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The asymmetric impact of government expenditure on economic growth: Evidence from a NARDL model

Hanane Abdelli [1,*], Zouheyr Gheraia [1], Habib Sekrafi [2], Mehdi Abid [3]

[1]Department of Business Management, College of Business, Jouf University, Skaka, Saudi Arabia
[2]Laboratory for the Valorization of Natural and Cultural Heritage (VPNC), University of Jendouba, Jendouba, Tunisia
[3]Department of Finance and Investment, College of Business, Jouf University, Skaka, Saudi Arabia

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ABSTRACT

Since the 2011 Revolution, Tunisia has faced significant economic development challenges. Government spending plays a crucial role in fostering economic growth. This study focuses on Tunisia from 1980 to 2022, considering factors like foreign direct investment (FDI), trade openness, capital, and labor. It particularly examines spending in four government sectors: agriculture, education, health, and military. Using the Non-linear Autoregressive Distributed Lag (NARDL) model, the study investigates how these sectoral government expenditures relate to Tunisia's gross domestic product (GDP). The findings suggest that the relationship between these factors and GDP is complex. For instance, increases in trade openness and FDI generally lead to GDP growth. Similarly, changes in the labor force impact GDP differently in the short and long term, with negative and positive changes eventually benefiting the economy, but positive changes can initially decrease GDP. The study also finds that government spending on agriculture and health positively affects GDP, whereas spending on military and education has a negative impact. To enhance government spending and stimulate economic growth in Tunisia, the study recommends addressing corruption, inefficiency, and waste. It emphasizes the importance of directing public funds towards infrastructure, particularly in the education and military sectors, to improve welfare and support productive activities.

1. Introduction

Government expenditure (GE) and GDP remain a topic of debate on a theoretical level (Yusuf and Mohd, 2021; Hajamini and Falahi, 2018; Asimakopoulos and Karavias, 2016). There are two main viewpoints in the literature. According to the Keynesian approach, GE is a driving force for economic development. The state can stimulate economic activity during times of low demand and slow it down during periods of high demand, creating internal and external imbalances (Aznan et al., 2022; Yovo, 2017; Bensoltane, 2023). The GE can affect the GDP through at least two channels: Directly, by investing in infrastructure and public firms, the economy can increase its capital stock. Indirectly, education, health, and other services contribute to the accumulation of human capital by increasing the marginal productivity of factors of production provided by the private sector (Connolly and Li, 2016; Akpan, 2005; Dinh et al., 2023). The theoretical research on the complex relationship between GE and economic activity is extensive. Many theories suggest that the level of national debt plays a crucial role in creating variations in the dynamics under study due to its significant impact on the national product. These theories explain the differences by distinguishing between a normal regime (where debt is below a certain threshold) and a critical regime (where debt exceeds this threshold). To determine the nature of the regime, these theories examine the signs of the coefficients of budgetary variables (such as public spending, revenue, or the overall budget balance). If a coefficient is positive, it indicates a Keynesian regime; if it is negative, the regime is anti-Keynesian; and if the coefficient is zero, it represents a non-Keynesian regime (Ntiga and Henri, 2022).

From an empirical point of view, the literature has also generated a great deal of debate among researchers regarding several aspects. Based on the

* Corresponding Author.
Email Address: habdelli@ju.edu.sa (H. Abdelli)
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Corresponding author's ORCID profile:
https://orcid.org/0000-0003-0217-885X

nature of the effect, many empirical studies using a variety of data sets did not reach monosemic conclusions. Indeed, some confirmed the existence of a positive relationship, while negative relationships were found by others (Nyasha and Odhiambo, 2019; Olayungbo and Olayemi, 2018; Dudzevičiūtė et al., 2018; Connolly and Li, 2016; Hamdi and Sbia, 2013). Other studies (Pula and Elshani, 2018; Olayungbo and Olayemi, 2018; Aregbeyen and Kolawole, 2015) focused on the direction of causality between GE and economic growth.

Like developing countries, Tunisia is now facing the need to improve the quality of its GE and preserve its fiscal sustainability after a decade of mixed economic results. The country's economic performance has weakened due to slow growth, a slowdown in the economic reform pace, a downturn in the global economy, and a succession of political, economic, security, and social shocks. Economic growth fell from 4.5% per year between 2006 and 2010 to 1.7% per year between 2011 and 2017. At the same time, the fiscal situation has deteriorated, and the budget deficit has further widened to an average of 5.4% of GDP between 2011 and 2017, compared to 2.1% of GDP between 2006 and 2010. As a result, public debt reached 70.3% of GDP in 2017, compared to 40% of GDP in 2010, which led to significant interest charges (2.5% of GDP in 2018). Tax revenues have held up relatively well despite the slowdown in growth. Non-tax revenues fell significantly due to the poor performance of public enterprises despite the sale of some public assets, while expenditure increased by 2% of GDP over the same period. The composition of expenditure deteriorated and was mainly dominated by recurrent expenditure attributable to salaries (14.7% of GDP in 2017), subsidies, and transfers (6% of GDP on average in 2017), while public investment (5.5% of GDP in 2017) underwent the adjustment dictated by budgetary constraints and bottlenecks in project execution. To this end, the objective of this study is twofold: to re-examine the relationship between GE and Tunisian economic growth and to analyze the symmetry of this said relationship.

The main contribution of this article is the understanding of a linear relationship between GDP and its determinants, as examined in most previous studies, as well as the non-linear relationship between GE and GDP, which has received little attention. To the best of our knowledge, the studies on the dynamic time-varying impact of fiscal policy are limited (Afonso and Carvalho, 2022; Jalles, 2021; Larch et al., 2021) and have reported mixed results. In Tunisia, this relationship was carried out in different ways, and it was shown that the influence exerted by GE on GDP is not always the same from one period to another; this influence varies according to the structure of the expenses incurred. However, the recent aspects of governance and the effects of the non-linearity of public expenditure on growth remain unanswered in the context of the Tunisian economy. Thus, the Tunisian study represents a prototype in scope since it attempts to address the gap outlined above, thus contributing to the existing body of knowledge about that country. In addition, this study is important, as it will provide policymakers in Tunisia with a road map for formulating sound macroeconomic policies. This will assist the government in determining how to increase its expenditures and direct them to meaningful economic activities for economic development.

Next, we will organize the rest of the article as follows: A literature review on the relationship between GE and GDP is presented in section 2. The methodology and data are presented in Section 3. The empirical results and discussion are presented in Section 4. Section 5 discusses the conclusions and policy implications.

2. Literature review

In the face of the great theoretical debate on the role of GE in GDP, a vast empirical literature has focused on studying the relationship between GE and GDP. Studies exploring this relationship used different forms to measure the growth variable (real GDP, real GDP per capita, or the growth rate of real GDP per capita) and the GE (GE as a percentage of GDP, health expenditure, public investment expenditure, education expenditure) (Mann, 1980; Khemili and Belloumi, 2018; Batuo et al., 2018; Nawaz et al., 2019). Indeed, changing the level and composition of total GE allows a country to improve its economic performance (Feng et al., 2022).

In this regard, Ashipala and Haimbodi (2003) used data from Namibia and found evidence of two long-term relationships between the level of economic activity measured by GDP and public and private investments. In a similar vein, during the 1990-2016 period, Alshammary et al. (2022) examined the impact of GE on GDP in MENA countries. The results indicate a dynamic adjustment in economic growth from short-term to long-term in the MENA region. In oil and non-oil countries, GE coefficients are positive and significant in the long term. A short-term analysis shows statistical significance in oil-producing countries but not for non-oil-producing countries. Fan and Rao (2003) showed that the effects of different types of GE on GDP in different continents are mixed. In Africa, GE's impact on health and agriculture significantly affects economic growth. In Asia, investments in education, agriculture, and defense have an effect on GDP. However, in Latin America, all types of government investment, except for health, contribute to economic growth.

The effect of GE on GDP was also discussed in the work of Onodugo et al. (2017), which examined the case of Nigeria using the OLS method. The authors concluded that public capital expenditure and private sector investment represent a medium-to-long-term catalyst for reducing unemployment. However, the authors found no effect of GE on the countries' institutional quality, while it does

stimulate economic growth. This outcome was also drawn from d'Agostino et al. (2018) who confirmed that GE contributes to the improvement of economic growth. However, the heavy military burden and non-capital GE reduce GDP. In addition, the authors found that corruption had a significant indirect impact, and any increase in GE may also lead to higher corruption levels in this country. Räsänen and Mäkelä (2021) studied the effect of GE on output and employment. They concluded that a 1% change in GE contributes to a 1.3% change in local output, so 100,000 euros of GE creates 1.84 additional jobs.

In a study conducted in Iran during the period 1959-2005, Khorasgani (2008) indicated that higher education plays an important role in economic growth. Michel's (2015) study showed that a 1% increase in education expenditure of GDP contributes to a 0.3% increase in economic growth. Comparing Algeria, Saudi Arabia, and Jordan, Boudia and Ben Zidane (2013) found positive correlations between higher education investments and GDP. Using panel data from 21 cities from 2000 to 2016, Liao et al. (2019) examined the causal relationship between education and GDP in Guangdong Province. The results of the study showed the existence of a bidirectional causality between education and GDP. Furthermore, the results demonstrate that investing in education can contribute to GDP.

The relationship between GE and GDP was also analyzed using the military expenditure variable. Indeed, as Benoit (1978) indicated, countries with substantial levels of defense expenditure have, for the most part, a faster growth rate compared to those with lower defense expenditure levels. In the same perspective, Narayan and Singh (2007) verified a causality in the sense of Granger between defense expenditure and exports on the one hand and a causality between exports and national income (GDP) on the other. They indicated, thus, that defense expenditure indirectly affects national income in the short term. The same methodology was also used by Malizard (2010), who found a bidirectional causal relationship between military expenditures and economic growth in France from 1960 to 2008.

The positive relationship between military expenditure and economic growth was also confirmed by Khalid and Noor (2018) for the case of 67 developing economies over the period 2002-2010. However, for 35 African countries, Saba and Ngepah (2019) analyzed the causality between military expenditure and GDP. They found that military expenditure negatively impacts economic growth. Joshua (2019) applied a cointegration test and a dynamic ARDL test to investigate the causal relationship between GE and economic growth for Nigeria for the 1981-2016 period. In both the short and long terms, the estimations show that GE contributes significantly to economic growth. Additionally, the pairwise Granger causality showed a unidirectional connection between GE and economic growth, supporting the Wagner law. Bergh and Henrekson (2011) provided an analytical framework for exploring the relationships between government size and economic growth, which can be positive, negative, and ambiguous. They demonstrate that GE and economic growth display an inverted U-shaped relationship with a flat top when using an endogenous growth model. Considering all this literature, the heterogeneity of many studies' empirical results- ranging from non-significant to positive or even negative- has surprisingly attracted little attention. Some studies, such as those by Straub (2008) and Lakshmanan (2011), highlighted the differences in empirical findings and identified the key reasons.

3. Data and econometric methodology

3.1. Data

The data used includes six variables of the Tunisian economy, namely, the GDP per capita (current LCU), Agriculture expenditure (AE) (% of general government expenditure), Military expenditure (ME) (% of general government expenditure), Education expenditure (EE) (% of GDP), Health expenditure (HE) (% of general government expenditure), Gross fixed capital formation (K) (current LCU), Foreign direct investment, net inflows (FDI) (% of GDP), Trade (T) (% of GDP), and labor force (L) in million (total population aged 15 to 64). All variables are transformed into natural logarithms except trade and FDI. All four government expenditure components were collected from the various annual reports of the Central Bank of Tunisia, while data on GDP, K, FDI, T, and K were sourced from the World Bank database (databank.worldbank.org) and covered the period 1980-2022.

3.2. Econometric methodology

According to economic theory, the factors that determine an economy's level of output (Y) are the available quantities of labor (L) and capital (K) and another variable (A) that measures the degree of efficiency in the use of L and K. The relationship between these variables can be expressed relying on a Cobb-Douglas functional form with constant returns to scale, which corresponds to the following equation:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} \quad (1)$$

where, α and β represent the elasticities of capital and labor power. Moreover, we assume that α<1 and β<1, thus implying diminishing returns. To include the financial sphere, the literature observes that in addition to facilitating the process of capital accumulation, financial development interacts with T, GE, and FDI to promote technology diffusion and thus support economic growth (Shahbaz and Lean, 2012; Ahmed and Mmolainyane, 2014). Therefore, we have the following technological progress relationship:

$$A_t = \lambda GE_t^{j\phi} FDI_t^{\varphi} T_t^{\gamma} \quad (2)$$

where, GE^j denotes government expenditure by sector, (j=1, 2, 3 and 4) represents the agriculture expenditure (AE), education expenditure (EE), military expenditure (ME), and Health expenditure (HE), respectively. Technological progress A is influenced by GE^j, FDI, and T. λ remains a constant over time. By adapting the augmented Solow model to our approach, we can, therefore, rewrite our standard global production function as follows:

$$Y_t = \lambda GE_t^{j\beta_1} K_t^{\beta_2} L_t^{\beta_3} FDI_t^{\beta_4} T_t^{\beta_5} \quad (3)$$

Applying the logarithm to Eq. 3 yields the following reduced form:

$$lnY_t = \beta_0 + \beta_1 \ln G E_t^j + \beta_2 lnK_t + \beta_3 lnL_t + \beta_4 \ln F DI_t + \beta_5 lnT_t + \varepsilon_t \quad (4)$$

However, the above model does not take into account the direction of the explanatory variables. In other words, there may be potential asymmetric effects of increases and decreases in these variables on real income. To this end, there are several reasons to believe that time series, whether economic or financial, can follow nonlinear paths (Shin et al., 2014; Shahbaz et al., 2017; Benkraiem et al., 2019).

In order to take into account the long- and short-term asymmetric relationship between the series, we use the NARDL model proposed by Shin et al. (2014). In terms of asymmetric cointegration, the following can be expressed:

$$lnY_t = \beta_0 + \beta_1^+ \ln G E_t^{j+} + \beta_2^- \ln G E_t^{j-} + \beta_3^+ lnK_t^+ + \beta_4^- lnK_t^- + \beta_5^+ lnL_t^+ + \beta_6^- lnL_t^- + \beta_7^+ \ln F DI_t^+ + \beta_8^- \ln F DI_t^- + \beta_9^+ lnT_t^+ + \beta_{10}^- lnT_t^- + \varepsilon_t \quad (5)$$

The long-term asymmetry is associated with parameters β_i^+ and β_i^-. Using the NARDL model proposed by Shin et al. (2014), we can obtain the following asymmetric error correction model:

$$\Delta lnY_t = \beta_0 + \rho lnY_{t-1} + \beta_1^+ \ln G E_{t-1}^{j+} + \beta_2^- \ln G E_{t-1}^{j-} + \beta_3^+ lnK_{t-1}^+ + \beta_4^- lnK_{t-1}^- + \beta_5^+ lnL_{t-1}^+ + \beta_6^- lnL_{t-1}^- + \beta_7^+ \ln F DI_{t-1}^+ + \beta_8^- \ln F DI_{t-1}^- + \beta_9^+ lnT_{t-1} + \beta_{10}^- lnT_{t-1} + \sum_{i=1}^{q} \alpha_1 \Delta lnY_{t-1} + \sum_{i=0}^{p} \alpha_1^+ \Delta \ln G E_{t-i}^{j+} + \sum_{i=0}^{p} \alpha_2^- \Delta \ln G E_{t-i}^{j-} + \sum_{i=0}^{p} \alpha_3^+ \Delta lnK_{t-i}^+ + \sum_{i=0}^{p} \alpha_4^- \Delta lnK_{t-i}^- + \sum_{i=0}^{p} \alpha_5^+ \Delta lnL_{t-i}^+ + \sum_{i=0}^{p} \alpha_6^- \Delta lnL_{t-i}^- + \sum_{i=0}^{p} \alpha_7^+ \Delta \ln F DI_{t-i}^+ + \sum_{i=0}^{p} \alpha_8^- \Delta \ln F DI_{t-i}^- + \sum_{i=0}^{p} \alpha_9^+ \Delta lnT_{t-i}^+ + \sum_{i=0}^{p} \alpha_{10}^- \Delta lnT_{t-i}^- + \varepsilon_t \quad (6)$$

where, Δ represents the first difference operator, coefficients for the short term are indicated by α_i for $i = 1,\ldots,10$, the long-term coefficients are denoted by β_i for $i = 1,\ldots,10$. p denotes the number of lags of the independent variables (GE_t^j,K_t,L_t,FDI_t, and T_t), while q indicates the number of lags of the independent variable (Y_t).

Several advantages can be attributed to the NARDL model, as outlined above. First, it is possible to estimate the exogenous variable by incorporating the technique of moments and by decomposing it into positive and negative partial sums.

$$x_t^+ = \sum_{j=1}^{t} \Delta x_t^+ = \sum_{j=1}^{t} max(\Delta x_j, 0) x_t^- = \sum_{j=1}^{t} \Delta x_t^- = \sum_{j=1}^{t} min(0, \Delta x_j) \quad (7)$$

where, x_t represents the explanatory variables GE_t^j,K_t,L_t,FDI_t, and T_t. Second, the long-term relationship between variables lnY_t,$\ln G E_t^j$, lnK_t ,lnL_t,$\ln F DI_t$, and lnT_t can be tested (i.e.,$\rho = \beta^+ = \beta^- = 0$) using the F_{PSS} statistic suggested by Pesaran et al. (2001) and Shin et al. (2014). The t_{BDEG} statistic proposed by Banerjee et al. (1998) can test the null hypothesis $\rho = 0$ against the alternative hypothesis ρ<0. The estimation can provide valid statistical inferences regardless of whether the exogenous variables are stationary, non-stationary, or a mixture between the two. We can, therefore, calculate the long-term asymmetric coefficients as follows: $L_{mi} = \frac{\beta^+}{\rho}$ et $L_{mi} = \frac{\beta^-}{\rho}$. Third, the standard Wald statistic can be used to examine the long-term symmetry $\beta = \beta^+ = \beta^-$ as well as the short-term symmetry which could take one of the two following forms: $\alpha_i^+ = \alpha_i^-$ for all $i = 1,\ldots,p$ or $\sum_{i=1}^{p} \alpha_i^+ = \sum_{i=1}^{p} \alpha_i^-$.

Finally, the effect of dynamic asymmetric multipliers on the variables can be expressed as follows:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial G_t^+}, m_h^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial G_t^-},$$
$$m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial K_t^+}, m_h^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial L_t^-}, m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial L_t^+}$$
$$m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial FDI_t^+}, m_h^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial FDI_t^-},$$
$$m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial T_t^+}, m_h^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial T_t^-}. \quad (8)$$

Knowing that, if $h \to \infty$, then $m_h^+ \to L_{mi}$+and $m_h^- \to L_{mi}$−.

Using these dynamic multipliers, the endogenous variable responds asymmetrically to positive and negative fluctuations in the exogenous variable. In the case of a variation to the model, the estimated multipliers allow us to observe the dynamic adjustment between the variables from the initial equilibrium to their new equilibrium after the variation.

4. Empirical results and discussion

To examine the stationarity of the series, we will apply the Dickey and Fuller (1981) augmented unit roots test (ADF) and the Phillips and Perron test (PP) (Phillips and Perron, 1988), which assumes that the null hypothesis is the presence of a unit root (the non-stationarity). We also relied on the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test (Kwiatkowski et al., 1992), for which the null hypothesis is the stationarity, and the test by Zivot and Andrews (1992) that take series breaks into account. A unit root with no break, which is the null

hypothesis, is assumed in this test, while a stationary series with an unknown break is assumed as the alternative hypothesis.

Table 1 presents the different stationarity tests of the variables. In level, the ADF unit root test shows that GDP, GE^j, and K contain a unit root for the trend and constant model. However, L, FDI, AE, and T are stationary or integrated of order 0. In the first differences, GDP, EE, ME, HE, and K are stationary or integrated into order 1, and therefore, none of these variables is integrated into order 2. Both the PP and KPSS unit root tests produce similar empirical results. This confirms our choice of relying on the NARDL model of Shin et al. (2014), which requires variables to be integrated in the order I(0) or (1) to study the cointegration relationship between them.

Table 1: Unit root test

Variables	Integrated order	ADF	PP	KPSS
GDP	Level	-2.404	-2.628	0.252
	First difference	-7.122***	-7.187***	0.156**
AE	Level	-4.322***	-3.044**	0.198**
	First difference	-	-	-
EE	Level	-1.527	-1.561	0.250
	First difference	-5.244***	-5.230***	0.187**
ME	Level	-1.354	-1.417	0.133
	First difference	-4.221***	-4.387***	0.134**
HE	Level	-1.088	-1.155	0.109
	First difference	-5.171***	-4.889***	0.167**
Capital	Level	-2.754	-2.121	0.225
	First difference	-4.433***	-4.447***	0.181**
Labor	Level	-5.537***	-3.911**	0.124*
	First difference	-	-	-
FDI	Level	-4.357***	-4.367***	0.187**
	First difference	-	-	-
Trade	Level	-3.641**	-6.462***	0.127*
	First difference	-	-	-

***, **, and * show significance at 1%, 5%, and 10% thresholds, respectively

To test the robustness of the results of the traditional unit root test, we will apply the Zivot and Andrews (1992) test, which tests the unit root when a structural change is endogenously identified. At this level, the results in Table 2 confirm that the non-stationarity null hypothesis cannot be rejected for all variables except labor, FDI, AE and trade. Moreover, GDP is observed as non-stationary, while a structural break occurred in 2011. This date coincides with the Tunisian Revolution, which supports our choice of introducing the dummy variable. However, when this test is applied to first differences, it rejects the non-stationary null hypothesis for all series, which means that all variables (except labor, FDI, and trade openness) are I(1). Labor, FDI, and trade openness are stationary in level I(0), and therefore labor, FDI, and trade openness have a different order of integration with respect to their determinants. In fact, Johansen's cointegration methodology requires that all variables have the same integration order, which cannot be achieved because of the variables' stationarity results I(0) and I(1).

Table 2: Zivot and Andrews (1992) tests

Variables	Integrated order	Zivot-Andrews	Break date
GDP	Level	-3.447	2011
	First difference	-8.454***	2010
AE	Level difference	-5.512***	2011
	First difference	-	-
EE	Level	-3.593	2006
	First difference	-6.746***	1982
ME	Level	-2.617	1990
	First difference	-6.288***	2011
HE	Level	-1.619	2008
	First difference	-5.617***	2009
Capital	Level	-3.762	1973
	First difference	-5.023**	1982
Labor	Level	-5.531***	1989
	First difference	-	-
FDI	Level	-5.025**	1990
	First difference	-	-
Trade	Level	-4.908**	1991
	First difference	-	-

*** and ** show significance at 1%, 5%, and 10% thresholds, respectively

Indeed, when the variables are integrated in different orders, the Johansen cointegration test is inappropriate. Therefore, to test the cointegration relationship adequately, we utilize a NARDL model. In Table 3, we present the results of estimations of the NARDL model in the long and short terms. The diagnostic test statistics are presented in Table 3. These tests are summarized by the statistics $\chi^2_{SC}, \chi^2_{HET}$ and F_{PSS}. χ^2_{SC} and χ^2_{HET} show no serial correlations and no homoscedasticity, respectively. In addition, the F_{PSS} statistic confirms the asymmetrical co-integration between GDP, GE, K, L, FDI, AE, EE, ME, HE, and T. W_{LR} (W_{SR}) is the Wald statistic that tests the symmetry relationship hypothesis between the variables in the long (short) term. Both statistics are significant, thus rejecting

the symmetric relationship hypothesis in the long and short terms. In this way, the NARDL model is able to provide a correct estimation based on all the tests. In order to explain the non-linear relationship between shocks and the independent and dependent variables, we can summarize the results as follows.

The long-term NARDL results presented in Table 3 confirm that an increase in AE would boost GDP (coefficient of 0.001), showing that a 1% increase in AE improves GDP by 0.1%. In addition, a negative shock to AE has a significant and positive effect on GDP in the long term. The positive coefficient (0.001) shows that any increase in AE improved economic growth. This weakness in institutional quality causes an asymmetry of information for citizens about the government's budgetary operations, such as total revenues and real public expenditures. Therefore, a positive shock to AE can stimulate an increase in private consumption and ultimately induce growth, while a negative shock can reduce consumption. This seems consistent with the theory that if the government finances increase AE by issuing bonds, the consumer may view the fact of holding government bonds as an increase in wealth. These results indicate that negative shocks in AE will stimulate GDP. The AE increase is beneficial based on the above results since higher government budgets promote infrastructure development, create a peaceful environment for investment, and contribute to maximizing resources and capital stock (Ntiga and Henri, 2022). From a long-term perspective, both positive and negative changes in health expenditure increase economic growth in Tunisia, with increases of 0.006 and 0.002, respectively. The positive change is statistically significant at the 1 percent level, whereas the negative change is not significant. This suggests that higher health spending enhances Tunisia's economic growth, while slower increases in health expenditure negatively affect the country by reducing economic growth.

Table 3: NARDL estimation results (Dependent variable: GDP)

Variables	Coefficients	t-statistic	Probability
	Long-term		
C	10.574***	6.235	0.001
AE^+	0.001*	2.162	0.067
AE^-	-0.008	-1.308	0.213
EE^+	-0.002*	-2.171	0.069
EE^-	-0.007**	-3.322	0.018
ME^+	-0.003*	-2.101	0.071
ME^-	-0.005**	-3.304	0.022
HE^+	0.006*	2.03	0.082
HE^-	0.002	1.204	0.226
Capital$^+$	-0.075**	-2.091	0.034
Capital$^-$	0.084	0.237	0.819
Labor$^+$	0.058*	2.031	0.081
Labor$^-$	0.062*	2.194	0.064
FDI$^+$	0.059**	2.455	0.043
FDI$^-$	-0.042***	-6.731	0.000
Trade$^+$	0.285	1.102	0.306
Trade$^-$	0.337*	1.923	0.095
D_{2011}	-0.010**	-2.115	0.035
	Short-term		
ΔAE^+	0.003**	3.307	0.013
ΔAE^-	0.009	1.088	0.164
ΔEE^+	-0.002*	-1.722	0.088
ΔEE^-	-0.007***	-6.039	0.000
ΔME^+	-0.003**	-2.039	0.045
ΔME^-	-0.005***	-4.012	0.005
ΔHE^+	0.007***	5.094	0.000
ΔHE^-	0.005***	3.974	0.006
ΔCapital$^+$	-0.052**	-2.730	0.048
ΔCapital$^-$	0.066*	1.920	0.096
ΔLabor$^+$	-0.023**	-2.686	0.031
ΔLabor$^-$	0.063**	3.033	0.019
ΔTrade$^+$	0.576***	3.950	0.005
ΔTrade$^-$	0.127**	2.450	0.047
ΔFDI$^+$	0.156***	7.318	0.000
ΔFDI$^-$	-0.051**	-2.449	0.048
	Diagnostic tests		
R^2	0.965		
Adj-R^2	0.931		
DW	2.571		
$W_{\text{LR.Government expenditure}}$	74.354***	$W_{\text{SR.Government expenditure}}$	17.451**
$W_{\text{LR.Capital}}$	13.687**	$W_{\text{SR.Capital}}$	8.489*
$W_{\text{LR.Labor}}$	2.897**	$W_{\text{SR.Labor}}$	10.486***
$W_{\text{LR.FDI}}$	65.548***	$W_{\text{SR.FDI}}$	55.476***
$W_{\text{LR.Trade}}$	25.483***	$W_{\text{SR.Trade}}$	11.145***
χ^2_{SC}	6.123		
χ^2_{HET}	0.548		
χ^2_{EF}	0.342		
F_{PSS}	8.567***		
T_{BDM}	-9.046***		

***, **, and * represent significance at 1%, 5%, and 10% thresholds, respectively

Studies by Oladosu et al. (2022) and Osathanunkul et al. (2023) have shown that initial health expenditures can have a negative impact on economic growth, particularly in developing countries. In contrast, both positive and negative changes in ME and EE significantly decrease economic growth. Specifically, EE has a slightly significant negative effect on economic growth with a p-value of 0.088, causing economic growth to decline by 0.007% and 0.002% for negative and positive changes, respectively. Similarly, a 1% change in ME, whether negative or positive, leads to decreases in economic growth by 0.005% and 0.003% respectively. These findings are consistent with previous research indicating that spending on education and the military can negatively impact economic growth in developing countries (Yelma et al., 2014; Selvanathan et al., 2021).

Indeed, FDI was found to have a positive and significant impact on GDP. The more FDI is made, the higher the growth rate. This positive effect is in line with Belloumi (2014) for the case of Tunisia. Contrary to this, a negative shock to FDI will harm economic growth, indicating that FDI contraction will negatively impact economic growth. The results of this study are in line with those of Sadik and Bolbol (2001) for Egypt and Saudi Arabia. In light of these findings, government policymakers are recommended to create an environment that is favorable to foreign investors so that they can invest in a variety of sectors. To achieve long-term sustainable economic growth in MENA countries like Tunisia, governments and policymakers should stimulate foreign investment.

Finally, positive capital shocks showed a negative relationship with economic growth, while negative capital shocks showed a positive relationship. According to these results, increasing capital investment hinders economic growth, while decreasing capital investment stimulates it. A similar relationship between capital and economic growth was reported by Benkraiem et al. (2019) for Bolivia. Our results contradict those of Amna et al. (2020), who found that the labor force productivity weakens Asian countries' economic growth model. In other words, the lack of diversification of economies that are heavily dependent on the primary sector contributes to accentuating this phenomenon. Furthermore, the positive coefficients support the argument that Tunisia's policy concerning labor is conducive to GDP.

On the other hand, from the short-run perspective, government expenditure on agriculture and health has a positive impact on GDP, while government expenditure on military and education has a negative impact on GDP. This reduction in ME and EE will disrupt production activities and dampen short-term economic growth in Tunisia. A priori government expenditures in the two sectors, namely education and military, are expected to have a positive influence on economic growth. A number of reasons are given in the literature regarding the occurrence of a negative relationship between government sectorial expenditures and economic growth.

Indeed, a positive shock to FDI is positively correlated with GDP (coefficient 0.156). However, that negative shock to FDI negatively affects economic growth (coefficient of 0.051). These results join those of Nyasha and Odhiambo (2017) in Kenya; Jalil and Feridun (2011) in Pakistan; Calderón and Liu (2003) for 87 emerging countries; Adeniyi et al. (2015) in Nigeria; and Musila and Yiheyis (2015) in Kenya. Neoclassical theory suggests that economic development and foreign direct investment are closely related. Abid (2016) confirmed this result, which is that increased financial developments stimulate FDI and, therefore, GDP. This implies that the increased inflow of FDI brings in new technologies, skills, and foreign capital while stimulating economic activities and infrastructure development.

Furthermore, in the short term, a positive shock to capital has a negative impact on economic growth. On the other hand, a negative shock to capital has a positive impact on economic growth, demonstrating that negative shocks in capital play a major role in the country's short-term economic growth. Our results were consistent with those of Shahbaz et al. (2017) in India, who argue that capital is detrimental to GDP. In the short term, these results demonstrate the importance of capital for economic development since economic growth is weakened when there is a positive shock in capital. Our results show that the positive shock to labor has a negative impact on GDP, while the negative shock has a positive impact on GDP.

5. Conclusion and policy implications

Developing countries face enormous challenges to economic growth. Hence, government expenditure is seen as a stimulating factor for economic growth. In this study, we investigate how sectorial government expenditure, gross fixed capital formation, foreign direct investment, trade, and labor force affect GDP asymmetrically in Tunisia during the period 1980-20 based on a NARDL model. Four sectorial government expenditures are used. They are agriculture, education, health, and military. Based on the results, we can conclude that the variables considered have an asymmetric relationship. Our results show that government expenditure on agriculture and health has a positive impact on GDP, while government expenditure on military and education has a negative impact on GDP. This asymmetric effect is well in line with previous studies, including those by Kim and Nguyen (2020) and Olaoye et al. (2020). The asymmetry also applies to the response of GDP to FDI and trade openness shocks.

The GDP increases because of a positive shock from T and FDI. Thus, a positive shock to GE boosts GDP in the long term. Additionally, a negative shock

to FDI hampers GDP, while a positive shock to trade openness increases GDP. The relationship between labor and economic growth was positive and significant in both positive and negative shocks in the long term. Nevertheless, positive shocks to labor negatively affect economic growth (at lag 0) but positively affect economic growth (at lag 1) in the short term.

Several important implications flow from these results for Tunisian policymakers and institutional investors. Overall, it is important for Tunisia to increase its GE by emphasizing its investment expenditure to the detriment of its operating expenditure, which has limited growth potential. This recommendation is in line with the objectives set out in the Tunisia Strategy Document for Growth and Employment (DSCE), which consists of increasing the investment rate to at least 13.3% of GDP. To do this, Tunisia should implement policies aimed at reducing current account and budget deficits. All this requires a structural transformation of countries' economies. It is time to move from a cash economy to a transformative economy. To increase its added value, raw materials should be transformed into semi-finished or finished products. For this transformation policy to be successful, it is necessary to resort to foreign investors.

Based on the results obtained, the following recommendations are made: (i) allocation of government spending needs to be based on the level of need and the versatility of individual sectors of the economy in Tunisia. (ii) in as much as the government is trying its best to see that education and the military are better funded to promote economic growth in Tunisia, the impact of this funding is not felt as a result of mismanagement and poor implementation. One of the reasons could be because the money spent on education and the military is not translated to economic gains in the domestic economy but has evidence of affecting the economy through technical know-how and expertise. The gains are being transferred to other economies in the form of brain drain, which is a reduction in the level of GDP. (iii) higher government expenditure on agriculture and health should be continually encouraged to create an enabling environment for businesses to strive through the provision of basic infrastructure that will reduce the cost of production.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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