & Sandler 2002).

After the revolution, Tunisia recorded several attacks. Thus, we are interested in the determinants of terrorism. This study attempts to analyze the socio-economic determinants of terrorism, especially as regards the labor market and growth in Tunisia, taking into account other indicators that affect employment indirectly through terrorist attacks. The purpose of this paper is to show the long- and short-term relationship between terrorism and socio-economic variables in Tunisia.

This issue invites us to highlight several questions:

- How can we define terrorism and what are its main characteristics?
- What are the main determinants of terrorism?
- How can political stability affect terrorism in Tunisia?

To address this issue, this study first examines the evolution of terrorism in its global dimension. The second part gives an overview of the macroeconomic framework of terrorism in Tunisia and a review of the literature that recalls the main determinants of terrorism as they emerge from economic theory and some studies conducted in this framework. Finally, the third part is devoted to the econometric estimation of the determinants of terrorism in Tunisia in order to identify the main factors that determine its evolution.

The examinations of these issues are quite imperative, as they will help determine the direct and indirect impact of policies on the stability of the country, therefore, to put in place measures to enhance economic growth. This will help Tunisia know if they are capable of solving recurrent problems and fostering growth, or if it is better to focus on international aid.

Recently, after the Arab Spring, an unprecedented wave of political violence and terrorist events occurred in several countries in the MENA region such as Tunisia. Tunisia is strongly affected by such dynamics; hence, the terrorist's actions intimidate law and public order and human rights by destroying essential infrastructure and economic prospects (Lanouar & Goaid, 2019).

This paper attempts to analyze the determinants of terrorism in Tunisia. The aim of our study is to analyze the short- and long-term effects of various social and economic variables on terrorism. More specifically, we seek to fill the gap in the literature concerning the relationship between the Terrorism Index, which measures the number of annual attacks and social and economic variables in Tunisia. To our knowledge, our study is the first to integrate all these economic and social variables to identify the determinants of terrorism in developing countries.

We used the ARDL model because it is useful to predict and disentangle long-term relationships from short-term dynamics. And we chose Tunisia as a sample because only a few studies have worked on this research theme. Finally, the implementation of the ARDL approach and its interpretation is quite simple (Rahman & Kashem 2017), and the ARDL framework requires a single-form equation (Bayer & Hanck 2013), while other procedures require a system of equations. The ARDL model is more reliable for small samples like our case compared to the cointegration methodology of Johansen and Juselius (Haug, 2002). Halicioglu (2007) also indicates two other advantages of the method, in particular: Simultaneous estimation of long-term and short-term effects and the possibility of testing hypotheses on the estimated long-term coefficients. This is not done in the Engle-Granger method. We find that macroeconomic instability is one of the determinants of terrorism identified by the literature. This is why the study of the link between terrorism in Tunisia and macroeconomic instability is now of increased importance. The main variables presented and used as approximations of macroeconomic stability in the literature are the inflation rate and the unemployment rate. Therefore, in this study, we decided to use inflation, presidential rotation rate, demand, and offer of employment as indicators of Tunisia's economic stability, taking into account poverty and wages as control variables.

The present study could be the first major contribution to the empirical literature on terrorism in Tunisia, which promises to trigger other studies in the field that would improve the strategies to combat this phenomenon, as Tunisia seeks to move towards a more diversified economy.

Two main points of view can highlight the importance of this study. First, the development of a dynamic autoregressive distributed lag model is relatively new when compared to other traditional approaches, especially in the context of Tunisia. It is hoped that this document will provide opportunities for researchers and practitioners to understand more practical and theoretical insights into the key determinants of terrorism, providing factual information to politicians. Second, the Tunisian economy is being restructured and considered to encourage investors in priority sectors such as tourism, information technology, and manufacturing. Therefore, this study attempts to identify the factors that influence terrorism in Tunisia, especially in behavioral aspects.

## LITERATURE REVIEW

The theoretical and empirical literature provides several explanations for the relationship between terrorism, the labor market, and economic growth.

According to a recent study, Goldstein (2005) observes that unemployment, coupled with a lack of political freedom, is an important factor in fueling terrorism. Cramer (2011) also opposes the use of the unemployment rate as a predictor of terrorism, stating that it is not a well-developed indicator and that its effect is moderated by other non-labor market variables.

In another study, based on a survey conducted in 56 countries from 1980 to 2008, Richardson (2006) sought to determine whether the interaction effect between unemployment and higher education was positively correlated with an increase in terrorist attacks. Although Richardson did not find such a relationship, she showed that there is a noticeable effect between unemployment and terrorism. Specifically, countries where terrorist incidents took place suffered more terrorism incidents when the unemployment rate was high. This finding led Richardson to conclude that countries with fewer job opportunities are more likely to suffer terrorist attacks.

Despite the results of these studies, many social scientists remain cautious about the idea that unemployment amplifies terrorism.

As a result, Piazza (2006) conducted an analysis to determine whether economic or political factors were responsible for terrorist activities. Piazza failed to find evidence that the unemployment rate or other economic factors predicted incidents of terrorism. However, he showed that political considerations such as state repression and the structure of partisan politics produced striking relationships.

Indeed, Caruso and Gavrilova (2012) examined the relationship between Palestinian unemployment and terrorism. They observed that unemployment and political violence are both predictors of violence and terrorism.

In addition, Ismail and Amjad (2014) studied the links between macroeconomic indicators and terrorism for Pakistan using annual data from 1972 to 2011, and they found a link between unemployment and terrorism.

Mercy Corps (2018) looked at young people from the Somali Land and Portland areas of Somalia and found that economic opportunities were not decisive factors in determining whether these young people decided to engage in political violence.

While previous research is certainly informative, there are a few reasons why the effect of terrorism on a country's labor market should continue to be studied. First, while most previous studies used the unemployment rate as an indicator of labor market conditions, the unemployment rate is just one of many potential labor market measures that can legitimately be used to predict terrorism. Another labor market measure worth considering is the participation rate. The labor force participation rate refers to the percentage of the non-institutionalized population in the labor force. While the unemployment rate measures the percentage of a population that is

unemployed but actively seeking employment, the participation rate covers the labor force as a whole. This distinction is important because the unemployment rate is a much narrower measure of labor market conditions, as it excludes employed and unemployed workers who wish to work but have given up looking for a job. Second, some argue that youth unemployment rather than the unemployment rate should be used when examining the association between labor market conditions and terrorism, since several studies have shown a substantial relationship between youth unemployment and terrorist activity.

Since the terrorist attacks of 2016, several research studies have been conducted on the socio-economic determinants of terrorism and more specifically on the link between terrorism and the Tunisian labor market which is a worrying subject in Tunisia.

Much of this research has focused on the speed of the spread of terrorism following changes in key indicators of the Tunisian economy and the link between the Tunisian labor market and the phenomenon of terrorism, in particular, taking into account that terrorist attacks fell significantly in 2019 with 29 attacks, while in 2016, there were around 40 terrorist attacks recorded. According to Moody, a terrorist attack costs a country between 0.5% and 0.8% growth. The rating agency used a database (*Global Terrorism Database*) of 156 countries to obtain this estimate for the 1994-2013 period. This has in fact led to a significant and negative impact of terrorism on the Tunisian economy. The growth rate in Tunisia decreased from 2.7% in 2014 to 0.8% in 2015, and according to the report of the World Travel and Tourism Council (WTTC), terrorism represents 7.4% of the national GDP. Foreign investment contributes significantly to employment, but since investors do not venture to settle in conflict zones, terrorist attacks do not encourage foreign investors to settle in Tunisia; on the contrary, they push those who are already there to relocate. Hence, terrorism has a negative and indirect impact on the labor market.

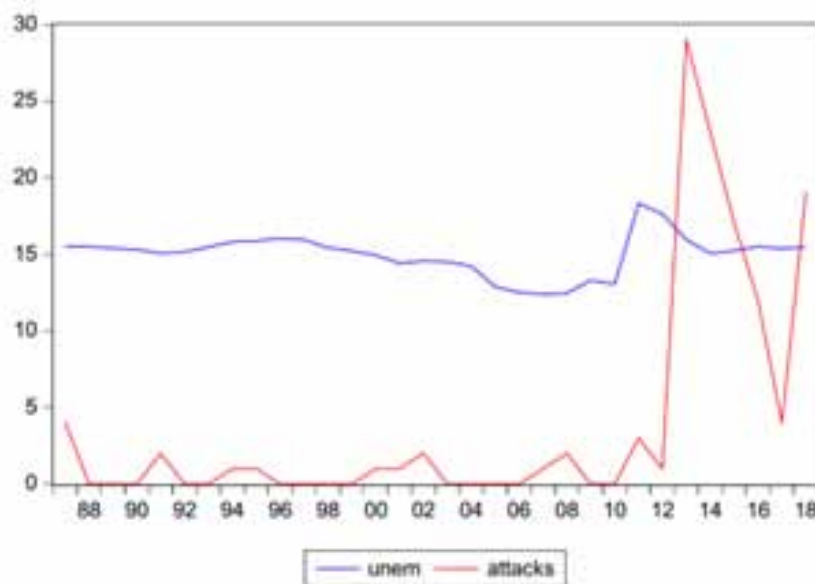
Following the attacks in Tunisia, a research study on the impact of these events on the labor market is essential. This work will first allow us to discover an economic analysis of terrorism and the relationship between terrorist attacks and socio-economic variables. Terrorism can be studied from a macroeconomic perspective when it comes to studying its economic costs to the state.

In March 2018, an attack hit Tunisia, which of Bardo, causing 24 dead and 45 wounded. An earlier attack on 26 June 2015 caused 39 dead and 30 wounded. Not only did these terrorist attacks cause physical, psychological, or psychological damage, but they also led to economic losses. Thus, we must think of strategies to account for and rectify our strategy to fight against this phenomenon.

Figure 1 shows a certain stability between the variation in the unemployment rate and the variation in the number of terrorist attacks over time. However, the post-revolutionary period remains special, given the events that impose a certain volatility on the study variables.

Several research studies have linked terrorism to many socio-economic and political variables, namely low GDP, emergence of poverty, high unemployment rate, inflation, political stability, investment, consumption, vulnerable job, trade, military spending, and the turnover rate of governors and presidents. The results indicate that GDP is a powerful predictor of terrorism (Gyamfi, 2018; Blomberg et al., 2004; Fearon & Laitin, 2003; Burgoon, 2006; Freytag et al., 2011; Lai, 2007). Regarding poverty, we find that the most popular theory is that poverty causes terrorism. When people are deprived of certain resources and opportunities, poverty can cause some to turn to terrorism to express outrage (Burgoon, 2006; Fearon & Laitin, 2003). When it comes to unemployment, it can lead to more terrorism following grief (Abadie, 2006; Goldstein, 2006; Berman et al., 2008; Harrison, 2006). In addition, an increase in inflation leads to an increase in the number of terrorist attacks (Auvinen, 1997; Feldmann & Perala, 2004; Caruso & Schneider, 2011; Piazza, 2006). Several socio-economic factors stimulate violence and terrorism. For example, it has been studied that policies trigger terrorist incidents in developing countries. In addition, regional violence makes regions more vulnerable. And that is why we used political stability, military spending, the presidential turnover

Figure 1. Terrorism and Labor Market



rate, and vulnerable jobs as explanatory variables in the model (Ajide et al., 2020; Kirisci, 2020; Morris et al., 2016).

There are several opinions regarding the effect of a change in GDP growth on terrorism. We find that, Li and Schaub (2004) and Collier and Hoeffler (2004) studied the relationship between GDP per capita and terrorism and found that the link is negative because increasing GDP improves the economic situation of individuals and therefore reduces the cost of opportunity of terrorism.

Several other studies examining the link between growth and terrorism show similar results (Bird et al., 2008; Bravo & Dias, 2006; Campos & Gassebner, 2008; Dreher & Fischer, 2011; Lai, 2007; Muller & Weede, 1990).

The model in which poverty is linked to political violence is Gurr (1988). According to some authors (Stern, 2003; Miguel et al., 2004; Aziz, 2009; Krieger & Meierrieks, 2011; Schneider et al., 2010; Bandyopadhyay et al., 2011; Berman et al., 2009), the relationship between poverty and the emergence of terrorism is positive and direct. Krueger and Malečková (2003) analyze the link between terrorism and poverty and find that the two are not linked in developed countries. In addition, Abadie (2006), Kurrild-Klitgaard et al. (2006), Gassebner and Luechinger (2011) and Piazza (2011) find no significant link between poverty and terrorism.

Regarding unemployment, Sayre (2009) has shown there is a direct relationship between unemployment and terrorism. In addition, Catalano et al. (2006) finds that unemployment causes terrorism (Abadie, 2006; Berman et al., 2008; Berman et al., 2009; Harrison, 2006; Honaker, 2010; Kalyvas, 2006; Oppenheim, 2007). The results also revealed terrorism is unrelated to a city's unemployment rate. According to Thompson (1989), unemployment does not fuel terrorism (Green & Ndiaye, 1998). Oyefusi (2010) found that a high unemployment rate increases the willingness of unemployed people to join terrorist groups. Thus, the link between unemployment and terrorism is insignificant as long as education is not taken into account (Krueger & Malečková, 2003).

The relationship between inflation and terrorism has been discovered as significant by several researchers (Auvinen, 1997; Caruso & Schneider, 2011; Feldmann & Perala, 2004; Pierrehumbert et al., 2003; Samaranayake, 1999). High inflation has destabilizing impacts on the economy and is

responsible for terrorism. Terrorism is a political phenomenon (Choi, 2010; Dreher & Gassebner, 2008; Hacker, 1976; Kis-Katos et al., 2011; Krueger & Malečková, 2003; Savun & Phillips, 2009). Lai (2007) and Basuchoudhary and Shughart (2010) found that higher levels of economic freedom reduce the emergence of terrorism.

So, we can see that socio-economic factors have an impact on terrorism. Inflation refers to general prices within the country, which acts as a proxy for the purchasing power of consumers to meet their demands and maximize their utilities. Several researchers have analyzed the price fluctuation of general goods, as well as household consumption to see their impacts on terrorism (Piazza, 2011; Ross, 1993). Because of inflation and consumer dissatisfaction, people find it difficult to live in these conditions. Based on the existing literature above, the proposed hypotheses are:

H1. Inflation increases number of terrorist attacks in Tunisia

H2. Job offers defeat terrorism in Tunisia

This is further proof that poverty has a significant impact on terrorism (Piazza, 2013). Political instability, unemployment, poverty, and vulnerable jobs also create groups of frustrated people, which give the opportunity for terrorist activities (Helfstein, 2014). So, based on the study of the above literature, we propose the following hypothesis:

H3. The deterioration of the economic and political situation in Tunisia favors terrorism.

## **DETERMINANTS OF TERRORISM**

Several research studies link terrorism to many socio-economic and political variables, namely low emergence of poverty, inflation, wages, and the turnover rate of presidents. The results indicate that poverty causes terrorism. When people are deprived of certain resources and opportunities, poverty can cause some to turn to terrorism to express outrage (Burgoon, 2006; Friedman, 2002a; Fearon & Laitin, 2003). When it comes to the inflation rate, an increase in inflation leads to an increase in the number of terrorist attacks (Auvinen, 1997; Feldmann & Perala, 2004; Caruso & Schneider, 2011; Pierrehumbert et al., 2003; Samaranayake, 1999; Piazza, 2006). Several socio-economic factors stimulate violence and terrorism. For example, it has been studied that policies trigger terrorist incidents in developing countries. In addition, regional violence makes regions more vulnerable. And that's why we used the presidential turnover rate as explanatory variable in the model (Ajide, et al., 2020; Kirisci, 2020; Morris et al., 2016).

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Finally, we would like to present to you our main contribution in this research. our main objective is to take into account the supply and demand of labor by sex in order to know about the impacts on the stability of the country and in particular on the propagation of the phenomenon of terrorism.

## METHODOLOGY

### Data

Our quantitative analysis is carried out using annual data from Tunisia over the period from 1987 to 2018. Our study involves building a model based on the determinants of terrorist attacks. We integrated several explanatory variables (table 1) by making simplifying assumptions about them.

In addition to the statistical series of the number of terrorist attacks in Tunisia from 1987 to 2018, we noted "ATTACKS" by the authors as part of a project—this index measures the number of attacks per year. We selected the inflation rate noted "INFL" as extracted from the *World Bank* (WDI) database; job offers and demands of women and men noted "Offre-F, OFFRE\_H" and "DDE -F, DDE\_H" ] are extracted from the database of the *National Agency for Employment and Self-Employment Tunisia* (NAESE). Moreover, we used poverty, noted "POV," accessible from the *WDI*. And finally, the presidential turnover rate calculated by the authors, and wage accessible from the *Trading Economics* database. This implies that the use of a cointegration "ARDL" time-lag autoregressive model is appropriate to estimate the existence of a long-term relationship.

Given that our sample is small, using this technique has the advantage of being more robust for our study. It applies to integrated series of order less than 2, unlike the cointegration tests of Engle Granger (1987), Johanson (1988), and Johansen and Juselius (1990).

**Econometric Method.** The existence of a cointegration relationship between the different variables can be determined by applying several tests within an econometric model. This method makes it possible to estimate short- and long-term dynamics in the same econometric model (Akpan et al., 2012). The direct sensitivity of terrorism is tested using a model where the number of terrorist attacks presents the dependent variable, and the rest of the variables are explanatory variables. The relationship between our explanatory variables and our variable to be explained is given by equation (1) within an ARDL model:

Table 1. Summary of the variables used and data sources

| Category    | variables | Variables Description                                                                                                              | Sources                            |
|-------------|-----------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Dependent   | ATTACKS   | All acts of violence committed by an organization or an individual to create a climate of insecurity or to blackmail a government. | Global Terrorism (GTD)             |
| Independent | DDE_F     | A job application refers to the number of self-employed women who are looking for a job.                                           | NAESE                              |
| Independent | DDE_H     | A job application designates the number of non-salaried men who are looking for a job.                                             | NAESE                              |
| Independent | OFFRE_F   | A job offer refers to the number of advertisements published by companies with the aim of recruiting female personnel.             | NAESE                              |
| Independent | OFFRE_H   | A job offer refers to the number of advertisements published by companies with the aim of recruiting male staff.                   | NAESE                              |
| Independent | INFL      | It is the loss of the purchasing power of money which results in a general and lasting increase in prices.                         | Central Bank of Tunisia (BCT)      |
| Independent | TRP       | The turnover rate is equal to the sum of presidents during a period divided by the number of years in that period.                 | Calculated by the author           |
| Independent | POV       | Refers to the situation of a person who is unable to access food.                                                                  | World Development Indicators (WDI) |

$$\begin{aligned}
\Delta(ATTACKS)_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 ATTACKS_{t-i} + \sum_{i=1}^n \alpha_2 \Delta DDE\_F_{t-i} + \sum_{i=1}^n \alpha_3 \Delta DDE\_H_{t-i} \\
& + \sum_{i=1}^n \alpha_4 \Delta OFFRE\_F_{t-i} + \sum_{i=1}^n \alpha_5 \Delta OFFRE\_H_{t-i} + \sum_{i=1}^n \alpha_6 \Delta INFL_{t-i} \\
& + \sum_{i=1}^n \alpha_7 \Delta TRP_{t-i} + \sum_{i=1}^n \alpha_8 W_{t-i} + \sum_{i=1}^n \alpha_9 POV_{t-i} + \varepsilon_t
\end{aligned} \quad (1)$$

with  $\Delta$ : the first difference operator,  $\alpha_0$ : constant,  $\alpha_1 \dots \alpha_9$ : are short-term effects,  $\varepsilon \sim iid(0, \sigma)$ : error term (white noise) and represents the speed of adjustment.

Equation (1) leads us to determine the existence of a cointegration relationship between our various variables in order to confirm our choice of using the time-lagged autoregressive model. Several cointegration tests have been provided by the econometric literature such as the Johansen test (1988,1991), the Pesaran et al. test (1996) and the Pesaran et al. test (2001). First, we apply the unit root test in order to know each variable's order of integration. Thus, we are interested in the Phillips Perron (PP) test to verify the order of integration of each series. When we find our variables of different order (I (0), I (1)), we can use the cointegration test called "bounds cointegration test" of Pesaran et al. (2001) to verify the existence of a cointegration relationship between the different variables in our ARDL model.

Finally, the last step is to compare the Fisher values obtained with the critical values for the different thresholds of Pesaran et al. (2001), taking into account that the integrated variables of order 1 I(1) are included in the upper bound while the integrated variables of order 0 I(0) are concerned by the lower bound. Thus, if Fisher is higher than the upper bound, a cointegration relationship exists; whereas, if Fisher's statistic is lower than the lower bound, the assumption of the existence of a cointegration relationship is rejected. And finally, if Fisher is between the lower and upper bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors.

Thanks to this procedure, an error-corrected model can confirm the existence or not of the cointegration between our variables. The final step is estimating the error correction model (ECM) and finds the short run parameters. Hence, the ECM is estimated as:

$$\begin{aligned} \Delta(ATTACKS)_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 ATTACKS_{t-i} + \sum_{i=1}^n \alpha_2 DDE\_F_{t-i} + \sum_{i=1}^n \alpha_3 DDE\_H_{t-i} \\ & + \sum_{i=1}^n \alpha_4 OFFRE\_F_{t-i} + \sum_{i=1}^n \alpha_5 OFFRE\_H_{t-i} + \sum_{i=1}^n \alpha_6 INFL_{t-i} \\ & + \sum_{i=1}^n \alpha_7 TRP_{t-i} + \sum_{i=1}^n \alpha_8 W_{t-i} + \sum_{i=1}^n \alpha_9 POV_{t-i} + \Phi ECM_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Equation (1), which specifies the relationship between terrorism and its socio-economics determinants, and equation (2) of the error correction model are estimated. But first, we have to determine the order of integration of our variables using the PP test, then test the existence of a cointegration relationship using the bounds cointegration test, and finally, analyze the short- and long-term relationships found.

## RESULTS AND DISCUSSIONS

Before analyzing these variables using the ARDL approach, we present a descriptive study of the annual data covering the 1987 to 2018 period.

The stationarity of all variables was tested using the PP procedures. The results presented in Table 2 show that all variables are integrated in the order of 1 I(1) with the exception of the variable job demand of men, which is stationary in the order of 0 I(0). These results confirm that all variables have an order of integration less than 2.

**Table 2. Stationarity test**

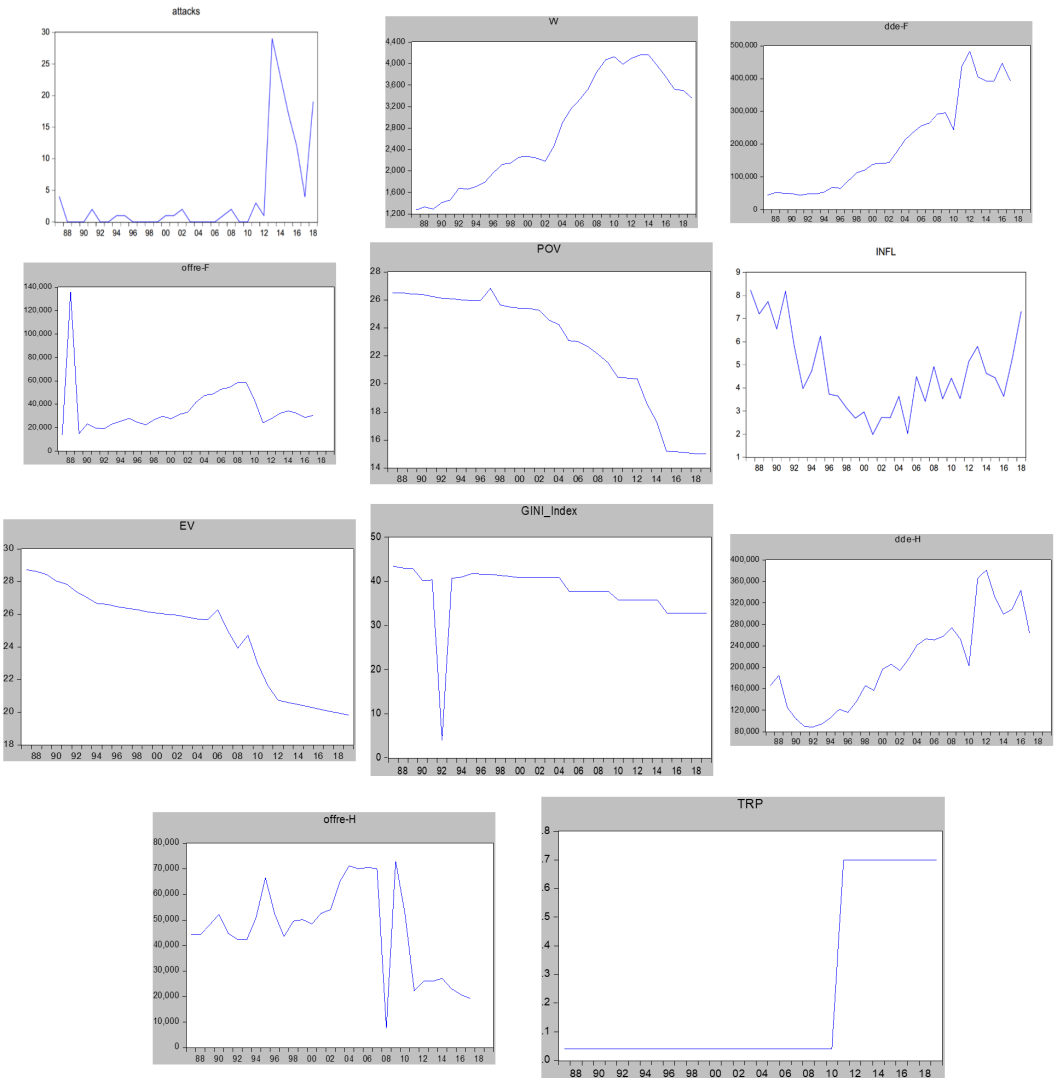
| variables | PP test                        |                                |
|-----------|--------------------------------|--------------------------------|
|           | in level                       | in first difference            |
| ATTACKS   | <b>-2.807156</b><br>(0.0685)   | <b>-9.634876**</b><br>(0.0000) |
| DDE_F     | <b>-0.342717</b><br>(0.9067)   | <b>-7.452500**</b><br>(0.0000) |
| DDE_H     | <b>-1.097554**</b><br>(0.7036) | <b>-5.627519**</b><br>(0.0001) |
| OFFRE_F   | <b>-5.645067</b><br>(0.0001)   | <b>-13.45975**</b><br>(0.0000) |
| OFFRE_H   | <b>-3.360606</b><br>(0.0208)   | <b>-10.72082**</b><br>(0.0000) |
| INFL      | <b>-2.805050</b><br>(0.0688)   | <b>-8.53347**</b><br>(0.0000)  |
| POV       | <b>1.211274</b><br>(0.9975)    | <b>-4.392025**</b><br>(0.0016) |
| W         | <b>-1.328262</b><br>(0.6042)   | <b>-2.632414**</b><br>(0.0375) |
| TRP       | <b>0.111962</b><br>(0.7111)    | <b>-5.477226**</b><br>(0.0000) |

SC is used « Bandwidth » to choose the number of optimal delays for the PP tests. The critical values related to the PP test is provided by MacKinnon (1996). The bracketed figures represent the delay levels based on the information criterion of Schwarz. Figures between square brackets represent Newey-West bandwidth's automatic selection using the Bartlett kernel. Note that only the constant is included in the tests, and (\*\*\*), (\*\*), and (\*) denote statistical significance at the 1%, 5%, and 10% thresholds, respectively.

Before moving on to ARDL modeling and in order to show, on the one hand, the long- and short-term relationships between the different variables and, on the other hand, the impact of terrorism on the Tunisian labor market and on economic stability, we present the evolution of the variables over time in order to better see the existence of simultaneous peaks between the indicators.

The study of the graphs (figure 2) shows a stability of the variables over time. After the revolution, more precisely in 2012, the volatility of variables is noticed with peaks that are followed by troughs. In fact, this period is characterized by a strong political instability caused by the revolution. According

Figure 2. Evolution of macroeconomic indicators



to this chart, the impact of terrorism on the job market, economic growth, and political stability is visibly positive. However, following an increase in the number of attacks, there has been a sharp fall in job offers, poverty, and wages (table 3).

At this stage, we are interested in applying cointegration tests linked to the ARDL model, in order to study the relationship between our variables. We will select the appropriate degree of delay (Feridun & Shahbaz, 2010) that the test requires at the bounds. The AIC selection criterion is used in our case. The bounds cointegration test results are presented in Table 4 below:

Lower and Upper-bound critical values are taken from Pesaran et al. (2001), Table CI(i) Case I.

Our results show that the calculated statistical F is greater than the critical value of Pesaran et al. (2001) at the 1% threshold, which confirms the existence of a long-term relationship between our different variables over the period of 1987 to 2018. So, we move on to estimating equation (1) using the ARDL approach. Table 5 shows the estimation results.

This table provides the estimated long-term coefficients. As shown, job demand of men positively impacts terrorism in Tunisia in the long term. This means that the fragility of employment and the

**Table 3. Correlation matrix**

| Correlation |           |           |           |           |           |           |           |           |          |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|
| Probability | ATTACKS   | DDE_F     | DDE_H     | OFFRE_F   | OFFRE_H   | INFL      | TRP       | W         | POV      |
| ATTACKS     | 1.000000  |           |           |           |           |           |           |           |          |
|             | -----     |           |           |           |           |           |           |           |          |
| DDE_F       | 0.554850  | 1.000000  |           |           |           |           |           |           |          |
|             | 0.0012    | -----     |           |           |           |           |           |           |          |
| DDE_H       | 0.505983  | 0.956430  | 1.000000  |           |           |           |           |           |          |
|             | 0.0037    | 0.0000    | -----     |           |           |           |           |           |          |
| OFFRE_F     | -0.095745 | 0.063539  | 0.197298  | 1.000000  |           |           |           |           |          |
|             | 0.6084    | 0.7342    | 0.2874    | -----     |           |           |           |           |          |
| OFFRE_H     | -0.514464 | -0.479553 | -0.408805 | 0.152118  | 1.000000  |           |           |           |          |
|             | 0.0031    | 0.0063    | 0.0224    | 0.4140    | -----     |           |           |           |          |
| INFL        | 0.111530  | -0.257151 | -0.282251 | -0.008226 | -0.233399 | 1.000000  |           |           |          |
|             | 0.5503    | 0.1626    | 0.1240    | 0.9650    | 0.2064    | -----     |           |           |          |
| TRP         | 0.723504  | 0.836266  | 0.755148  | -0.147086 | -0.705590 | 0.027992  | 1.000000  |           |          |
|             | 0.0000    | 0.0000    | 0.0000    | 0.4298    | 0.0000    | 0.8812    | -----     |           |          |
| W           | 0.488310  | 0.936813  | 0.879250  | 0.128219  | -0.324595 | -0.357109 | 0.651223  | 1.000000  |          |
|             | 0.0053    | 0.0000    | 0.0000    | 0.4918    | 0.0748    | 0.0486    | 0.0001    | -----     |          |
| POV         | -0.656601 | -0.912347 | -0.805489 | -0.021327 | 0.544078  | 0.134735  | -0.857863 | -0.848054 | 1.000000 |
|             | 0.0001    | 0.0000    | 0.0000    | 0.9093    | 0.0016    | 0.4699    | 0.0000    | 0.0000    | -----    |

**Table 4. Bounds cointegration test**

| Dependent Variable | Lag Selection               | F-statistic | Decision      |
|--------------------|-----------------------------|-------------|---------------|
| ATTACKS            | (2, 2, 2, 2, 1, 1, 2, 2, 2) | 125.1548    | Cointegration |
| Significance       | I0 Bound                    | I1 Bound    |               |
| 10%                | 1.85                        | 2.85        |               |
| 5%                 | 2.11                        | 3.15        |               |
| 2.5%               | 2.33                        | 3.42        |               |
| 1%                 | 2.62                        | 3.77        |               |

Table 5. Long-term relationship

| Variable | Dependent variable D(ATTACKS) |           |        |
|----------|-------------------------------|-----------|--------|
|          | Coefficient                   | T-Ratio   | Prob.  |
| DDE_F    | -0.000124                     | -4.450002 | 0.0043 |
| DDE_H    | 0.000114                      | 5.264351  | 0.0019 |
| INFL     | 0.850070                      | 6.672935  | 0.0005 |
| OFFRE_F  | 6.18                          | 2.109503  | 0.0794 |
| OFFRE_H  | -1.60                         | -1.619145 | 0.1565 |
| TRP      | 37.01083                      | 14.62281  | 0.0000 |
| W        | 0.005526                      | 5.107940  | 0.0022 |
| POV      | 0.346463                      | 1.015031  | 0.3493 |
| C        | -29.50208                     | -3.729759 | 0.0097 |

high level of unemployment of men facilitate the attraction of young people by terrorist groups. While the effects of job demand of women are negative and rather more than proportional, a 1% increase in job demand of women leads to a 0.000124% decrease in terrorist attacks. Attacks directed against the State or with the aim of destabilizing political life may influence the labor market in the interest of investment strategies created and maintained by the governors in order to stabilize the Tunisian economy, taking into account that the embryonic state of the country's economic systems, coupled with political instability that do not provide the country with effective economic policies, would justify this counterintuitive result in the long term. In addition, job offer of women positively affects terrorism. However, every 1% increase in the level job offer of women leads to a 6.18% increase in the level of terrorist attacks. As for the inflation rate, its impact is positive and significant at the 1% significance threshold. Indeed, a 1% increase in the inflation rate leads to an increase in terrorist attacks of 0.85%. However, the effect of the changing presidential turnover rate on terrorism is positive and significant. Indeed, the frequent change of presidents destabilizes the State by leading to terrorist attacks. As for salary, it turns out that it is a main determinant of terrorism in Tunisia, as its sign is positive and significant at the 1% threshold. Finally, our results also show the existence of a negative and significant effect between terrorism and most variables.

After representing the long-term relationship between our different variables, the error correction model is estimated. The ECM estimators are presented in Table 6 below.

Short-term results show that the history of the variable ATTACKS has a negative and significant effect on the number of terrorist attacks. Therefore, as soon as the phenomenon of terrorism appeared, its spread became higher and higher. Thus, the job demand of men is one of the main determinants of the short-term terrorism phenomenon in Tunisia; its effect is longer expected. Once the phenomenon of terrorism emerges, the job demand of men becomes more and more rapid over time as we note that the delays of the variable job demand of men are negative and significant while the job offer of men has a negative effect on terrorism. Moreover, the job demand of women negatively and significantly affects terrorism. Thus, an increase in job demand of women of 1% of terrorism accelerates its spread by 1.66% in the short term. The results also show that the coefficient associated with the inflation rate delayed by one period is higher than that associated with the same variable delayed by two periods. The increase in the inflation rate is increasingly one of the main catalysts of the phenomenon of terrorism. For delays in the changing presidential turnover rate, we note that they positively and significantly affect terrorism. Hence, a 1% increase in the presidential turnover rate leads to a rise of terrorism of 61.80%.

Table 6. Short-term relationship

| Variable       | Dependent Variable D(Attacks) |           |        |          |
|----------------|-------------------------------|-----------|--------|----------|
|                | Coefficient                   | T-Ratio   | Prob.  |          |
| ATTACKS(-1)    | -1.669978                     | -16.01770 | 0.0000 |          |
| DDE_F(-1)      | -0.000207                     | -3.868507 | 0.0083 |          |
| DDE_H(-1)      | 0.000191                      | 4.593955  | 0.0037 |          |
| INFL(-1)       | 1.419598                      | 6.795934  | 0.0005 |          |
| OFFRE_F(-1)    | 0.000103                      | 2.077136  | 0.0831 |          |
| OFFRE_H(-1)    | -2.68                         | -1.602960 | 0.1601 |          |
| TRP(-1)        | 61.80726                      | 10.62531  | 0.0000 |          |
| W(-1)          | 0.009229                      | 4.530926  | 0.0040 |          |
| POV(-1)        | 0.578586                      | 1.062611  | 0.3288 |          |
| D(DDE_F)       | -0.000145                     | -5.397924 | 0.0017 | 46.35910 |
| D(DDE_F(-1))   | -8.74                         | -4.368068 | 0.0047 |          |
| D(DDE_H)       | 0.000116                      | 6.094502  | 0.0009 |          |
| D(DDE_H(-1))   | -1.64                         | -0.911599 | 0.3971 |          |
| D(INFL)        | 0.586500                      | 3.977335  | 0.0073 |          |
| D(OFFRE_F)     | 0.000218                      | 4.225859  | 0.0055 |          |
| D(OFFRE_F(-1)) | 4.61                          | 3.283062  | 0.0168 |          |
| D(OFFRE_H)     | -4.05                         | -0.392191 | 0.7085 |          |
| D(TRP)         | 15.10415                      | 3.274850  | 0.0169 |          |
| D(TRP(-1))     | -4.139402                     | -0.898393 | 0.4036 |          |
| D(W)           | 0.002144                      | 1.039864  | 0.3385 |          |
| D(POV)         | -0.548608                     | -1.380345 | 0.2167 |          |
| D(POV(-1))     | -1.424968                     | -4.210033 | 0.2167 |          |
| C              | -49.26782                     | -4.470138 | 0.0042 |          |

Moreover, the level of wage rate has a positive and significant impact at the threshold of 1%. Hence, an increase in the level of wage of 1% undergoes a 0.009229% increase in terrorism in Tunisia.

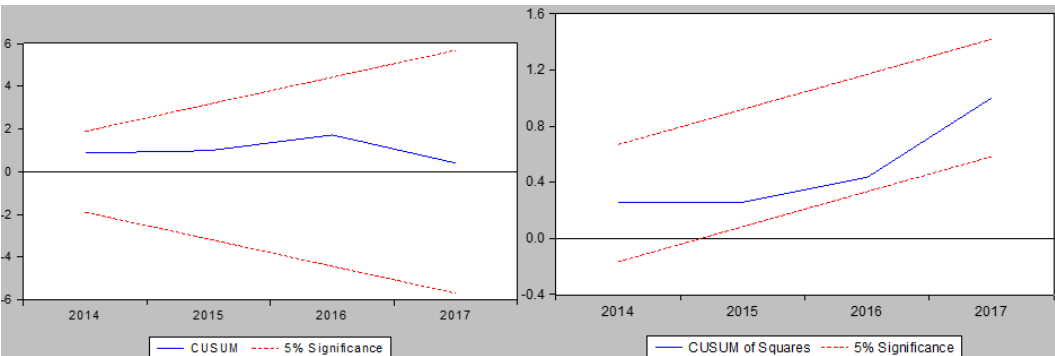
1 The Breusch–Godfrey LM test statistic for no serial correlation

2 The White's test statistic for homoscedasticity

Table 7. Diagnostic test

|                                            | Values (probability) |
|--------------------------------------------|----------------------|
| $\chi^2$ (serial correlation) <sup>1</sup> | 8.352464[0.0373]     |
| $\chi^2$ (functional form) <sup>2</sup>    | 0.550705[0.6055]     |
| $\chi^2$ (normality) <sup>3</sup>          | 0.553772 [0.758141]  |
| $\chi^2$ (heteroscedasticity) <sup>4</sup> | 9.604353[0.0046]     |

Figure 3.



- 3 The Jarque–Bera statistic for normality
- 4 The Ramsey’s Reset test statistic for regression specification error

Table 7 contains the diagnostic test results for the selected ARDL model (2, 2, 2, 2, 1, 1, 2, 2, 2). The normality of the distributed residuals is noted by the Jarque-Bera test of normality. By applying the heteroscedasticity test, the results show that the F statistics indicate that the null hypothesis of no correlation of the series cannot be rejected and also confirm the absence of heteroscedasticity of the residuals.

One of the econometric requirements of an ARDL model is to justify the stability of the parameters, of course after the analysis of the diagnostic tests. We apply the cumulative sum tests (CUSUM) and the cumulative sum of squares (CUSUM Square) in order to test the stability of the short- and long-term coefficients by the ARDL model. These tests are applied to recursive residuals from the ARDL model estimated in this work (Brown et al., 1975)

Table 6 presents the results of these tests. It can be clearly seen that the squares of CUSUM and CUSUM Square are within the 5% critical boundaries. Therefore, we can justify the robustness and stability of our estimated coefficients of the ARDL cointegration model (2, 2, 2, 2, 1, 1, 2, 2, 2).

## CONCLUSION AND IMPLICATIONS

In order to combat the phenomenon of unemployment and accelerate the offers of job creation, it is necessary to stabilize growth and create investments and, above all, know how to respond to terrorism with innovative strategies. The objective of this research was to find out the main determinants of long- and short-term terrorist attacks to verify the relationships in Tunisia. The estimated ARDL model is an innovative approach to addressing this issue in the case of Tunisia.

In this context, the effect of socio-economic variables on the phenomenon of terrorism is captured by taking into account other commonly used control variables in the empirical literature for which its influence improves outcomes.

In fact, in the short term, we have found that the history of the variable noted ATTACKS (as measured by the number of terrorist attacks), the job offers of men, and the job demand of women have a significant and negative effect on terrorism. In addition, the increase of the level of job demand of women by 1% decreases the phenomenon of terrorism in the short and long terms.

And in the long term, we note that there is a significant relationship between terrorism and the labor market, following effective economic policies that justifies these results. From a normative point of view, terrorist attacks can urge the State to conduct investment strategies to stabilize growth in order to increase the level of employment and reduce long-term unemployment in Tunisia. We find

that the labor supply of women and the labor demand of men have a positive and significant effect on the number of terrorist attacks, of course, without forgetting that inflation and the presidential turnover rate have a positive and significant effect on terrorism.

Therefore, we must increase the level of growth of the country by stabilizing the policy and by controlling governance to show the effectiveness of the results of this study which aims at reducing terrorism and improving the country's economic conditions.

In addition, in view of the results found in this research, recommendations can be addressed to the political authorities of the country. On the one hand, investments are a channel for transmitting the effects of terrorism on the labor market. Thus, terrorism can stabilize the long-term labor market through investment by putting in place realistic economic policies that are time-bound to encourage the State to create vacancies for the unemployed. On the other hand, the struggle and monitoring of the political stability of the country leads to effective economic policies over time that encourage economic openness by imposing good governance in the fight against corruption.

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