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Revisiting the Determinants of Investment- The Case of Tunisia

NESRINE DARDOURI¹, ABDELKADER AGUIR², RAMZI FARHANI³, MOUNIR SMIDA⁴

¹University of Sousse, Faculty of economics and management of Sousse, MOfid LR21 ES28

E-mail: nesrine.dardouri91@gmail.com; ORCID ID : 0000-0003-3323-8931

²ESPI2R Research Unit (Groupe ESPI).

University of Sousse, Faculty of economics and management of Sousse, MOfid LR21 ES28

E-mail: a.aguir@groupe-espi.fr

³University of Sousse, Faculty of economics and management of Sousse, MOfid LR21 ES28

E-mail: ramzi.farhani@gmail.com

⁴University of Sousse, Faculty of economics and management of Sousse, MOfid LR21 ES28

E-mail: mounirsmida2006@gmail.com

ABSTRACT

This study aims to analyse the determinants of investment for developing countries, through the case of Tunisia, which is strongly affected by such a dynamic. Using the ARDL model on annual data for the period 1987 to 2020, we found evidence of a short- and long-term relationship between various social and economic variables and the investment. These findings have important policy implications for economic agents, politicians, and policymakers. This study is useful to identify the socioeconomic determinants of total investment in Tunisia.

Keywords: Investment; Economic growth; Tunisia

JEL Classification: F21, F41

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Los Determinantes de la Inversión: El Caso de Túnez

NESRINE DARDOURI¹, ABDELKADER AGUIR², RAMZI FARHANI³, MOUNIR SMIDA⁴

¹Université de Sousse Faculté des Sciences Economiques et de Gestion de Sousse.

E-mail: nesrine.dardouri91@gmail.com; ORCID ID : 0000-0003-3323-8931

² ESPI2R Research Unit (Groupe ESPI).

Université de Sousse Faculté des Sciences Economiques et de Gestion de Sousse.

Laboratoire MOFID

³Université de Sousse Faculté des Sciences Economiques et de Gestion de Sousse

E-mail: ramzi.farhani@gmail.com

⁴Université de Sousse Faculté des Sciences Economiques et de Gestion de Sousse

E-mail: mounirsmida2006@gmail.com

RESUMEN

Este estudio pretende analizar los determinantes de la inversión para los países en desarrollo, a través del caso de Túnez, fuertemente afectado por dicha dinámica. Utilizando el modelo ARDL sobre datos anuales para el periodo 1987 a 2020, encontramos evidencias de una relación a corto y largo plazo entre diversas variables sociales y económicas y la inversión. Estas conclusiones tienen importantes implicaciones políticas para los agentes económicos, los políticos y los responsables de la formulación de políticas. Este estudio es útil para identificar los determinantes socioeconómicos de la inversión total en Túnez.

Palabras clave: Inversión; Crecimiento económico; Túnez

Clasificación JEL: F21, F41

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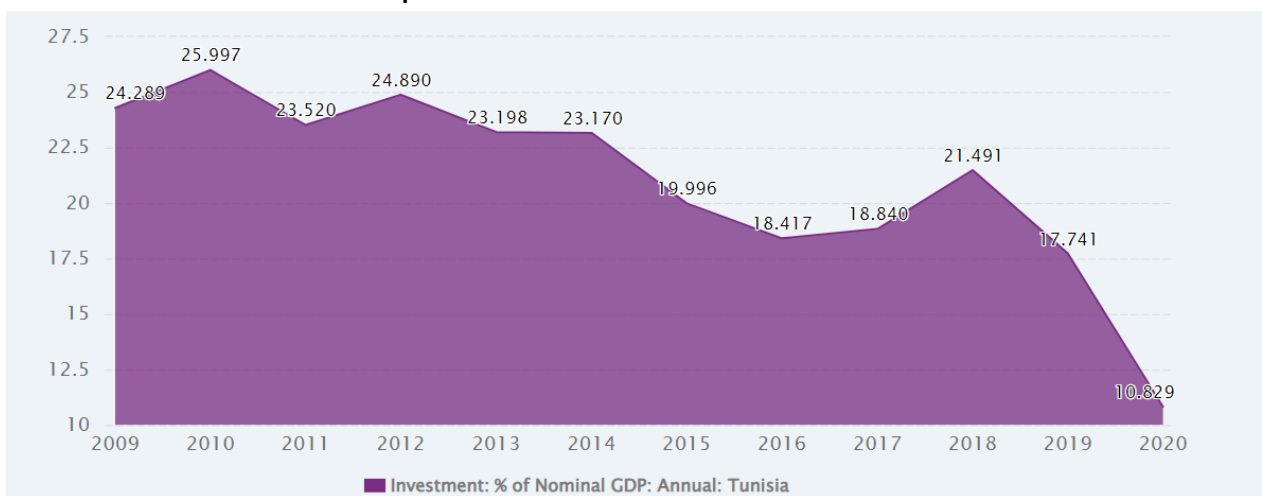
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1. Introduction

Investment in Tunisia plays a key role in economic activity. In fact, it is not only an important component of final demand, but it is also considered the engine of economic growth insofar as it increases the country's productive capacity and improves its productivity. It is as such that the investment, is in the middle of the dynamics of adjustment and takes a particular importance in the economic policy engaged by Tunisia since the end of the Eighties and it, with the engagement of several reforms and programs of support having for main target to incite the companies to accumulate more capital, while directing them towards a better use of the installed capacities. This study aims to analyse the determinants of investment in Tunisia. We want to analyse the short and long term effects of various social and economic variables on investment. More specifically, we seek to fill the gap in the literature concerning the relationship between investment and social and economic variables in Tunisia, notably the growth rate, trade openness, the unemployment rate, the inflation rate, corruption, and nominal and real effective exchange rates. To the best of our knowledge, this study is the first to integrate all these economic and social variables to identify the determinants of investment in developing countries.

The analysis of investment trends is based on the growth of gross fixed capital formation 'GFCF' in real terms and the monitoring of the investment rate, while making international comparisons.

Graph 1: The evolution of investment in Tunisia



Sources: National Institute of Statistics

The examination of the evolution of the investment rate in Tunisia along the decade shows a decline over the period 2014-2016 from 23.17% in 2014 to 18.41% in 2016. From 2017, it recovered without reaching the level achieved at the beginning of the decade. During the post-Covid period, a significant decline in GFCF in relation to GDP was recorded under the effect of the economic, social and security instability that followed it. The investment rate thus fell from 21.49% in 2018 to 10.82% in 2020.

We can therefore see that socio-economic factors have an impact on investment in Tunisia. Inflation refers to the general prices of the country within the country, which acts as an indicator of the purchasing power of consumers to meet their demands and maximize their utilities. Several researchers have analysed the fluctuation of prices of general goods, as well as household consumption to see their impacts on investment (M. Gillman, 2011). Due to inflation and consumer dissatisfaction, people find it difficult to live in these conditions and no longer have the confidence to invest.

This issue invites us to highlight several questions: how can we define corruption and what are its main characteristics? What are the main determinants of investment? How can corruption affect local investment in Tunisia?

To address this issue, this study first examines the evolution of investment in its global dimension. The second part gives an overview of the macroeconomic framework of investment in Tunisia and a review of the literature that recalls the main determinants of investment 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 investment function in Tunisia in order to identify the main factors that determine its evolution.

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

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 few studies have worked on this research theme. Finally, the implementation of the ARDL approach and its interpretation is quite simple (Rahman and Kashem 2017) and the ARDL framework requires a single-form equation (Bayer and 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 indicated 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 stability is one of the determinants of investment identified by the literature. This is why the study of the link between investment in Tunisia and macroeconomic stability 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 both as indicators of Tunisia's economic stability, taking into account corruption and exchange rates as control variables.

The study attempts to identify the indicators that influence investment in Tunisia. Specifically, the study was designed to:

- Identify the outlook factors influencing the investment decisions of investors in Tunisia;
- Determine the relationship between political stability, the socio-economic environment and investment in Tunisia; and
- Discover the herd factors that influence the investment decisions of investors in Tunisia.

The present study could be the first major contribution to the empirical literature on investment in Tunisia, which promises to trigger other studies in the field that would improve the country's investment market - companies, traders, investors, institutions, analysts, bankers, researchers - 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 investment practitioners to understand more practical and theoretical insights into the key determinants of investing, providing factual information to investors. 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 the decision-making capacity of investors in Tunisia, especially in behavioural aspects.

The initiation of the Autoregressive Distributed Delay (ARDL) or Bounds test is due to Pesaran and Shin (1999), while its further development is due to Pesaran et al. (2001).

It is recognized as one of the most flexible methods in the econometric analysis of the determinants of investment, especially when the research framework is shaped by regime shifts and shocks. Moreover, the fact that the ARDL method can tolerate different delays in different variables makes the method very

attractive, versatile and flexible. The ability to accept enough offsets allows better capture of the mechanism of the data generation process. Moreover, the ARDL model provides unbiased estimates and valid t-statistics, regardless of the endogeneity of some regressors (Harris and Sollis 2003; Jalil and Ma 2008). Finally, the interpretation of the ARDL approach and its implementation is quite simple (Rahman and Kashem 2017) and the ARDL framework requires a single-form equation (Bayer and Hanck 2013), while other procedures require a system of equations.

The ARDL approach is more reliable for small samples compared to the cointegration methodology of Johansen and Juselius (Haug 2002). Halicioglu (2007) also mentions two other advantages of the method, which are: Simultaneous estimation of short-term and long-term effects and the possibility of testing hypotheses on the estimated long-term coefficients. This is not done in the Engle-Granger method.

The rest of this paper is organized as follows. In section 2 we analyse the development of investment and its main determinants in Tunisia. In section 3, we introduce the data to empirically study the determinants of investment based on annual data from 1998 to 2020. Our main empirical results are presented in section 4. In section 5 we describe some political implications of our results.

2. Review of theoretical and empirical literature and research hypotheses

Theoretical Review

The assessment of the determinants of investment can be distinguished by two approaches: one is theoretical and the other is empirical.

We begin with the theoretical approach where Keynes tried to explain the demand for investment which is determined by the size of the present value of the expected net gain relative to the additional capital expenditure incurred by the cost of capital at that time, based on the concept of marginal capital. The demand for investment depends on the level of profits when we consider the theory of internal funds proposed by Jan Tinbergen. The level of profit in question is the level of profit expected in the future. While the expected profit in the future is generally reflected by the level of interest rates and the level of risk expected in the future. Referring to neoclassical theory, we find that the desired capital stock of a firm is determined by production and consumption. Finally, investment is influenced by the desired capital stock, the market price, and the replacement cost of capital goods, according to Tobin's q theory.

Empirical Review

We now turn to the empirical work that has studied the determinants of investment. It is generally accepted that the stability of the macroeconomic framework as well as the establishment of a favorable business environment are among the essential conditions that a country must observe to promote investment. In fact, several studies have been carried out and have led to the existence of a set of structural constraints to investment in Tunisia such as the lack of financing, the quality of the infrastructure, the qualification, in addition to the political and social instability that has plagued the national scene in recent years.

The evolution of investment is explained by various factors such as corruption which is at the same time rich, complicated and multidimensional. Among economists and since the 1960s, this phenomenon has been the subject of much ink and continues to be the subject of controversy until this day, as to its impact on economic growth as well as on public and private investment. Thus, many economists such as Mauro (1995, 1996); MO (2001); Balamoune-Lutz and Ndi-kumana (2007-2008); MO (2001). Zheng and Xiao (2020); Kuvvet, E (2021), found that corruption has a negative effect on private and public investment. The proliferation of corrupt practices increases the indirect cost of production, in the private sector, and in the inefficiency of meritocracy, which results in a degradation of human capital and uncertainty as to the future returns of the economy. Therefore, corruption affects the public sector, through public

expenditure and in particular public investment. This action has several forms, either by an adverse selection of public investment projects in which projects of greater political interest are favoured over those of a high economic and social nature or by the allocation of public funds to large-scale projects and capital intensive as a result of the inadequate allocation of resources. In contrast, other economists claim that corruption has a "paw grease effect" on investments, such as Ackerman and Rolfhus (1999), Tanzi and Davoodi (1997), Ugur and Dasgupta (2011), Belitski, Chowdhury and Desai, (2016); Thuy Dieu Nguyen (2020), Son and al(2020). Thus, all sectors of activity are affected by this corruption. Hence the interest to study the determinants of total investment in Tunisia, knowing that corruption is one of its fundamental determinants. Tunisia is a developing country, which despite its progress and its economic and social achievements, records lower growth rates compared to those achieved in other developing countries. That is 2% of real GDP and an investment rate of 19%, in 2017, compared to 4.1% in Morocco and an investment rate of 33.5%, and 3.5% of GDP in Algeria with 30% in total investment, in the same year. Moreover, the current economic situation in Tunisia raises many challenges and the business climate is characterized by uncertainty and an increasingly deep institutional failure. Thus, the main object of this work is to study to what extent corruption affects Tunisia's local investment. Like certain experiences in certain countries, can corruption constitute a stimulus for local investors "a grease in the legs" or constitute a brake on investment in Tunisia? Does the unemployment rate influence investment in Tunisia? What is the relationship between inflation and investment? And more generally what are the determinants of investment in Tunisia?

Through a Granger causality analysis, Muafiqie (2018) showed that Foreign Direct Investment (FDI) has a significant influence on the unemployment rate in Indonesia from 2000-2016.

Moreover, an analysis by the VAR model showed that FDI has a negative relationship with the unemployment rate. In addition, Malik and Saima (2013) using Johanson's co-integration approach, found that there is a long-run relationship between FDI and the unemployment rate in Pakistan from 1970-2011. Whereas, the study by Adam and Zure (2011) with the VAR approach shows that there is a short-term relationship between FDI and unemployment in Poland from 1995-2009. Some works such as that of P. Samuelson and V. Nordhaus (2010) were the first to formulate the interaction mechanism between economic growth and investment. This interaction implies that real gross domestic product growth is caused by real investment growth.

Several other studies on the determinants of investment have been carried out since the pioneering work of Keynes (1936) including the accelerator approaches (Goodwin, 1951; Lucas, 1967; Treadway, 1974; Jorgensen, 1971) and q of Tobin (Tobin, 1969). However, the flexible accelerator theory is the most popular and widely used to analyze investment behaviour in the least developed countries and especially in Sub-Saharan Africa (SSA). For this reason, studies of the behaviour of private investment in SSA simply focus on testing hypotheses that explain variations in investment in these economies (Mutenyo et al. 2010). However, the effect is stronger for provinces with high levels of corruption. For example, we find that Hoinaru et al (2020) found that the effects of corruption on economic development are greater in developed countries than in less developed countries. Furthermore, corruption positively affects economic development in low-income countries. Some work, such as that of Truong (2020), has studied the relationship between corruption and economic growth in China using a dynamic panel data model. The author finds that corruption harms economic growth by reducing the efficiency of investments. Moreover, the negative impact of corruption is huge in provinces with higher investment rates.

Adopting the ordinary least squares regression technique, Hauwa (2016) conducted a study on Nigeria which focuses on the impact of unemployment on economic growth, the data was taken from 1980 to 2010. The result showed that unemployment does not significantly affect economic growth so there is need for policy makers to want on good governance to increase the level of output in Nigeria by reducing unemployment. Furthermore, Abaukaka (2014), evaluated the relationship between foreign direct

investment and job creation in Nigeria over the period from 2002 to 2012. The study revealed that there is a negative relationship between FDI and employment level in Nigeria.

Regarding the relationship between the real interest rate and investment, many researchers draw different conclusions about this relationship based on a large number of empirical analyses. According to the study by Qing and Chong, 2004, it is found that investment certainly affects interest rates, if investment is added as an endogenous variable in a monetary utility function model. The analysis of irreversible investment under variable rates showed that the change in interest rate has a significant effect on the demand for investment which can be positive or negative (Alvareand and Koskef, 2004). The short-run rate diffusion model showed that interest rate uncertainty can limit the best investment based on the study of Luis H.R Alvarez 2010.

Based on the existing literature above, the proposed hypotheses are:

H1. The high unemployment rate decreases investment in Tunisia.

H2. GDP boosts investment in Tunisia

Another additional hypothesis raised by this work indicates that the weakness of a country, in general, has a significant impact on investment. Economic stability, low unemployment and a high level of growth also create investments. Thus, based on the study of the literature below we have proposed the following hypothesis:

H3. The stability of the economic and political situation in Tunisia favours investment

In summary, we can conclude that there is an ambiguous relationship between investment and several socioeconomic variables, with mixed results from some researchers. But most of these studies focus on developed countries and few focus on developing countries, particularly Tunisia. It is for this reason that this study seeks to assess the impact of socio-economic variables on investment in Tunisia by taking into account trade openness and the main indicators that are capable of promoting economic growth in Tunisia, notably the decrease in inflation and unemployment and the disappearance of corruption.

3. Empirical methodology

Several techniques have been used to estimate the determinants of investment that are already presented in the previous section. But since we are using time series data, we need to justify the order of integration of the variables in order to know how to choose the best econometric model. Our variables are all integrated of order less than 2, therefore we use the ARDL model. This estimation technique has the advantage of being more robust for this work because of its ability to estimate both cost and long-run effects. This technique also produces high precision results because it takes into account the dynamics of the evolution of the variables throughout the period used, while having the best properties for small sample sizes in terms of bias and precision.

3.1. Data source and variables definitions

The empirical work is based on annual data for the period from 1998 to 2020. The total investment (tot Inv) is accessible from the database of the National Institute of Statistics (NIS), this index measures the rate of the total investment in Tunisia each year. The growth rate (GDP) is accessible from the World Development Index (WDI) database, it is used as a proxy for economic growth. Trade openness (openness) is calculated by the author using the INS database and applying the following formula $OPENESS = (X + M) / 2PIB$. The unemployment rate (unemp) is taken from the database of the Tunisian National Statistics Institute (INS).

Corruption (CPI) can be accessed from the INS database. Inflation (INFL) is extracted from the INS database while real exchange rate (RER) and real interest rate (RIR) are extracted from the Central Bank Central Tunisia (TCB).

Table 1 provides a summary of the different used variables

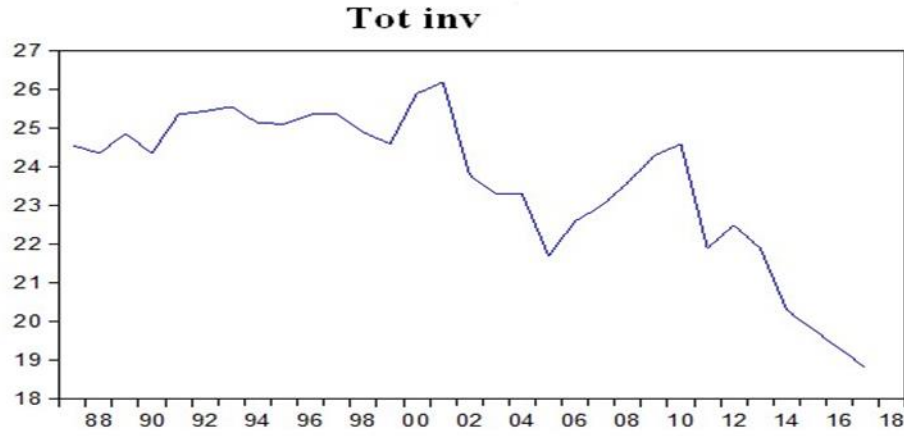
Table 1. Summary of the used variables and data sources

Variables	Definitions	Data sources	expected sign	empirical justification
Total Investment	The investment rate is the share of the investment regarding the produced wealth. It allows knowing the percentage of wealth devoted to investment each year.	The Tunisian National Institute of Statistics (NIS)	-	-
GDP	The growth of a country's economy from year to year.	World Development Indicators, world bank (WDI).	Positive	R. David (2006)
Openness	The openness index corresponds to the share of international trade in an economy. It is obtained by adding the number of exports and imports of a country, which is divided by 2 and then by the GDP of this country, the whole multiplied by 100.	Calculated by the author.	negative	Bibi et al (2012)
Unemployment	This is the percentage of people in the labour force who are unemployed.	The Tunisian National Institute of Statistics (NIS)	negative	Abaukaka (2014)
PCI	Corruption is the diversion of interdependence with several people, for the corrupter, to obtain particular advantages and retribution in exchange for his complacency.	The Tunisian National Institute of Statistics (NIS)	negative	Truong (2020)
INFL	It is the loss of the purchasing power of money that results in a general and lasting increase in prices.	The Tunisian National Institute of Statistics (NIS)	positive	Frimpong and Marbuah (2010)
RER	The price of a foreign currency in a given country.	Central Bank of Tunisia (CBT).	negative	Badry (1998)
RIR	The real interest rate is a nominal interest rate that takes into account inflation, that is, the increase in prices. To calculate it, we deduct the inflation rate from the nominal rate.	Central Bank of Tunisia (CBT).	negative	Badry (1998)

Table 2. Evolution of investment and its main determinants in Tunisia before, after and during the Revolution

Date	Tot Inv	GDP	openness	unemployment	PCI	RER	RIR
1998	24.9	7.73	0.32	15.43	5	5.28	3.77
2005	21.7	8.06	0.37	12.87	4.9	5.11	2.98
2011	21.9	8.35	0.45	18.33	3.8	4.58	1.36
2012	22.5	8.32	0.45	17.63	4.1	4.56	-1.94
2014	20.3	8.35	0.43	15.06	4	4.53	0.07
2015	19.8	8.25	0.39	15.22	3.8	4.57	0.46
2016	19.3	8.21	0.39	15.51	4.1	4.53	0.67

Graph 1. Total investment in Tunisia



3.2. Econometric method

The methodology we used in this study is based on an estimate using the ARDL model (Auto-Regressive Distributed Lags), which makes it possible to analyze both the short-term and long-term relationship between the investment and its determinants with both integrated order (0) and order (1) variables Pesaran, Shin, and Smith (2001). This ARDL cointegration method is better than the traditional cointegration techniques suggested by Johansen (1988) and Johansen and Juselius (1990), as it uses a single equation. Despite its outperformance, it is worth mentioning that ARDL has several advantages over other time series models. The existence of a cointegrating relationship between the variables is tested via several tests. However, the staged delay cointegration test proposed by Pesaran et al (1999, 2001) is increasingly used in recent studies. The choice of this technique is because it has the advantages of being more effective for studies with a small sample size and applies to series that are integrated at order 1, at level 0 or mutually integrated, unlike the series. Traditional cointegration tests such as those of Engle Granger (1987), In addition, the technique cannot be applicable in the case where the order of integration of the series is more than 1. An additional advantage of this method, it makes it possible to estimate long-term and short-term dynamics (Akpan et al, 2012). There is also a second advantage that the technique circumvents too many specifications, such as the number of endogenous and exogenous variables to include, the order of vector autoregression (VAR), the treatment of deterministic elements, and an optimal number of lags to apply (Bhasin & Gupta, 2017b). On the contrary, it allows the variables to show different optimal delays. In addition, the ARDL model estimates all the short and long term parameters together, thereafter it provides reliable and consistent results, which alternative cointegration methods cannot produce. In addition, it is more efficient in case of small or infinite sample sizes (Arize, 2017). Specifically, the ARDL model offers reliable results with 30 to 80 observations (Bhasin & Gupta, 2017b).

Our ARDL specification of the link between investment and socioeconomic variables is represented by equation (1):

$$\begin{aligned}
 \Delta(\text{tot Inv})_t = & \alpha_0 \\
 & + \sum_{i=0}^p \alpha_{1i} \Delta \text{tot Inv}_{t-i} \\
 & + \sum_{i=0}^q \alpha_{2i} \text{GDP}_{t-i} + \sum_{i=0}^q \alpha_{3i} \Delta \text{Openness}_{t-i} + \sum_{i=0}^q \alpha_{4i} \Delta \text{une}_{t-i} \\
 & + \sum_{i=0}^q \alpha_{5i} \Delta \text{GDP}_{t-i} + \sum_{i=0}^q \alpha_{6i} \Delta \text{INFL}_{t-i} + \sum_{i=0}^q \alpha_{7i} \Delta \text{RER}_{t-i} \\
 & + \sum_{i=0}^q \alpha_{8i} \Delta \text{RIR}_{t-i} + \beta_1 \text{tot Inv}_{t-1} + \beta_2 \text{GDP}_{t-1} + \beta_3 \text{Opness}_{t-1} \\
 & + \beta_4 \text{une}_{t-1} + \beta_5 \text{PCI}_{t-1} + \beta_6 \text{INFL}_{t-1} + \beta_7 \text{RER}_{t-1} + \beta_8 \text{RIR}_{t-1} + \varepsilon_t
 \end{aligned} \tag{1}$$

However, when one uses the dependent variable of equation (1) at its long-term equilibrium level, it may not immediately follow a change in one of its main determinants. In this way, the speed of adjustment between the short and the long term of different explanatory variables can be captured through the estimation of the following error correction model:

$$\begin{aligned}
 \Delta(\text{Inv tot})_t = & \alpha_0 \\
 & + \sum_{i=0}^p \alpha_{1i} \Delta \text{tot Inv}_{t-i} \\
 & + \sum_{i=0}^q \alpha_{2i} \Delta \text{GDP}_{t-i} + \sum_{i=0}^q \alpha_{3i} \text{opness}_{t-i} + \sum_{i=0}^q \alpha_{4i} \Delta \text{unem}_{t-i} \\
 & + \sum_{i=0}^q \alpha_{5i} \Delta \text{CPI}_{t-i} + \sum_{i=0}^q \alpha_{6i} \Delta \text{INFL}_{t-i} + \sum_{i=0}^q \alpha_{7i} \Delta \text{RER}_{t-i} \\
 & + \sum_{i=0}^q \alpha_{8i} \Delta \text{RIR}_{t-i} + \theta \mu_{t-1} + \varepsilon_t
 \end{aligned} \tag{2}$$

Where Δ represents the first difference operator, μ_{t-1} represents the error correction term (ECT) of our model. The (ECT) in the equation measures the speed of the adjustment of the imbalance between the short term and the long term of the variable to explain. What we are waiting for is the negative and significant sign of the (ECT) (Gujarati DN. 2003). To see and examine the cointegrating relationship that exists. Thus, we must first establish the order of integration of each variable. Thus, we will use the Dickey-Fuller test (ADF), the Phillips-Perron test (PP) and the structural break test (Breakpoint test) which are popular unit root tests generally used to test and verify the order of integration of the series. These tests are carried out with different specifications to verify if the series is stationary at the level of indifference. The latter has a null hypothesis of non-stationarity against an alternative of stationarity. Next, we need to verify the existence of a cointegration relation, however, we will use the terminal cointegration test. This test is based mainly on the Wald statistic F whose null hypothesis means the absence of a cointegrating relation. The Bounds test consists of a first step in estimating the model (1) by the least ordinary squares

(OLS). Then to test the joint nullity of the long-term multipliers using the F-test. So we present the following two considered hypotheses:

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = 0$$

Against the alternative hypothesis

$$H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq 0.$$

Finally, the last step is to compare the calculated F statistic with the critical value. Indeed, Pesaran et al. (2001) initiated a study that includes two sets of critical values for a given significance level. We start with the first which is calculated by assuming that all the variables of the ARDL model are integrated at the level I (0), while the second set is calculated by assuming that the variables are integrated into the first differences I (1). If the calculated statistical F is greater than the upper critical limits, cointegration is accepted, i.e. there is a cointegration relationship. But, if the calculated statistical F is less than the lower critical value, we cannot accept the hypothesis of the existence of a cointegration relation. And if the calculated F statistic is between the limits, one must know the order of integration of the underlying regressors for a conclusive inference to be made. Once estimated, the cointegration equations are used to calculate the long-run elasticities. If the cointegration relationship is not detected, then the short-term causal relationship is measured. After specifying our modelling, the general approach will be followed by several specification tests, in particular: (i) the normality of the residue (Jarque-Bera normality test); (ii) Series correlation (Breusch-Godfrey LM test); (iii) Heteroscedasticity (ARCH test); and (iv) the specification of the model (specification of the Ramsey test regression error - RESET). These steps are followed by the square CUSUM and CUSUM test to analyse the stability of the model. The results are presented and discussed in the next section.

4. Results and discussions

Before analysing these variables using the ARDL approach, we will present a descriptive study of annual data that covers the period from 1998 to 2020.

From this table, we can note that the average level of investment was 23.60. Likewise, the average values of inflation, corruption perception index and unemployment are above the minimum desirable level. Likewise, the average value of GDP, the real exchange rate is very low. So overall, Tunisia's conditions are not up to par. Before starting the analysis of variables through the ARDL approach proposed by Pesaran et al 2001, we first focus on unit root tests to see the order of integration of the different dependent and independent variables. The results which are presented in Table 4 show that all the variables are integrated from order 1 I (1) except for three variables which are trade openness, the real exchange rate and the real interest rate which are stationary at the level I (0). These results confirm that all the variables have an order of integration of less than 2.

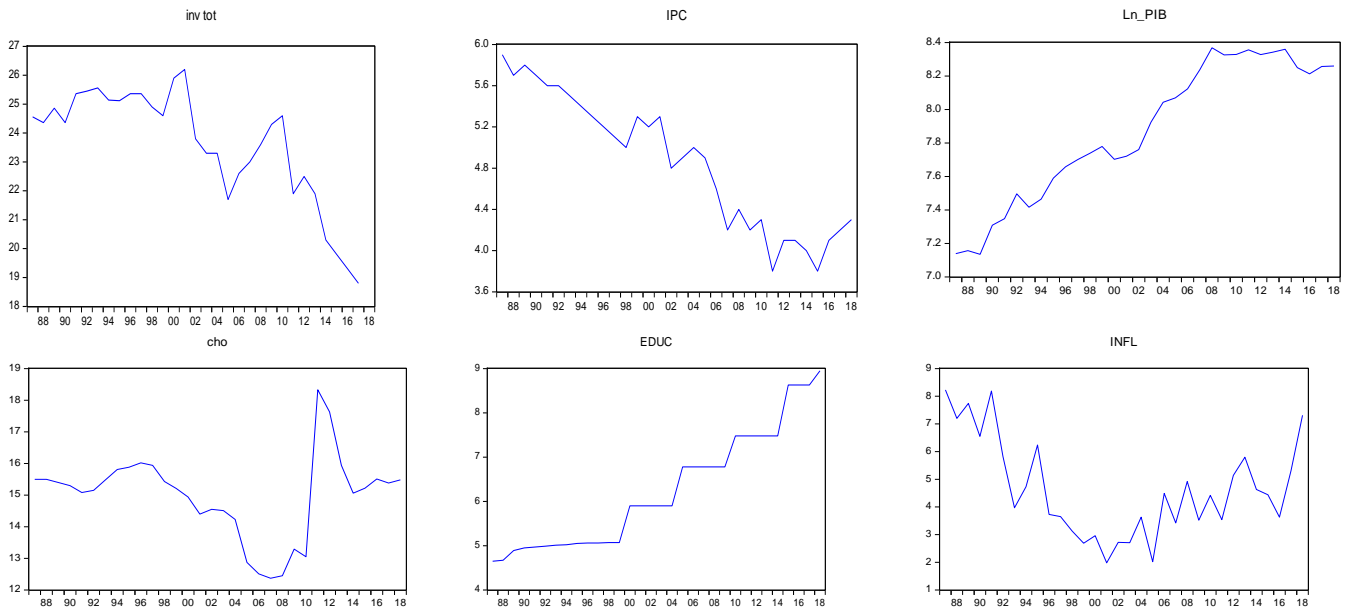
Table 4. Stationary test

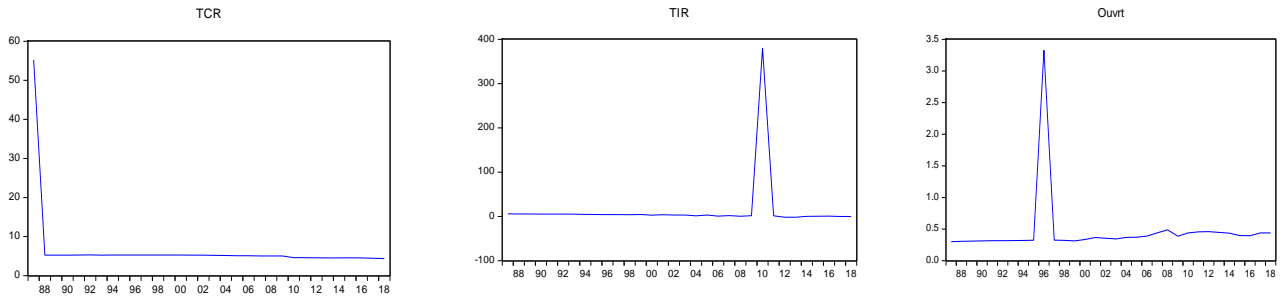
Variables	ADF Test		PP Test	
	In level	First difference	in level	First difference
Tot Inv	-0.089302 [0.9419]	-5.610584** [0.0001]	0.164889 [0.9655]	-5.628499** [0.0001]
GDP	-1.765977 [0.3896]	-4.789255** [0.0006]	-1.787105 [0.3796]	-4.786287** [0.0006]
Openness	-5.70649** [0.0000]	-9.146068** [0.0000]	-5.728693** [0.0000]	-29.58684** [0.0001]
Unemplo	-2.353594 [0.1626]	-5.471741** [0.0001]	-2.439659 [0.1397]	-5.872020** [0.0001]
PCI	-1.448619 [0.5457]	-7.422913** [0.0000]	-1.663975 [0.4390]	-9.153833** [0.0000]
INFL	-2.569358 [0.1100]	-7.795384** [0.000]	-2.442633 [0.1389]	-7.881347** [0.0000]
RER	-149.1916** [0.0001]	-604.5434** [0.0001]	-73.31394** [0.0001]	-604.5434** [0.000]
RIR	-5.595305** [0.0001]	-9.091453** [0.0000]	-5.597170** [0.0001]	-29.18988** [0.0001]

SC is used to choose the number of optimal delays for the ADF tests, whereas «Bandwidth» is used for PP tests. The critical values related to ADF and PP tests were 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 tests. (***) and (**) and (*) denote statistical significance at the 1%, 5% and 10% levels respectively

Indeed, the evolution of the variables over time presented in Chart 2 shows the existence of peaks, this leads us to wonder about the existence of a regime change.

Graph 2. Evolution of socio-economic variables





The results we found in the stationarity tests lead us to analyse the relationship between the investment and its fundamentals by applying the cointegration tests linked to the ARDL approach (Feridun and Shahbaz 2010), in our case the AIC choice criterion is used. Table 5 shows the results of the Bounds cointegration test.

Table 5. Bounds cointegration test

Dependant variable	lag selection	F-statistic	Decision
Inv tot	(1, 2, 2, 0, 2, 0, 0, 1)	5.785968	co integration
Significance	I0 Bound	I1 Bound	
10%	1.92	2.89	
5%	2.17	3.21	
2.5%	2.43	3.51	
1%	2.73	3.9	

Pesaran& al. (2001), Table CI(i) Case I.

The results show that the calculated statistical F is of the order of 5.785968 which is greater than the critical value advanced by Pesaran et al (2001) at the 1% threshold, this confirms the existence of at least one long-term relationship between variables in Tunisia for the period from 1998 to 2016. The existence of a long-term relationship brings us back to estimating equation (1), using the ARDL technique. The results of the estimation are presented in Table 6:

Table 6. Long-term relationship

Variable	Dependent variable tot Inv		
	Coefficient	T-Ratio	Prob.
PCI	1.585408	0.515982	0.6145
LN_GDP	13.06815	2.502060	0.0265
Open	0.382489	0.737007	0.4742
RER	23.02650	3.196005	0.0070
RIR	-0.018996	-1.048330	0.3136
UNEMP	0.746377	2.929895	0.0117
INFL	2.002366	2.480728	0.0276
C	-222.4436	-2.929007	0.0117

Source : Authors, Eviews 10

The results of our model, describing the long-term relationship between total investment and its determinants, are presented in Table 6. The existence of a long-term relationship between investment and its fundamentals is confirmed for Tunisia. The results show that the growth rate has a positive and significant impact on investment in Tunisia at the 5% threshold. Hence a 1% increase in the growth rate causes a 13.06% increase in investment. Although several studies have shown a relationship between investment and economic growth and they have obtained different results depending on the sample and the method used. This study marks the exceptional because the relationship we seek is reversed. Most studies seek the impact of investment, whether public or private or direct abroad, on economic growth, whereas we seek the impact of economic growth on investment. The results of this study, in terms of relationship, were similar to those of Kiviyiro and Arminen (2014), Chakraborty and Mukherjee (2012), and Goh et al. (2017), and Basu et al. (2003). However, these results contrasted with the results of Sunde (2017), Azman-Saini et al. (2010), Katircioglu (2009), Shahbaz and Rahman (2010), and Wang (2009). This result indicates that economic growth can cause an increase in investment in Tunisia, so the decline in economic growth will reduce investment. From this finding, we can deduce that economic growth is a variable considered for investors and it has a positive effect on investment (Carruth, A. et al. (1997), Dehn, J. (2000) and Ribeiro, M. (2001)).

In addition, the effect of changes in the unemployment rate on investment is positive and significant. This result is unexpected compared to those of several previous works which found a negative and significant sign. This means that the fragility of employment and the high level of unemployment facilitate the integration of young people in investment projects. In principle, this is logical, because a rise in the unemployment rate should lead to an increase in investment (due to the fall in job vacancies). This result is proven by Yayli and Deger (2012) who showed that there is a short-term causal relationship between foreign direct investment to employment. As for the real exchange rate (REER), its impact is positive and significant at 1%. Thus an increase in the real exchange rate of 1% undergoes an increase in the investment level of 23.02%. These results are in contradiction with the existing literature (Ahmed M. D., et al. (2014)).

We also found that a one percentage point increase in inflation results in the investment rate by 2 percentage points. As for the real exchange rate, it turns out that it is the main determinant of investment in Tunisia, its sign is positive and significant at 1%. Thus politically unstable countries offer unfavourable conditions for investment projects. Fisher's equation posits that the nominal interest rate is composed of the real interest rate plus the rate of inflation. From this relationship, it implies that a low inflation rate leads to low nominal interest rates. Therefore, the cost of capital and the financial cost of new investments will be low. Thus, the availability of capital at a lower nominal interest rate in a country attracts investors. Fisher's equation provides a basis for concluding that inflation and investment are inversely related. So this is consistent with our result (Tantiasti. D, (2008)).

These results support any policy changes that may attract investors. A policy adopted by government decision-makers that encourages investors could lead to a decrease in the unemployment rate. In this sense, these inflows create new jobs, improve technology transfer and increase profits. As a result, Tunisia's economic growth is boosted.

Finally, and from the results of the estimates, we can notice that there is no longer a relationship between investment and the corruption perception index in Tunisia in the long term. This result is justified by Freckleton et al. (2012) who found a positive relationship between corruption and investment in a study of a group of 42 countries in developing countries and 28 developed countries. They find that low levels of corruption have a positive impact on economic growth and investment.

After having identified the long-term relationship between the variables, Table 7 presents the short-term model and shows that the coefficient (-102.7449) indicates the speed of convergence towards the long-term equilibrium "the correction coefficient of ECT error (-1)" is negative and significant at 1%. Thus, in the short term, the ECM estimates are presented in Table 7:

Table 7. Short-term relationship

Dependent variable: tot Inv			
Lag structure : (1, 2, 2, 0, 2, 0, 0, 1)			
Variable	Coefficient	t-Statistic	Prob.
C	-102.7449	-3.625433	0.0031
Tot Inv (-1)	-0.461892	-2.611340	0.0215
GDP(-1)	0.732287	0.500083	0.6254
LN_GDP(-1)	6.036077	2.716298	0.0176
Openness	0.176669	0.835523	0.4185
RER(-1)	10.63576	4.554332	0.0005
RIR	-0.008774	-1.329902	0.2064
Unempl	0.344745	1.866158	0.0847
INFL(-1)	0.924877	5.032500	0.0002
D(GDP)	1.204345	1.521384	0.1521
D(GDP(-1))	-0.821812	-1.124318	0.2812
D(LN_GDP)	-6.415522	-3.050164	0.0093
D(LN_GDP(-1))	-7.119268	-2.920591	0.0119
D(RER)	-4.047419	-0.768710	0.4558
D(RER(-1))	0.028710	2.022374	0.0642
D(INFL)	0.695020	4.972655	0.0003

Adj. R2=0.970203

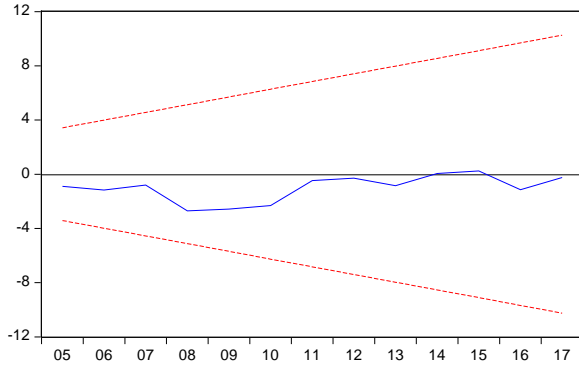
AIC=1.836388

F-stat.=28.21889, F-prob.=0.0000

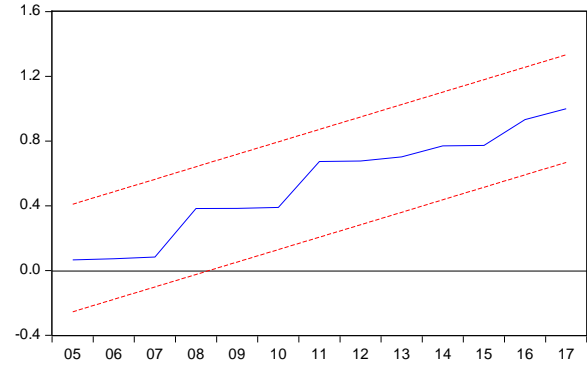
The existence of an equilibrium relationship between the investment and the various explanatory variables of the model makes it possible to highlight a long-term relationship between them at least in one sense. For the short-term coefficients, we notice that the lags of the investment variable have a strongly significant and negative effect. Once the investment phenomenon has appeared in a specific location, the speed of its propagation slows down over time. The results also show that the coefficient associated with the growth rate lagged by one period is greater than that associated with the same variable lagged by two periods. The level of growth is increasingly becoming one of the main catalysts for investment. For the real exchange rate delays, we notice that they positively and significantly affect the investment rate. Hence a 1% increase in the real exchange rate undergoes an investment rate appreciation of 10.63%. In addition, the unemployment rate and inflation have a positive and significant impact on investment at the 10% and 1% threshold respectively. Finally, our results indicate that corruption does not have a significant effect in the short term as in the long term. As for the growth rate used as a proxy for the development of the economy, it turns out that it is a determinant of investment in Tunisia. Its sign is positive and significant. Hence an increase in the economic growth of one percentage point undergoes a 6.03% increase in investment in Tunisia.

Table 8. Diagnostic test

χ^2 (serial correlation) ¹	3.981966[0.0500]
χ^2 (functional form) ²	0970990[0.3507]
χ^2 (normality) ³	0678213[0.712407]
χ^2 (heteroscedasticity) ⁴	0.886553[0.3551]



— CUSUM — 5% Significance



— CUSUM of Squares — 5% Significance

- 1 The Breusch–Godfrey LM test statistic for no serial correlation.
- 2 The White’s test statistic for homoscedasticity.
- 3 The Jarque–Bera statistic for normality.
- 4 The Ramsey’s Reset test statistic for regression specification error.

To validate the model, a series of econometric tests must be carried out on the residue. Table (8) shows the results of diagnostic tests for the selected ARDL model (1, 2, 2, 0, 2, 0, 0, 1, 0). The Jarque–Béra test of normality confirms that the distribution is normal. Further, from the results of the "Breusch-Godfrey" test of the correlation of the series and the Breusch-Pagan-Godfrey test of heteroskedasticity, an absence of correlation of the residuals is shown, which means the absence of heteroskedasticity. In addition, the Ramsey Reset test confirms the linear specification of our model.

Finally, to judge the structural stability of the model coefficients, one of the econometric requirements for an ARDL model is to verify the presence of the stability of the parameters. To test the stability of the short-term and long-term coefficients estimated by the ARDL model, we apply the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUM Square) tests, carried out to recursive residuals from the ARDL model estimated in this paper (Brown et al. 1975). The results of the tests are presented in Table 8. We note that the curves do not intersect the 5% confidence interval, taking into account that the CUSUM and CUSUM squared plots are located within the critical limits by 5%. Thus, we have empirical evidence which shows that the estimated coefficients of the ARDL cointegration model (1, 2, 2, 0, 2, 0, 0, 1) are structurally stable.

5. Conclusion

In conclusion, we can say that this research paper could be included among the works that focus on the study of the relationship between total investment and macroeconomic stability in Tunisia.

Before describing the main findings of this study and also some policy implications, we provide a brief description of the limitations implied by this study. We start with the most important one which is represented by the use of short time series.

We see that this weakness is found in several investment research studies. Furthermore, we are aware that for Tunisia the period between 1998 and 2020 was characterized by significant macroeconomic

imbalances and instability such as the revolution, the health crisis and terrorist attacks. Although one can overlook this shortcoming by using quarterly data, this approach may not be feasible because this type of data is not available. But, we believe that these results should be viewed with great caution and treated more as starting points for more elaborate future research.

Many factors explain the investment mainly including unemployment, corruption, real exchange rate, level of GDP, real interest rate, inflation, etc. During the period in question, the social and economic conditions of Tunisia are not satisfactory. Bounds cointegration analysis reveals that there is a long-term relationship between the various social and economic variables under study and investment. The results of the long-term relationship showed that the unemployment rate, inflation, the RER and the growth rate significantly affect investment. Likewise, important results have been drawn from the short-term relationship. These results showed that the history of the investment is an important determinant in the depreciation of the level of investment. In addition, we have found that in the short run the coefficient associated with unemployment is greater. To verify the reliability of our estimated model, we applied various econometric tests in this work. The results are robust and show that there is no problem with heteroskedasticity, multicollinearity or autocorrelation. The results also showed that the residues are normal.

From this research study, we can indicate that the investment in Tunisia was strongly linked to the economic situation of the country. Regarding the growth rate, there is a positive and significant relationship. Hence high investment mainly presents a good sign from the point of view of economic growth. So, the implementation of this result that to improve of economic growth through efforts to increase value-added in each production sectors.

From the results, it is inferred that the country's economic stability can handle the investment-related issues satisfactorily in the organization. It is the duty of the superior to be the backbone of the economic development of the country. They must act with decision-makers to meet the needs of the organization.

The conclusion that can be drawn from the study shows that socio-economic conditions are the real determinants of investment. For this, we must ensure the political stability of the country and conduct good governance. Thus, decision-makers can initiate an investment policy to improve the socio-economic conditions of the country. Unemployment is the main determinant of investment in this work. When it comes to the relationship between investment and economic growth, an increased effort to stimulate it could be an important measure to encourage investment in Tunisia. Efforts to improve educational attainment by providing greater educational opportunities in terms of improving merit-based education systems could be a good policy measure.

The empirical result of this study provides policy implications for increasing investment, and this requires a good governance strategy.

According to the results of this study, trade openness facilitates the import and export process, which encourages producers to increase their investments in the country. In addition, the improvement of the country's economic situation contributes to creating an attractive investment climate, which motivates investment in the country. It is therefore essential that the Tunisian government improve the investment climate, continue to open the Tunisian economy to foreign trade, and improve the quality of services offered. Finally, the government's economic policy of liberalizing foreign trade has been an effective policy to motivate investment in the country. Therefore, it is vital for the Tunisian government to adopt the same policy after the health crisis.

Our study revealed that there is a positive and significant relationship between economic growth and investment, the implementation of this result allows to improve economic growth through efforts to increase the added value in each production sector. In addition, inflation has a positive effect on investment in the long and short term, so the government must target the inflation rate to maintain the

stability of the general price level. The real exchange rate has a positive impact on investment. Thus, the government can use this result to encourage the stability of the exchange rate at a reasonable position. Therefore, the weakening of the exchange rate in the long run could disrupt the overall economic activity.

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