

# EXPLORING THE LONG-TERM EFFECT OF TRADE OPENNESS AND FOREIGN DIRECT INVESTMENT ON ECONOMIC GROWTH IN TUNISIA: ANALYSIS USING THE AUTOREGRESSIVE DISTRIBUTED LAG MODEL

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## Abstract

The objective of this paper is to assess the effects of foreign direct investment (FDI) and its combination with trade openness on Tunisia's economic growth. The theoretical literature shows that there is a near consensus on the positive effect of FDI on the economic growth of the host country. However, this effect depends on several preconditions, including the degree of trade openness of the country. In order to address this question, we deploy the "AutoRegressive Distributed Lag" (ARDL) approach based on macroeconomic data from Tunisia covering the period 1990-2023. The results obtained during this empirical investigation reveal that foreign direct investment exerts a positive and significant effect on economic growth for the period studied. Our estimation also shows a negative and significant effect of the interaction between FDI and trade openness. This finding suggests that, although FDI and trade openness are individually beneficial, their combination could generate potential adverse effects. This complexity can be attributed to various factors such as trade imbalances, excessive dependence on foreign capital or structural inefficiencies in the Tunisian economy. These results highlight the need for policy makers to modulate economic openness and foreign investment strategies, taking into account the country's specific dynamics. Developing integrated and balanced economic policies could maximize the benefits of FDI while mitigating the potential risks associated with excessive trade openness.

**Keywords:** Trade Openness, Foreign Direct Investment, Economic Growth, Human Capital, Economic Growth, Tunisia, ARDL.

**GEL Classification:** F10, F21, O40, J24, C22.

## INTRODUCTION

The growing attention to FDI is mainly explained by the dramatic increase in these flows over the last twenty-five years, with a significant proportion of them being directed towards developing countries. According to UNCTAD statistics, global FDI flows increased from \$205 billion in 1990 to \$1.3 trillion in 2022. For developing countries, these flows increased from about \$34 billion to \$836.5 billion over the same period. This dynamic is largely due to the intense competition among countries for these investments. Many countries, particularly developing countries, have adopted policies to enhance their attractiveness by devoting significant resources while taking advantage of the presence of FDI in their territories. Indeed, one of the main motivations for countries to invest in FDI attractiveness is that it offers an alternative to financing the economy, often hampered by insufficient domestic savings. In addition, FDI generates positive spillovers on the growth of host countries. This highlights the importance of thinking about FDI and its potential impact on the economy.

There is a wealth of academic literature, both theoretical and empirical, that confirms the positive effects of FDI on host country economic growth. These investments, in addition to their crucial role in financing the economy by filling the gap related to the insufficiency of domestic savings (Mallampally & Karl, 1999), contribute to strengthening competition among local businesses, by stimulating their productive capacity and their technical and economic efficiency. FDI also contributes to value added, export growth and job creation (De Mello, 1999). Moreover, FDI is also expected to stimulate growth indirectly through technology externalities disseminated to domestic firms, thus positioning FDI as one of the main vectors for technology and knowledge transmission-between countries (Boudjedra, 2004). However, FDI can only fully play its role as a catalyst for growth if the host economy meets a number of key criteria. These criteria generally include the country's absorption capacity, such as skilled labour, financial sector development, infrastructure level, and trade openness. Low absorption capacity can thus limit the positive effects of FDI on host country economic growth (Borensztein et al., 1998). This theory is based on the idea that growth in developing countries depends on their ability to adapt and take advantage of technologies available in developed countries. It is these new technologies, innovative management methods and know-how that enable developing economies to achieve higher levels of growth than in the past. In this sense, FDI is seen as a vector, among others, for the transfer of these technologies to developing countries.

In neoclassical growth models, FDI flows only have a short-term positive effect on host country growth, while in the long term their impact on growth is reduced. However, endogenous growth theories argue that FDI can have a lasting positive effect on long-term growth. These theories suggest that developing countries can only catch up economically by acquiring and adopting new technologies, including through international trade and FDI. These represent a relatively inexpensive solution for the acquisition of advanced technologies. In this regard, the work of Berthélemy and Sylvie (2000) has shown that FDI stimulates growth by increasing the knowledge stock in host countries. This theoretical consensus on the positive effects of FDI is also supported by numerous empirical studies that link FDI to economic growth. Many empirical studies have been conducted to assess the impact of FDI on economic growth in host countries. For example, research by Iqbal Chaudhry et al. (2013) on China found that FDI has a positive effect on the country's economic growth. Similar results were obtained for the African continent, notably in the work of Awolusi and Adeyeye (2016), as well as for sub-Saharan Africa in the study of Jugurnath et al. (2016). These authors conclude that FDI is one of the key drivers of economic growth.

This research is part of the studies that aim to assess the impact of FDI on economic growth in host countries, taking into account their absorption capacity. More specifically, the study aims to examine the effect of FDI and its interaction with trade opening on economic growth in Tunisia. The case of Tunisia is particularly relevant because of its historic commitment to economic openness and its efforts to attract FDI in order to stimulate its development. However, the impact of FDI on Tunisia's growth depends largely on how these investments are integrated into the local economy and whether the country is open to trade. By analysing this interaction specific to the Tunisian context, the study aims to provide insights into the

conditions under which FDI can truly contribute to economic growth in Tunisia, Taking into account the challenges and opportunities of its current economic and political framework. The results of this research could provide policy recommendations for maximizing the positive impact of FDI in an open business environment. To further this reflection, it is crucial to formulate a central problem: to what extent does the interaction between FDI and trade openness influence economic growth in Tunisia? This question raises several essential hypotheses. First, it is plausible to think that the effect of FDI on economic growth is amplified when these investments are accompanied by increased trade openness, thus allowing a better integration of Tunisia into global value chains. Second, it is possible that this interaction strongly depends on the absorptive capacity of the Tunisian economy, that is, its ability to take advantage of the technologies and knowledge associated with FDI.

To answer this problem, this article will be structured in two main parts. The first section will be devoted to a review of the existing literature, which will explore theories and empirical studies on the relationships between FDI, trade openness and economic growth. This review will situate Tunisia in the broader context of developing countries and identify the mechanisms by which FDI and international trade can interact to influence growth. The second section will focus on an empirical analysis applied to the Tunisian case. This empirical analysis will examine, using economic data, the joint effect of FDI and trade openness on Tunisia's economic growth. The results obtained will be used to formulate concrete policy recommendations to maximize the positive impact of FDI in an increasingly globalized business environment.

## LITERATURE REVIEW

Empirical evidence from various studies provides a nuanced perspective on the effects of FDI and trade opening on host country growth. Although FDI and trade openness are generally seen as crucial drivers of economic growth, their real impacts remain ambiguous. The literature highlights that FDI can have positive impacts, particularly in terms of technology transfer, knowledge dissemination and productivity growth (Mishrif A. et Asharul K., 2024). In addition, it is demonstrated that trade openness can promote economic growth in specific contexts, such as Nigeria (Ajayi, F. O. et al., 2024). However, the relationship between FDI, trade opening and economic growth varies according to the level of income of countries, with higher-income countries benefiting more from these dynamics than those in the middle or low income group (Sugözü, İ. H.; and Dorbonova, İ., 2024). In addition, the impact of FDI and trade opening can be modulated by factors such as cultural distance and quality of institutional infrastructure in the host country (Correa da Cunha et al., 2022). These findings highlight the complexity of the interactions between FDI, trade opening and economic growth, underlining the importance of developing appropriate policies to maximize potential benefits.

Borensztein, De Gregorio and Lee (1998) argue that FDI plays a fundamental role in the success of economic growth in developing countries, as economic development is based primarily on rapid and effective transfer, and cross-border adoption of best practices. These practices include the management and technical use of imported technologies. Furthermore, previous empirical research, both at the level of transnational studies and country-specific

analyses, on the interaction between trade and FDI on growth (Kohpaiboon, 2004; Mansouri, 2005), as well as on the links between FDI and growth and trade and growth (Pahlavani, Wilson and Worthington, 2005), conclude that both FDI flows and trade openness contribute to economic growth. In their study on the dynamic interaction between FDI, domestic investment and economic growth in Pakistan, Ullah, Shah and Khan (2014) apply the Johansen cointegration approach as well as the Toda-causality approach Yamamoto to analyze the causal links. Empirical results show a long-term relationship between domestic investment, FDI and economic growth, supported by the Toda-Yamamoto causality tests. In addition, the authors identify a two-way causality between FDI and domestic investment, indicating a reciprocal influence between these two types of investment.

Adhikary (2011) applied the vector error correction model to a time series of data covering the period 1986-2008 in Bangladesh, revealing a close relationship between explanatory variables and economic growth, with unidirectional causality flows. The results indicate that FDI and capital formation have a positive impact on economic growth. However, trade opening shows a negative, albeit decreasing, effect on growth. Adhikary (2011) suggests that this may be due to factors such as exchange rate depreciation, relatively high import levels and the unfavourable trade balance. FDI and trade opening can indeed have negative effects on economic growth, especially when they generate large outflows in the form of profit transfers and dividends, or when multinational companies obtain significant concessions from the host country. Although FDI is generally considered a growth driver in developing countries, recent research suggests that its impact may vary depending on the country's absorption capacity and degree of trade openness (Minh, V. T. H., Trinh, P. T. T., 2023). In addition, some studies show a negative relationship between FDI and per capita GDP growth in developing economies, which highlights the need for complementary national policies to maximize the benefits of FDI flows (Majumder, T., & Roy, S. S., 2023). The results also suggest that trade openness can have negative effects on economic growth in the short and long term, highlighting the importance of capital flows relative to trade openness for sustainable growth (Ari, Y. O., Jibir, A., & Hassan, A. A., 2022) These observations highlight the importance for policy makers to implement balanced strategies that maximize the benefits of FDI and trade opening while protecting themselves against potential negative consequences, to ensure sustainable economic development.

Different researchers have used different methodologies to examine the relationship between FDI and economic growth. For example, Belloumi (2014) explored this relationship in Tunisia using the distributed autoregressive shift cointegration approach (ARDL) for the period 1970 to 2008. His results show the absence of Granger's causality between the variables studied, challenging the widely held idea that FDI systematically generates positive externalities for the host country. Similarly, Adelowakan and Maku (2013) applied a regression based on the standard growth model to analyze the impact of trade opening and FDI on economic growth in Nigeria between 1970 and 2011. Their findings reveal contrasting effects: trade openness has a positive effect on growth, while FDI has a negative impact. Also in Nigeria, Soliu and Ibrahim (2014) studied the relationship between FDI, trade opening, capital formation and growth, and found a long-term relationship between these variables. However, although FDI has a positive

effect on growth, it has been statistically insignificant. According to Soliu and Ibrahim (2014), this result could be explained by factors such as corruption, poor governance and the deteriorating economic system in Nigeria. The relationship between trade opening and economic growth has been the subject of many studies, particularly in the context of trade between developed and developing countries. Research indicates that trade openness has a positive impact on economic growth in various contexts. For example, a study of OECD countries from 1988 to 2020 using methods such as quantile regression and the dynamic panel GMM model demonstrated a positive association between trade openness and GDP growth (Hrvoje J., 2023). Similarly, research on eight Balkan countries covering the period 2000-2019 using panel models also confirms this positive relationship (Siniša K. et al., 2023). In addition, surveys of newly industrialized countries from 1990 to 2020 show that trade openness promotes economic growth, especially when it is associated with financial development (Tosunoğlu, B.T., 2023). Moreover, a study of 82 developing countries from 1980 to 2020 shows that FDI and trade opening contribute significantly to the growth of per capita GDP in these countries (Siniša K. et al., 2022). These results highlight the importance of trade openness as a factor for economic growth, particularly in developing countries.

The first studies on FDI, notably those of Singer (1950) and Prebisch (1968), highlighted the potentially negative effects of FDI by pointing out that host countries can reap limited benefits from these investments if most of the profits are repatriated to the home country of the foreign investor. Another explanation for the negative correlation between FDI and growth is that, although FDI is expected to increase the overall level of investment, it can actually reduce the growth rate by distorting input prices or by misallocating resources. Boset et al. (1974) studied the effects of FDI from American firms on the growth of developing countries over the period 1965-1969. Their results revealed an inverse relationship between FDI and economic growth. They attribute these results to the fact that profit outflows to the US exceeded the level of new investment for each year studied. Other factors explaining this negative relationship include price distortions caused by protectionist policies and the depletion of natural resources in host countries.

## **Data description and model specification**

### **Data description**

In the context of global economic integration, the interaction between FDI and trade opening raises complex issues. The literature suggests that these two factors can only truly stimulate economic growth if institutional and legal infrastructures are sufficiently developed. It is in this perspective that we conduct an empirical analysis of the combined effect of FDI and trade opening on economic growth in Tunisia over the period 1990-2023, while taking into account other macroeconomic variables. The results of this research will provide a better understanding of the conditions under which these two factors, when properly framed, can interact synergistically to promote sustainable economic development. We begin our analysis by using per capita gross domestic product, expressed in 2015 constant US dollars, as a dependent variable to measure the country's economic growth. This measure is obtained by dividing the gross domestic product by the number of inhabitants in a given year. The domestic investment

rate (INV) is used as an indicator of physical capital, while the demographic variable (POP) reflects the annual population growth rate. The inflation rate (Inf), measured by the consumer price index, is included to capture changes in general price level. Human capital (CAPH) is represented by the gross enrolment rate in higher education, a key measure of skills development among the population. International capital flows (FDI) and trade openness (TRADE), measured by the ratio of imports and exports to GDP, are also included in the model.

The model also includes a constant ( $\alpha_0$ ) and an error term ( $\varepsilon$ ), while the coefficients ( $\beta_1, \dots, \beta_8$ ) represent the effect of each independent variable on the dependent variable. An interactive term (FDI\*TRADE) is added to assess the combined effect of FDI and trade opening on economic growth. This interactive term is crucial because it tests the hypothesis that FDI's impact on growth is amplified by a high degree of trade openness. This approach allows us to better understand the potential complementarity between FDI and trade opening in the process of economic growth.

### **Model specification and methodology**

Time series econometrics have evolved considerably over the years, with notable contributions such as the co-integration approaches developed by Engle and Granger (1987), Johansen (1988) and the method of Johansen and Juselius (1990). These techniques are widely used to examine long-term relationships between series that are integrated in the same order, whether I(0) or I(1), and are particularly suitable for long estimation periods. However, these conditions do not necessarily apply to all data samples, especially when the series have different integration orders or shorter estimation periods. It is in this context that Pesaran and Shin (1998), as well as Pesaran et al. (2001), introduced the technique of Auto Regressive Distributive Lags (ARDL).

This method is particularly useful for testing the presence of a long-term relationship between variables that do not share the same order of integration, thus providing valuable analytical flexibility in contexts where traditional co-integration approaches are not applicable. In our study, we chose to adopt the ARDL (Auto Regressive Distributive Lags) approach for several reasons. First, this method combines simultaneously the characteristics of an autoregressive model (AR) and a distributed shift model (DL). It integrates the shifted levels of dependent and independent variables, as well as their shifted differences, which allows to model complex dynamics between variables. Second, the ARDL approach can correct correlation and endogeneity problems in time series, provided that appropriate offsets are selected.

Third, the ARDL approach is distinguished by its use of the cointegration test which compares the calculated F statistic to two sets of critical limits, upper and lower. These limits are derived from simulations and vary depending on the number of regressions in the model as well as the sample size, thus providing greater accuracy in the assessment of cointegration relationships. Fourth, this method allows a direct estimation of long-term coefficients, providing valuable information on the equilibrium relationships between the variables studied. Finally, the ARDL approach is particularly robust and works well even with relatively small sample sizes, making it a superior methodological tool to other cointegration techniques in many cases. This

flexibility and increasing robustness explains why the ARDL method is increasingly used in recent research to explore long-term links between macroeconomic variables (Farjallah and Abdelhamid, 2017; Abonazel and Elnabawy, 2020). Given the disparity in the order of integration of the series used in this study and the relatively small size of our sample, we chose to use the ARDL method to estimate long-term cointegration relationships as well as short-term adjustments of our model. ARDL modeling is particularly suitable because it allows to take into account a sufficient number of delays in order to accurately capture the data generation process. Accordingly, the basic equation of the ARDL model, as formulated by Pesaran et al. (2001), is written as follows (equation 1):

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \dots + \beta_k Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + \alpha_q X_{t-q} + \varepsilon_t \quad (1)$$

From this equation, it is possible to observe the presence of delays in the dependent variable as well as in the explanatory variables. In our case study, the model comprises six variables: a dependent variable (GDP) and five explanatory variables (FDI, TRADE, INV, POP, CAPH and INF). Therefore, the most appropriate empirical model (equation 2) to analyze the relationship between FDI, trade opening and economic growth is:

$$GDP_t = f (FDI_t, TRADE_t, INV_t, POP_t, CAPH_t, INF_t, IDE*TRADE_t) \quad (2)$$

Thus, the ARDL model is illustrated in the equation. 3:

$$\Delta GDP = \alpha_0 + \sum_{i=1}^k \alpha_{1i} \Delta GDP_{t-i} + \sum_{i=1}^k \alpha_{2i} \Delta FDI_{t-i} + \sum_{i=1}^k \alpha_{3i} \Delta TRADE_{t-i} + \sum_{i=1}^k \alpha_{4i} \Delta INV_{t-i} + \sum_{i=1}^k \alpha_{5i} \Delta POP_{t-i} + \sum_{i=1}^k \alpha_{6i} \Delta CAPH_{t-i} + \sum_{i=1}^k \alpha_{7i} \Delta INF_{t-i} + \sum_{i=1}^k \alpha_{8i} \Delta FDI*TRADE_{t-i} + \gamma ECM_{t-1} + \beta_1 GDP_{t-1} + \beta_2 FDI_{t-1} + \beta_3 TRADE_{t-1} + \beta_4 INV_{t-1} + \beta_5 POP_{t-1} + \beta_6 CAPH_{t-1} + \beta_7 INF_{t-1} + \beta_8 FDI*TRADE_{t-1} + \varepsilon_t \quad (3)$$

In the above model,  $\Delta$  denotes the first difference operator;  $i=1, \dots, k, i=1, \dots, k, i=1, \dots, k$  represents the number of lags; " $\alpha_0$ " is the constant, and  $\alpha_1$  through  $\alpha_8$  represent the short-term dynamics of the economic growth function. The coefficients  $\beta_1$  through  $\beta_8$  capture the long-term dynamics of the model, and  $ECT_{t-1}$  is the error correction term. Therefore, to estimate our ARDL model, we follow two steps.

First, we identify the optimal offset using the Schwarz information criterion (SIC). This procedure helps us to choose the most appropriate ARDL model, which produces statistically significant results while having the minimum number of parameters. Then, we use the Fisher test to examine the existence of a cointegration relationship, based on the following assumptions:

- $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$ : Existence of co-integration,
- $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$ : Lack of co-integration.

The procedure for this test consists of comparing F statistics obtained with simulated critical values (upper and lower bounds) for different scenarios and levels of significance, as recommended by Pesaran et al. (2001). If the calculated statistic F exceeds the upper bound, it means that we can reject the null hypothesis, thus indicating the existence of a cointegration relationship. Conversely, if the statistic F is lower than the lower bound, the null hypothesis is accepted, suggesting that there is no co-integration between variables. When the F statistic is between the two limits, the cointegration test is undecided.

## EMPIRICAL RESULTS AND DISCUSSIONS

### Unit root test

In our empirical analysis, we first examine the stationnarity properties of data using unit root tests. The economic literature has widely used proven and reliable unit root tests, such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. A series is considered stationary when the test statistic (ADF, PP) exceeds in absolute value the critical value of 5%. The results presented in table 1 show that the dependent variable (GDP) as well as the TRADE variable are integrated of order I(1), while the other variables are integrated in order I(0). This indicates that the integration orders of the series are heterogeneous, varying from I(0) to I(1). Therefore, these results justify the use of the ARDL method, as developed by Pesaran et al. (2001), to establish a long-term equilibrium relationship. In this method, the dependent variable (GDP) and the explanatory variables are integrated at order I(1), with the exception of the independent variable (INF), which is integrated at order I(0). This indicates that the integration orders of the different series are heterogeneous, varying between I(0) and I(1). Consequently, these results allow the ARDL method developed by Pesaran et al. (2001) to be applied to determine a long-term equilibrium relationship.

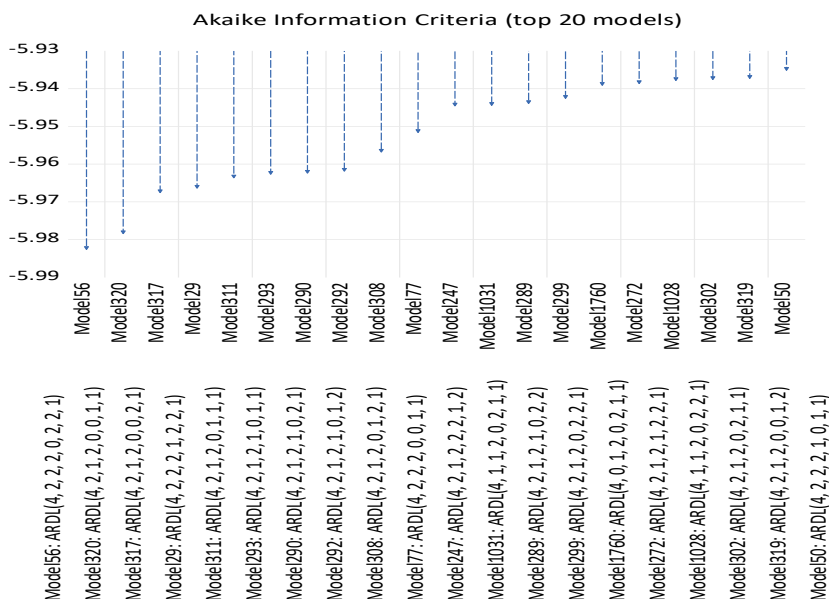
**Table 1: Unit Root Tests**

Variables	Test ADF		Test PP		Conclusions
	<i>At the level</i>	<i>En1<sup>ère</sup> difference</i>	<i>Au niveau</i>	<i>En1<sup>ère</sup> difference</i>	
<b>GDP</b>	-2.403810 (0.1484)	-4.945577 (0,0003)	-2.431433 (0.1413)	-5.004662 (0,0003)	I (1)
<b>FDI</b>	-4.335893 (0.0017)	-	-9.490371 (0.0000)	-	I (0)
<b>TRADE</b>	-2.283515 (0.1829)	-6.091112 (0.0000)	-2.211837 (0.2060)	-8.325055 (0.0000)	I (1)
<b>INV</b>	-6.362733 (0.0000)	-	-6.334898 (0.0000)	-	I (0)
<b>POP</b>	-3.045548 (0.0413)	-	-2.867227 (0.0601)	-	I (0)
<b>CAPH</b>	-2.024262 (0.2754)	-6.376498 (0.0000)	-2.067257 (0.2585)	-6.379701 (0.0000)	I (1)
<b>INF</b>	-1.387617 (0.5738)	-6.650422 (0.0000)	-1.515078 (0.5137)	-6.053589 (0.0000)	I (1)



### Cointegration tests

We start by identifying the optimal offset using the Schwarz information criterion (SIC). This approach helps us to select the most appropriate ARDL model, that is, one that provides statistically significant results while minimizing the number of parameters. Thus, as shown in Fig. 1, the ARDL model (4,2,2,0,2,2,2,1) is the most optimal of the 19 models considered, since it has the lowest value of SIC. Schwarz Criteria (top 20 models)



The cointegration test results, as shown in Table 2, confirm the existence of a cointegration relationship between the analyzed series with a significance level of 5%. Indeed, the value of statistic F exceeds the upper bound, this allows us to estimate our model over the long term.

**Table 2: Cointegration Test**

Variables	PIBH, DF, INS, KAOPEN, TRADE	
F-stat calculated	6.432940	
critical threshold	I0 Bound	I1 Bound
1%	3.599	5.23
5%	2.597	3.907
10%	2.196	3.37

### ARDL estimate: short and long term relationship

After checking the order of integration of the series, selecting the optimal offset for our ARDL model and establishing the existence of a long-term relationship between the variables of interest, we use the ARDL model to analyze short and long-term dynamics. The specifications of the estimated ARDL model are detailed in Table 3. This model has a generally satisfactory quality of fit and is statistically significant at conventional levels. Most coefficients, both short-term and long-term, including the error correction term, are in theoretically acceptable ranges between 1 and 0. Furthermore, the Durbin-Watson statistic indicates that there is no

autocorrelation. The error correction term, which measures the rate of adjustment of deviations from equilibrium, is negative and statistically significant at 1% (ECT<sub>t-1</sub> = -0.49). As a result, we can conclude that there is moderate convergence towards long-term equilibrium.

**Table 3: ARDL model results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<b>Estimations de court terme</b>				
D(GDP(-1))	0.155103	0.079872	1.941905	0.1002
D(GDP(-2))	-0.065698	0.077805	-0.844383	0.4308
D(GDP(-3))	-0.597234	0.103903	-5.748024	0.0012
D(FDI)	0.255035	0.024357	10.47080	0.0000
D(FDI(-1))	-0.094630	0.019179	-4.934110	0.0026
D(TRADE)	0.551196	0.078368	7.033413	0.0004
D(TRADE(-1))	-0.308211	0.084105	-3.664607	0.0105
D(INV)	0.003485	0.000246	14.17962	0.0000
D(INV(-1))	-0.001533	0.000282	-5.426835	0.0016
D(FDI*TRADE)	-0.334094	0.031198	-10.70890	0.0000
D(FDI(-1)*TRADE(-1))	0.117215	0.024123	4.858991	0.0028
D(CAPH)	-0.008974	0.001845	-4.864845	0.0028
D(CAPH(-1))	-0.007317	0.002018	-3.625705	0.0110
D(INF)	0.057122	0.008364	6.829850	0.0005
CointEq(-1)*	-0.497452	0.042799	-11.62290	0.0000
<b>Estimations de long terme</b>				
FDI	0.937569	0.304625	3.077782	0.0217
TRADE	2.955551	0.905612	3.263594	0.0172
INV	0.008795	0.003457	2.543888	0.0439
POP	-0.385307	0.071016	-5.425619	0.0016
FDI*TRADE	-1.193024	0.378071	-3.155557	0.0197
CAPH	0.009710	0.002820	3.443454	0.0137
INF	0.044374	0.061108	0.726162	0.4951
C	5.933804	0.689075	8.611266	0.0001

The results presented in Table 3 lead to several important conclusions:

For Tunisia, in the short term, variables such as FDI, international trade (TRADE), population (POP), national investment (INV), human capital (CAPH) and inflation (INF), as well as the interaction between FDI and trade opening (FDI\*TRADE), show varying effects on economic growth. FDI, although it brings capital and technology, is limited in its impact by factors such as political stability and the country's absorption capacity. International trade, despite its potential benefits, is hampered by high costs and trade barriers. Population growth, which increases the availability of labour, is offset by unemployment and education challenges. Domestic investment is hampered by structural problems and excessive bureaucracy. Human capital, while crucial to improving productivity, has positive effects only in the long term. Inflation, when it is moderate, can have a stimulating effect on the economy, but it becomes harmful when it reaches high levels. Finally, although the combined effect of FDI and international trade could theoretically promote growth, it is often limited by challenges specific to the Tunisian context.

In the long term, FDI has a significant and positive impact on economic growth in Tunisia. Indeed, an increase of 1% in FDI flows leads to a 0.93% increase in economic growth. These results are in line with the findings of various empirical studies on the relationship between FDI and economic growth, such as those by Djankov and Hoekman (2000), Li and Liu (2005), and Bouoiyour and Toufik (2007). FDI promotes growth in recipient countries by contributing to value added, employment growth, export promotion and human capital accumulation through labour training. They also improve the performance and productivity of local businesses through technology transfer, thereby positively impacting economic growth. In Tunisia, FDI has been instrumental in the development of various high-demand technology and value-added industrial sectors such as machine manufacturing, energy, computer technologies, and telecommunications. More specifically, the establishment of foreign firms in these sectors has led to a significant increase in productivity on the local market, demonstrating the presence of positive externalities generated by FDI. Similarly, Shahzad et al. (2013) observed that FDI brings many economic benefits, including technology transfer, improved organizational framework, enhanced managerial skills, balance of payments support, Job creation and export stimulation, as also highlighted in the UNCTAD report (2011).

Trade openness has had a positive impact on economic growth in Tunisia, as several studies indicate. An increase of 1% in the degree of trade openness (TRADE) results in a 2.95% increase in economic growth. Research shows that trade openness promotes economic growth by attracting foreign direct investment (FDI) and facilitating technology transfer through international trade (Younes & Ameer, 2023; Dahmani, 2022). In addition, the relationship between trade openness and economic growth is strengthened when it is combined with financial development, suggesting that these factors combined are driving economic progress in Tunisia as well as other North African countries. However, it is important to note that despite this positive impact on economic growth, trade opening can also exacerbate regional inequalities in Tunisia, resulting in disparities between different regions.

The coefficient associated with the variable “domestic investment” has a positive value and is statistically significant at the 5% threshold. An increase of 1% in domestic investment leads to a 0.008% increase in economic growth. This result is in contradiction with the conclusions of Nam Hoaitrinch (2015) and Ahmed Abdulrahman (2014). In addition, the effects of domestic investment are manifested by the allocation of a substantial share of oil revenues to projects that promote employment, labour competitiveness and economic growth. Domestic investment, which is often reinvested in the country, is therefore a key determinant of economic growth. Moreover, the impact of FDI on domestic investment can also boost growth levels in Tunisia.

Indeed, the use of goods and services provided by foreign companies can improve the efficiency of domestic industries. In addition, the multiplier effects of FDI are reflected in spin-offs in terms of know-how and new technologies in production processes, as well as job creation by multinationals. With local spending on goods and services increasing, this benefits domestic investors and stimulates economic growth. With regard to population growth, the results indicate that the population variable has a negative and statistically significant effect on

economic growth. Specifically, a 1% increase in population leads to a 0.38% decrease in economic growth. This result is in line with much of the existing literature, which postulates that an uncontrolled population growth rate can have an unfavourable impact on a country's economic growth (Mankiw et al., 1992).

The interactive term FDI\*TRADE, which represents the interaction between FDI and TRADE, has a complex impact on Tunisia's economic growth. An increase in the interaction of 1% leads to a decrease in growth of 1.19%. Research indicates that increases in trade openness and foreign direct investment generally lead to GDP growth (Abdelli H. et al. (2024)). However, the relationship between these factors and GDP is complex, with changes in the labour force having a different impact on GDP in the short and long term (Abdelli H. et al (2024)). In addition, the shadow economy, as measured by the Tanzi method, plays an important role in the finance-growth relationship in Tunisia, influencing the effect of financial development on short- and long-term growth (Terzi C. et al (2023)). In addition, corruption has been found to demoralise private investment and to have a negative impact on economic growth in Tunisia over time (Kaddachi H. and Ben Zina N. (2024)). Therefore, although the interactive term FDI\*Opportunity may have a negative effect on economic growth in Tunisia due to various factors such as corruption and the black economy, its overall impact is influenced by a multitude of interconnected variables.

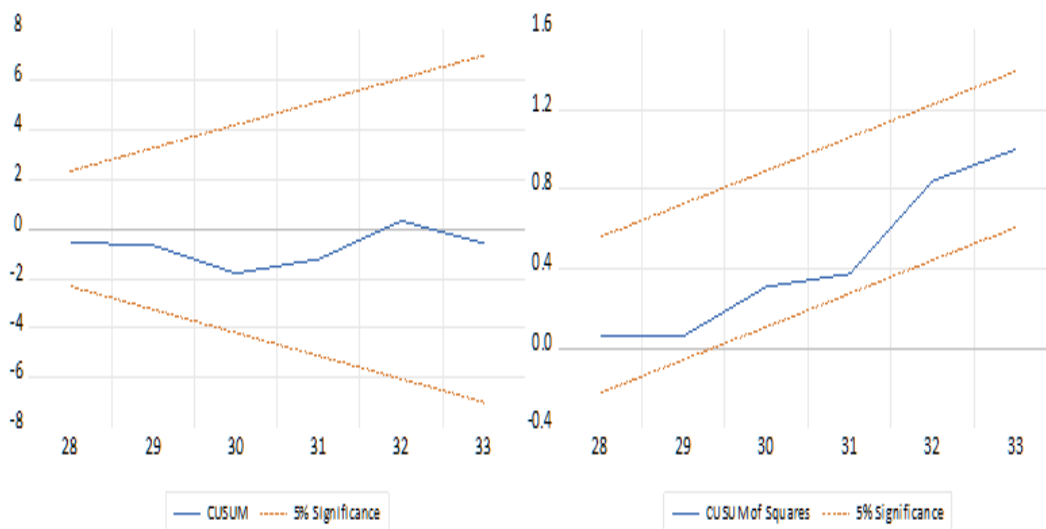
The human capital variable is positive and statistically significant at the 5% level. This result is in line with the literature, which emphasises the beneficial effect of human capital on economic growth (Blankenau and Simpson (2004); Anwar and Sun (2011)). Tunisia's national human resources development policy focuses on improving skills and know-how in order to take full advantage of the country's technological potential. More concretely, Tunisia's economic growth relies heavily on capital inflows and the continuous improvement of human capital. In line with the theory of endogenous growth, human capital is thus recognised as a determining factor in long-term economic growth.

### **Diagnostic tests**

When estimating the ARDL model, several tests are commonly used to diagnose the validity of the assumptions underlying the classical linear regression model. Table 4 presents a series of tests that do not reveal any significant violation of these assumptions. In particular, the Breusch-Godfrey Lagrange multiplier test, based on the residual correlation of the series, indicates the absence of autocorrelation of the errors (with an associated probability greater than 0.05). In addition, the hypotheses of heteroscedasticity, as assessed by the Breusch-Pagan-Godfrey test and the ARCH test, are rejected on the basis of the regression of the squares of the residuals. The Jarque-Bera test, based on an examination of the skewness and kurtosis of the residuals, also confirms the normality of the errors. The Ramsey reset test also validates the correct specification of the model (with a probability associated with the Fisher test greater than 0.05). In sum, the model appears to be well specified: the error terms are normally distributed, serially uncorrelated, and the residuals exhibit homoscedasticity. These results suggest that the model is statistically robust.

**Table 4: Diagnostic tests**

Test hypothesis	Tests	Values	Probability
<b>Auto-correlation</b>	Brusch-Gaufrey	3.056324	0.1565
<b>Heterocedasticity</b>	Brusch-Pagan-Gaufrey	0.369855	0.9597
	ARCHTest	2.210853	0.1491
<b>Normality</b>	Jarque-Bera	4.960634	0.083717
<b>Specification</b>	Ramsey (Fisher)	0.741745	0.6367



**Fig 2: Stability Tests: CUSUM and CUSUMSQ**

The stability of the model parameters was assessed using the CUSUM (Cumulative Sum of Recursive Residuals) and CUSUMSQ (Cumulative Sum of Squares of Recursive Residuals) statistics proposed by Brown et al (1975). The aim of these tests is to verify the constancy of the parameters over the long term.

More specifically, the CUSUM test was used to detect any systematic changes in the estimated coefficients, while the CUSUMSQ test is used to identify sudden and unexpected variations in the stability of the coefficients. Figure 2 shows that the coefficients are stable throughout the sampling period, as they fall within the critical area of the CUSUM and CUSUMSQ tests, with a significance level of 5%.

**CONCLUSIONS AND RECOMMENDATIONS**

This article highlights the significant impact of FDI and international trade on economic growth in Tunisia, emphasizing their crucial role as catalysts for development. The results obtained through the ARDL method show that, taken in isolation, FDI and international trade promote economic growth, by providing capital, technologies, and by strengthening the country's economic integration on the global stage.

However, the study also reveals a more complex dimension: the interaction between FDI and international trade, when not optimized, can lead to negative effects on economic growth.

This observation calls for a thorough reflection on the need to design coordinated economic policies that maximize the synergies between these two levers of growth. In other words, for Tunisia to take full advantage of FDI and international trade, it is essential to ensure that their interaction is managed strategically, in order to avoid potential perverse effects that could compromise the expected benefits. This result therefore challenges Tunisian decision-makers to formulate public policies aimed at harmonizing FDI and foreign trade, with a view to promoting sustainable and inclusive growth.

In light of the results of this study, it is essential that Tunisian decision-makers adopt an economic strategy that is both proactive and thoughtful, taking into account the nuances and complex interactions between FDI and international trade. To do this, several lines of action can be considered. First, attracting FDI and promoting international trade must remain strategic priorities. Tunisian authorities should strengthen tax incentives for foreign investors, ensuring that they are targeted at strategic sectors capable of generating ripple effects across the economy.

At the same time, it is crucial to negotiate advantageous trade agreements that open new markets for Tunisian products, while strengthening logistics and digital infrastructure to support sustained growth in trade. However, the implementation of these policies cannot be done without a thorough analysis of the interactions between FDI and trade.

It is recommended to identify the sectors where this interaction is most beneficial and to develop appropriate sectoral policies. For example, in sectors where FDI contributes significantly to exports, measures should be taken to avoid excessive dependence on imported inputs, which could weaken competitiveness in the long term. In this sense, the State could encourage the development of local value chains, by promoting partnerships between local and multinational companies, aimed at increasing the production of components and technologies on Tunisian soil. In addition, the diversification of export markets must be a priority to reduce the vulnerability of the Tunisian economy to external shocks.

Strategies aimed at penetrating new emerging markets and strengthening trade relations with less exploited regions could mitigate the risks associated with excessive dependence on certain traditional trading partners. Finally, it is crucial to establish mechanisms for monitoring and continuous evaluation of the impact of FDI and international trade policies.

These mechanisms would allow for rapid adjustment of policies according to economic developments and market dynamics, thus ensuring that the interaction between FDI and trade remains beneficial for economic growth. In conclusion, although FDI and international trade are undeniable drivers of Tunisian economic growth, their management must be fine and adaptive. By optimizing the interaction between these two levers, Tunisia can not only stimulate its growth, but also ensure sustainable and inclusive economic prosperity.

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