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Military Expenditures and Economic Growth: Evidence from Turkey

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Abstract

A recent focus on the socioeconomic impacts of military expenditures has led to a resurgence of interest in research and development activities in this domain. A comprehensive review of extant academic studies reveals a conspicuous absence of research examining the augmented Solow growth model, encompassing capital formation, labor force, military expenditures, and economic growth for Turkey. Consequently, this study aims to investigate the impact of capital formation, labor force, and military expenditures on economic growth in Turkey from 1991 to 2022. To this end, the study employs the residual augmented least square (RALS) approach. The coefficients for the variables in the long run are analyzed with the EKK method and FMOLS, DOLS, and CCR estimators. The original contribution of this study lies in its comprehensive examination of the impact of developments in military expenditures on economic growth in Turkey, thereby addressing a significant research gap. The study's findings indicate that while military expenditures exerted a negative influence on the Turkish economy during the period 1991–2022, the augmentation in capital formation and the labor force exerted a positive influence on the same economy.

Keywords: Economic growth, military expenditures, capital formation, labor force, Turkey

JEL Classification: F62, F63, O47

1. Introduction

Since Benoit's (1973) study, which shown that military spending has a favorable impact on economic development, scholars have closely examined the relationship between military spending and economic growth. The long-term growth rate is significantly impacted by public spending, according to endogenous growth theories. The degree to which the government intervenes and the various facets of public spending determine how they affect growth. However, the impact of various public expenditure initiatives on economic expansion differs. The military industry is heavily financed by governments. Endogenous growth theory explains the link between military spending and long-term economic growth and suggests the possibility that the two may be inversely related. The relationship between the military sector's direct and indirect expenses and its indirect earnings forms the basis of theoretical theories linking military investment to economic growth. The benefits of military investment can be greater when it costs less than any other sector (Deger and Sen, 1995; Shieh *et al.*, 2002; Pieroni, 2009).

Policy makers and researchers continue to debate the link between a country's military spending and economic growth. Military spending has many effects on economic growth. Military spending has a negative effect on economic growth by reducing investment activities while increasing security and aggregate demand (Dixon and Moon, 1986; Enimola and Akoko, 2011; Dimitraki and Menla Ali, 2015). The economic literature has yet to provide a clear explanation for the link between military spending and economic expansion. For example, Deger and Sen (1995) argue that military expenditure significantly inhibits economic growth, but security is essential for it. However, Benoit (1978) provided evidence that military expenditure enhances economic expansion in developing countries. This ambiguity in the literature stems from factors such as theoretical foundations, empirical methods (Blasko *et al.*, 2007), the country groups examined, and the time period considered (Ram, 1995; Arshad *et al.*, 2017). Since models indicate that military spending can have neutral, positive, or negative effects on economic growth, it is possible that each channel will yield different findings, and the overall effect is unknown (Alptekin and Levine, 2012: 636). The differences among these comprehensive literature reviews highlight the importance of conducting in-depth research.

Theoretical studies on military expenditures have enabled the identification of various channels, such as labor, capital, foreign relations, debt, geopolitical risks, and technology, that can affect economic growth in the long term. The relative importance, direction, and general impact of these effects are predominantly determined through empirical analysis (Smith, 1989). The level and direction of the impact of all these channels vary across country groups (d'Agostino *et al.*, 2019). While a less developed African economy may be more concerned with the conflict trap it finds itself in, a more advanced developing country may be more focused on the industrial im-

pact, technology, and foreign direct investment advantages of its involvement in arms production, as well as the opportunity cost (Collier, 2007).

Turkey, which has been in the news lately by devoting a large portion of its budget to the military, is trying to increase its geopolitical influence. Turkey's geopolitical context, characterized by its location in a region marked by instability and the prevalence of separatist movements and uprisings, compels the government to allocate a substantial portion of its budget to national security. The country's geographic location in a region characterized by instability, coupled with the pervasive occurrence of major political, social, economic, and military crises in neighboring countries, contributes to an already challenging security environment (Khalid and Habimana, 2019). The geopolitical risk level in Turkey is further elevated by the ongoing military confrontation between Russia and Ukraine, the protracted conflicts in the Middle East, tensions between Iran and Israel, security concerns, and the prevailing climate of instability. In recent years, terrorist organizations that have emerged because of the internal unrest in Syria have posed a direct threat to Turkey's border security and have been the focus of an intensive campaign by Turkish forces. Additionally, combating internal threats, such as groups frequently involved in terrorist activities, alongside external threats, including nuclear, chemical, radiological, and biological weapons found in other countries' inventories, has become increasingly important. On the other hand, Turkey has been engaged in violent conflict with domestic separatist terrorist organizations, particularly since the 1970s. In response, governments allocate budgetary resources to military expenditures with the aim of eliminating internal threats, mitigating geopolitical risks, and ensuring border security. Despite the absence of direct military operations at the country level, Turkey's ongoing confrontation with various terrorist organizations and its military expenditures are indicative of the risks emanating from its geopolitical context. The question that emerges within this context is whether the relationship between military expenditures is beneficial or detrimental to economic growth for developing country economies in conflict-prone regions. This situation underscores the need for countries like Turkey to monitor their military spending policies and economic impacts to maintain their power capacity.

This study contributes to the existing literature in three aspects. First, it provides additional evidence on the long-run link between military expenditures and economic growth by building on the preliminary results of previous studies. Studies in the literature have examined the relationship between military expenditures and economic expansion. However, our literature review reveals that there are not many studies that look at how labor force participation, capital creation, and military expenditures affect economic growth in the context of the Solow growth model for the Turkish economy. One of the main goals of looking at the direction and extent to which characteristics affect economic growth in the long run is to look at the various components simultaneously. Some of these elements have a beneficial impact on economic growth, while others have

a negative impact, as is to be expected. In contrast to the conventional cointegration test, this study determines the cointegration test utilizing the RALS ADL cointegration approach. The finite sample distribution is probably best estimated by such a test. As a result, the potential drawbacks of previous studies using very small annual data samples to assess whether there is a long-run relationship between economic growth and military expenditures will be avoided. On the other hand, this data set makes it possible to reveal potential impacts on security concerns due to Turkey's geopolitical position and economic structure. Finally, this study may be useful for policymakers in analyzing the relationships between security concerns, the defense industry, investments, and a skilled labor force. Thus, this study will fill the aforementioned gap in literature.

In 1991, Turkey held a 0.63% share of the global GDP, which increased to 0.90% by 2022. Similarly, while Turkey's military expenditures represented 0.81% of total global military expenditures in 1991, this percentage fell to 0.48% in 2022. From this perspective, while Turkey nearly quadrupled its GDP from 1991 to 2022, the share of military expenditures in its GDP decreased by 68%. Consequently, by spending less on military expenditures relative to its growing income, Turkey increased its per capita income by 500% in 2022 compared to 1991 (World Bank, 2024). In this context and in line with the theoretical framework of the study, it aims to address the issue of how military expenditures affect the Turkish economy from 1991 to 2022. In the study, the effects on GDP, gross capital formation, labour force participation and military expenditures between 1991 and 2022 are investigated using annual data. Using the Standard ADF and PP tests, the series' stationarity was first examined. When the first difference of the series was calculated, all variables became stationary. The association between the variables was assessed using the recently published RALS-ADL test, which takes into account the cointegration potential among all variables. Lastly, for long-term coefficient estimations, the Dynamic Ordinary Least Squares (DOLS), Canonical Cointegrated Regression (CCR), and Fully Modified Least Squares Method (FMOLS) estimators were used.

The rest of the paper is structured as follows. The background of the study on military expenditures and economic growth is given in Section 2. The theoretical foundation and methodology of the study are presented in Section 3. The empirical findings are analysed in Section 4. Policy recommendations and conclusion are presented in Section 5.

2. Literature Review

Economic growth is influenced by military expenditures in various ways. Many countries allocate a significant portion of their budgets to military spending. Benoit (1972) conducted the first study examining the impact of military expenditures on economic growth in developing countries. Benoit concluded that military spending enhances economic growth (Benoit, 1973; Benoit, 1978).

The relationship between military expenditures and economic growth remains inconclusive in the literature. Long-term economic growth can be affected differently by various phases of government spending. Studies suggest that capital expenditures, infrastructure, and education are often among the elements that foster positive effects. According to Alpenkin and Levine (2012), these are frequently considered the productive components of government spending. Numerous studies examine the link between military spending and economic growth. Abdel-Khalek and Mazloum (2020) found that India's military production and scientific policies facilitated access to sophisticated infrastructure opportunities in critical industries, encouraging foreign direct investment. Awaworyi Churchill and Yew (2018) examined the impact of military spending on economic growth using 272 meta-observations collected from 48 original studies. They found that previous research has shown that military spending has a growth-retarding effect. Additionally, they argued that industrialized countries gain more from military spending than less developed countries. Dimitraki and Win (2021) utilized the Gregory-Hansen cointegration technique and ARDL methodology to examine the relationship between Jordan's military spending and economic development from 1970 to 2015, accounting for structural breaks. The study found positive short- and long-term relationships between military spending and economic growth in Jordan during this period. Similarly, Iheonu and Ichoku (2023) examined how military spending relates to terrorism and economic expansion in Africa, finding that terrorism adversely affects the economic development of several African nations. Additionally, when the number of terrorist incidents was used as a proxy for terrorism, military spending exhibited a positive net effect on the relationship between terrorism and economic growth; however, when the number of terrorist fatalities was used as a proxy, a negative effect was observed. In contrast, other studies demonstrate a negative correlation between military expenditures and economic growth. For example, Using the Augmented Solow Growth Model, Hou and Chen (2013) investigated the connection between military spending and economic growth in 35 developing nations between 1975 and 2009. The study's conclusions show that the military significantly and negatively affects the sample countries' economic development. Saba and Ngepah (2019) investigated the connection between military spending, state instability, and economic growth in African countries' regional economic communities using a balanced panel of 34 African nations spanning the years 1990–2015. According to the data, military spending has a detrimental effect on the African economy and there are notable regional economic differences. Fragile states are more affected by this. Between 1965 and 2016, Luqman and Antonakakis (2021) examined the immediate and long-term relationships among Pakistan's military spending, human development, and economic growth. The findings show that whereas urbanization and food shortages have positive effects on economic growth and human development, military spending has the reverse effect. Geng *et al.* (2024) investigated the impact of military spending on economic growth in 48 Islamic countries between 1990 and 2018 using

a multivariate regression model based on increased production function in the presence of energy consumption. The study found that military spending had a negative impact on economic growth, with upper-middle income countries having the lowest elasticity of military spending on economic growth when compared to the other three groups.

Additionally, some research indicates a negative correlation between military spending and economic growth. Whether this finding represents a general pattern in which military operations are high but do not yield economic benefits or a basic relationship between military spending and economic growth is up for debate. By displacing investments, health and education expenditures, and infrastructure upgrades, defense spending might impede economic growth (Lebovic and Ishaq, 1987; Scheetz, 1991; Dunne and Vougas, 1999; Yıldırım *et al.*, 2015). The literature provides the case that military spending can impede economic growth in a number of ways, including by decreasing rates of investment and savings, taking funds away from other productive sectors like health and education, increasing budget deficits, debt, and corruption, as well as by raising taxes, decreasing the productivity of the private sector, capital formation, and resource extraction (Klein, 2004; Pieroni, 2009; Yang *et al.*, 2011; Manamperi, 2016; Dunne and Tian, 2017; Yolcu Karadam *et al.*, 2017; G d'Agostino *et al.*, 2019; Wang *et al.*, 2023).

Political, military, and regional prosperity serve as critical stepping stones for the economic growth of any developing country. Alongside the financial costs of military expenditures, there are also potential advantages. Military expenditures rise rapidly in economies with low productive investments and high security risks. As investment activities focus on productive sectors and risk factors diminish, the crowding-out effect of military spending starts to lessen. As the nation's resource utilization patterns shift from inefficient to efficient sectors, the overall economic efficiency level across society will increase (Dunne *et al.*, 2005 The degree to which military spending affects economic growth depends on a number of factors, including how these expenditures are funded, the externalities they cause, and the degree to which peace and security are upheld. The economic effects of military spending will also differ since these factors frequently shift over time and between nations (Yıldırım and Öcal, 2016). According to the findings of Awaworyi Churchill and Yew, 2018; Dimitraki and Menla Ali, 2015; Huang *et al.*, 2017; Kollias and Paleologou, 2010; Yıldırım *et al.*, 2005, military spending and economic growth are positively correlated in both developed and developing nations.

Studies on the connection between military spending and economic growth have been published recently. There aren't many studies looking at the Solow growth model, which considers capital formation, labor force participation, military spending, and economic growth in Turkey, according to our thorough study evaluation. The RALS approach, a powerful estimator, was used to examine the long-term relationship between these variables. As anticipated, some stud-

ies in the literature suggest that military expenditures positively impact economic growth, while others indicate the opposite. Moreover, this information facilitates understanding how changes in Turkey's military expenditure model could affect economic growth. Finally, this study could provide decision-makers with critical insights into the connections among trade, military infrastructure investments, and the military budget. This research will address the gaps mentioned above in the existing literature.

3. Augmented Solow Model

Robert Solow developed a model in 1956 that fundamentally altered the understanding of economic growth. According to his theory, an economy has a Cobb-Douglas production function, a constant level of technology, and diminishing marginal returns to capital. Population increase, the savings rate, and technological advancement were all regarded as exogenous variables in the traditional Solow growth model. According to this concept, nations with lower initial incomes should be able to grow faster than those with higher initial incomes, ultimately resulting in a conditional convergence of living standards across nations. In their groundbreaking study, Mankiw *et al.* (1992) extended the Solow growth model by incorporating human capital. It has been demonstrated that the model can forecast cross-country convergence in living standards and account for up to 80% of the variation in output per worker between nations. Knight *et al.* (1996) and Dunne *et al.* (2004) use a version of the extended Solow growth model to calculate the effect of military spending on growth.

There are various methods for simulating how military expenditures affect economic expansion. As shown by Dunne *et al.* (2005), a particular approach is to assume that military spending (as a percentage of total output) affects factor productivity by having a level effect on the productivity parameter that determines technical change that augments labor. For example, Mankiw *et al.* (1992) provide a brief description of the model using an aggregate neoclassical production function that includes labor-augmenting technical innovation and human capital.

$$Y(t) = K(t)^{a}H(t)^{\beta}[A(t)L(t)]^{1-a-\beta} \tag{1}$$

In this model, the technological parameter (A) is represented by labor (L), capital (K), total output (Y), and human capital (H). The following factors influence the development of technological parameter A:

$$A(t) = A_0 e^{gt} m(t)^{\varphi} \tag{2}$$

Here g is the exogenous rate of Harrod-neutral technological progress in this model, while m represents the proportion of military spending to overall output. A permanent shift in the rate

of military spending can have a lasting impact on per capita income during periods of steady-state growth, according to Dunne *et al.* (2005). However, they assert that it has no impact on the steady-state growth rate in the long term. Additionally, military expenditures (m) may influence short-term growth rates, resulting in a new steady-state equilibrium. As shown by Dunne *et al.* (2004), panel data can be utilized to evaluate the impact of military spending on growth under these criteria.

Some of the model's dynamic components become apparent due to their unconventional formulation. The model shows typical capital accumulation dynamics under the conventional assumptions of a constant labor force growth rate (n), an exogenous saving rate (s), and capital depreciation (d). Below is an explanation of the evolution of human capital per active worker ($h_e = H/AL$) and physical capital per active worker ($k_e = K/AL$):

$$h_e(t) = s_h y_e(t) - (n + g + d)\, h_e(t) \; ve \; k_e(t) = s_k y_e(t) - (n + g + d)\, k_e(t) \tag{3}$$

In this context, the terms s_h and s_k represent the proportions of total income invested in human and physical capital, respectively. It is assumed that depreciation in human and physical capital occurs at the same rate (d). The equilibrium levels of human and physical capital stock are provided below:

$$k_e^* = \left[\frac{s_h^{\beta} s_k^{1-\beta}}{n+g+d}\right]^{1/(1-\alpha-\beta)} \text{ and } h_e^* = \left[\frac{s_h^{1-\alpha} s_k^{\alpha}}{n+g+d}\right]^{1/(1-\alpha-\beta)} \tag{4}$$

The following is an estimate of the effective income per worker in the transitional dynamics surrounding the steady state:

$$\frac{\vartheta ln y_e}{\vartheta t} = (\alpha + \beta - 1)(n + g + d)[\ln ye(t) - \ln ln y_e^*] \tag{5}$$

According to the short-term dynamics of output per effective worker near the steady state, the actual revenue per worker formula is as follows (Dunne *et al.*, 2004, 2005):

$$\ln y(t) = e^z \ln y(t-1) + (1 - e^z)$$
$$\mathrm{X}\{\ln A_0 + \frac{\alpha}{1-\alpha-\beta}\ln s_k + \frac{\beta}{1-\alpha-\beta}\ln s_h + \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+d) + \theta \ln m(t) -$$
$$e^z \theta \ln m(t-1) + (t - (t-1)e^z) \tag{6}$$

The long-term growth rate is denoted by α, the military expenditure level by n, the government spending level by g, and the domestic spending level by d. Despite the discrepancies in the output level and growth rate models, Dunne *et al.* (2005) demonstrate that the steady-state income elasticity for the long-run proportion of military spending is represented by $z \equiv (\alpha - 1)(n + g + d)$ and θ. This difference is less noticeable in real-world situations. With g and d being

uniform, time-independent constants, zero value is seen as both country-specific and time-independent respectively.

A modification of the previous conceptual equation for empirical analysis can be achieved by employing the following type of dynamic panel model specification.

$$\ln y_{it} = \beta_0 + \beta_1 \ln y_{it-1} + \beta_2 \ln s_{it} + \beta_3 \ln (n_{it} + g + d) + \beta_4 \ln m_{it} + \beta_5 \ln m_{it-1} + \varepsilon_{it} \quad (7)$$

The formula mentioned above forms the basis for empirical studies examining the potential effects of capital formation, labor force participation, and military expenditures on economic development using a Solow-style regression approach. As previously noted, military expenditures have the capacity to influence economic growth in various ways. Due to this complexity, analyzing these channels within the neoclassical growth model framework is challenging and unpredictable. The total labor force growth rate is denoted by ln(*nit* + *g* + *d*), the logarithmic growth of real GDP by ln*y*, the gross capital creation by ln*s*, and the percentage of GDP that share to military spending by ln*m*. The dynamic structure of the expanded Solow defense-growth model allows academics to examine whether military spending affects economic growth immediately or over time (Yıldırım and Öcal, 2016).

3.1 Methodology

In this study, time series methods were employed as the econometric approach, and Eviews 10 software was used for analysis. For this purpose, the time series characteristics of the variables were first examined. Neglecting the time series properties can lead to misleading regressions that falsely indicate non-existent relationships (Granger and Newbold, 1974; MacKinnon, 1991: 266–267). The initial step in analyzing the relationships between military expenditures, capital formation, labor force participation, and economic growth involved assessing the stationarity of the variables using the ADF (Augmented Dickey-Fuller, 1981) and PP (Phillips-Perron, 1988) unit root tests. Since the series were found to be integrated at the same level, the RALS-ADL cointegration test was utilized after examining the time series characteristics of the series used in the analysis.

For this study, the Lee *et al.* (2015) residual augmented least squares (RALS) cointegration test was selected for three primary reasons (Oh *et al.*, 2019). First, in the RALS cointegration test, data with non-normally distributed errors, which were not considered in previous studies, are used. The series analysis did not reveal a normal distribution. The RALS estimator can be described as a robust technique when errors in a linear model do not follow a normal distribution (Lee *et al.*, 2015). Therefore, it is believed that the RALS cointegration test provides a significant

contribution to the existing body of knowledge by overcoming the issue of non-normal errors (Salihoğlu and Hepsağ, 2021).

The application of the leading specification of a particular functional form is hampered by RALS cointegration tests. RALS-based tests are based on data from non-normally distributed errors, and functional forms with a low level of functionality can render the RALS method weak.

The third and last justification is that the explanatory power of RALS-based tests approaches that of other cointegration tests when the non-normality information gleaned from the error terms is minimal. tests. On the other hand, due to the non-normal characteristics at the estimation stage, RALS-based tests offer a higher explanatory power. Lee *et al.* (2015) demonstrated that RALS cointegration tests are more effective than alternative tests when applied to non-normally distributed data.

Lee *et al.* (2015) looked at four distinct test regressions in the RALS cointegration test. Among these test regressions, the RALS ADL test regression was assessed (Hepsağ, 2022):

$$\Delta y_t = d_t + \emptyset y_{t-1} + \delta' \Delta x_{t-1} + \gamma' \Delta x_t + \varepsilon_t \tag{8}$$

Equation (1) represents the ADL. In this equation, the variable d_t represents factors reflecting the constant term or deterministic trend. Lee *et al.* (2015) developed cointegration tests based on the RALS technique in cases where the error terms in the test regression described above do not follow a normal distribution.

Lee *et al.* (2015) recommended using the ADL test regressions in the RALS cointegration tests to determine the crucial values of these test regressions. With the aforementioned issues in mind, the RALS-ADL test regression is defined as:

$$\Delta y_t = d_t + \emptyset y_{t-1} + \delta' \Delta x_{t-1} + \gamma' \Delta x_t + \vartheta_2 \dot{w}_{2t} + \vartheta_3 \dot{w}_{3t} + u_t \tag{9}$$

According to the ordinary least squares estimation of the RALS-ADL test regressions (2), the parameter $\emptyset_1 < 0$ indicates the presence of a cointegration relationship, while $\emptyset_1 = 0$ represents the null hypothesis of no cointegration relationship. To conduct the test, the following test statistics can be collected.

$$\tau^*_{ADL} \rightarrow \rho \tau_{ADL} + \sqrt{1 - \rho^2} Z \tag{10}$$

In Equation (3), Z is a random variable with constant variance and zero mean. The test statistic τ_{ADL} is obtained using the conventional test regressions (1), and the long-term correlation coefficient of the residuals is represented by ρ = (corr $\ddot{u}_t$, $\ddot{\varepsilon}_t$) with $\ddot{\varepsilon}_t$ and $\ddot{u}_t$ (Demirtaş *et al.*, 2023).

3.2 Data and Model

To analyze the connections between military expenditures, capital formation, labor force participation, and economic growth, annual data from 1991 to 2022 were used. The dataset includes labor force participation, gross capital formation, military expenditures, and gross domestic product. The data for the study were provided by the World Bank's World Development Indicators system.

In the model, GDP was used as the dependent variable, while labor force participation, gross capital formation, and military expenditures were employed as explanatory factors.

Mathematically:

$$GDP = f(ME, GCF, LA) \tag{11}$$

To make the mathematical expression estimable, the logarithm of all variables was taken, transforming it into Equation (2) below:

$$\ln GDP = \alpha + \beta_1 \ln ME + ß_2 \ln GCF + ß_3 \ln LA + \mu_i \tag{12}$$

In this context, *GDP* represents gross domestic product, *ME* stands for military expenditures, *GCF* denotes gross capital formation, and *LA* signifies labor force participation. To eliminate the issue of spurious regression from the model, a stationarity test was first conducted, and the series were found to be stationary at the first difference level.

4. Analysis Findings and Discussion

Table 1 shows the descriptive statistics of the series. According to the descriptive statistics, the series does not follow a normal distribution. In this case, the more powerful RALS ADL approach was used to analyze the series that did not follow a normal distribution.

Tablo 1: Diagnostic Tests

Statistics on Series E	Values	Significance Level
***t*-statistic**	0.000	1.000
Skewness	0.979	0.037
Kurtosis	1.357	0.178
Jarque–Bera	7.094	0.028

Source: Author's own calculations

Table 2 displays the findings of the PP and ADF unit root tests for the labor force, economic growth, military spending and capital formation data.

Table 2: Stationarity Levels of Variables

Variables	ADF Test		Phillips–Perron Test	
	I(0)	I(1)	I(0)	I(1)
ln*GDP*	–2.4623(0.34)	–5.5576(0.00)***	–2.3619(0.39)	–7.4136(0.00)***
ln*ME*	–1.1702(0.99)	–5.2957(0.00)***	0.0547(0.99)	–5.2752(0.00)***
ln*GCF*	–2.2361(0.45)	–6.7708(0.00)***	–2.2551(0.44)	–6.7572(0.00)***
ln*LA*	–1.6618(0.74)	–5.7500(0.00)***	–1.6339(0.75)	–5.7500(0.00)***

Note: ***: indicates a rejection of the H_0 hypothesis at the 1% level, **: indicates a rejection at the 5% level, and *: indicates a rejection at the 10% level. Chi-square statistics are displayed by values outside of parenthesis, while probability values are displayed by values inside.

Source: Author's own calculations

As seen in Table 2, all four series exhibit a unit root at level values but become stationary at the 1% significance level when considering their first differences. Accordingly, in the estimation phase of the model, a cointegration relationship is required to estimate the level values of the variables, as specified in Equations (2), (3), and (4). At this point, long-term relationships between the variables were identified using the RALS-ADL cointegration test developed by Lee *et al.* (2015), which can produce highly effective findings, especially in the presence of non-normal residuals. This test is used for its robustness in examining linear models, its use of error terms from series with non-normally distributed data, and its stability in the presence of non-normally distributed series. Lee *et al.* (2015) demonstrated that their RALS cointegration tests are more robust than alternatives in non-normal distributions. In this context, Table 3 below shows the results of the selected RALS-ADL cointegration test.

Table 3: RALS-ADL Cointegration Test Results

Model	tau_RALS-ADL Test Statistic	φ^2	RALS-ADL Table Critical Values According to φ^2 Values		
			%1	%5	%10
ln*GDP* = f (ln*ME*, ln*LA*, ln*GCF*)	–5.12174	0.51231	–4.142	–3.467	–3.114

Source: Author's own calculations

As the test statistics from the models testing the relationship between ln*GDP* and ln*ME*, ln*LA*, and ln*GCF* at the 5% significance level are greater than the critical values in absolute values, the RALS-ADL cointegration test suggests that there is a long-term cointegration relationship between the relevant series when the cointegration test results displayed in Table 3 are evaluated. In other words, it can be argued that *GDP* and the series *ME*, *LA*, and *GCF* move together in the long run. The extent of the long-term relationship between the relevant series was examined using the Dynamic OLS estimator, and since a long-term connection was established between ln*GDP* and ln*ME*, ln*LA*, and ln*GCF* series, the results in accordance with the RALS-ADL test are presented in Table 4.

Table 4: Coefficient Estimation Results for the Long-Term Model

Model	**Ln*GDP* = *f* (ln*ME*, ln*LA*, ln*GCF*)**		
Variables	**Coefficient**	**Test Statistics**	**Prob**
ln*ME*	–0.1038	–2.3791	0.024
ln*LA*	0.6859	4.7242	0.000
ln*GCF*	0.1377	4.9465	0.000
Constant	13.8298	4.7855	0.000
Trend	0.0266	6.8949	0.000

Source: Author's own calculations

At the 5% level, military spending has a statistically significant and adverse long-term impact on economic growth, according to the OLS model results displayed in Table 4. To put it another way, Turkey's economic growth slows by 0.10% for every 1% increase in military spending. Nonetheless, it is determined that capital formation and labor force participation have a positive and statistically significant impact on long-term economic growth at the 5% level. To put it another way, Turkey's economic growth increases by 0.68% for every 1% long-term increase in capital creation. Furthermore, it is discovered that a 1% long-term increase in the work force adds 0.13% to Turkey's economic development.

Regression analysis among variables with a cointegration relationship can be conducted using the FMOLS (Pedroni, 2001), CCR (Park, 1992), and DOLS (Stock and Watson, 1993) models. The primary feature of these models is that they perform regression using the level values of the variables, thereby preventing information loss due to differencing.

Table 5: Coefficient Estimates for FMOLS, DOLS and CCR Methods

Variable	Coefficient	Standard Error	*t*-statistic	Prob.
FMOLS				
ln*ME*	−0.126979	0.052196	−2.432760	0.0222
ln*LA*	0.144286	0.033623	4.291302	0.0002
ln*GCF*	0.777733	0.177970	4.370026	0.0002
C	5.504322	1.526057	3.606891	0.0013
DOLS				
ln*ME*	−0.384086	0.109644	−3.503016	0.0032
ln*LA*	0.284626	0.049175	5.788046	0.0000
ln*GCF*	0.861437	0.195865	4.398113	0.0005
C	5.943453	2.154622	2.758466	0.0146
CCR				
ln*ME*	−0.225813	0.096966	−2.328782	0.0279
ln*LA*	0.176252	0.043687	4.034427	0.0004
ln*GCF*	0.701260	0.183337	3.824973	0.0007
C	6.690389	1.794006	3.729302	0.0009

Source: Author's own calculations

The FMOLS coefficient indicates that economic growth rises by 0.14% for every 1% increase in ln*GCF* and by 0.77% for every 1% increase in ln*LA*. However, economic growth falls by 0.12% for every 1% increase in ln*ME*. The DOLS coefficient indicates that economic growth rises by 0.28% for every 1% increase in ln*GCF* and by 0.86% for every 1% increase in ln*LA*. Conversely, economic growth falls by 0.38% when ln*ME* rises by 1%. The CCR coefficient indicates that economic growth rises by 0.17% for every 1% increase in ln*GCF* and by 0.70% for every 1% increase in ln*LA*. Conversely, economic growth falls by 0.22% when ln*ME* rises by 1%.

Considering economic growth, the FMOLS, DOLS, and CCR coefficients increase by an average of 0.19% for each 1% rise in gross capital formation and by an average of 0.78% for each 1% increase in labor force participation. Additionally, the FMOLS, DOLS, and CCR coefficients show that each 1% rise in military expenditures decreases economic growth by an average of 0.24%. This finding aligns with the conclusions of the studies conducted by Yakovlev (2007), Hou and Chen (2013), and Dunne and Tian (2017). These studies demonstrated that military expenditures exert a negative and significant influence on the growth of both local and interstate war groups. These findings are consistent with the conclusions of the study by Arshad *et al.* (2017),

who reported the negative impact of military expenditures on the economies of 61 countries. Military expenditures in the face of internal and external threats in regions susceptible to war have a detrimental effect on economic growth, particularly for underdeveloped and developing country economies. Conversely, the present study's findings contradict those reported by Dimitraki and Win (2021), who asserted that military expenditures in Jordan promote long-term economic growth by fostering a secure investment environment and a conducive production environment.

In the case of Turkey, where military spending is often financed through borrowing, this can place significant pressure on public debt and interest payments. Consequently, allocating increased public debt resources to various sectors and excluding profitable investment opportunities may have a detrimental effect on economic growth. Furthermore, due to Turkey's underdeveloped domestic defense sector, a significant portion of its military equipment must be procured from foreign markets. This situation not only increases demand for foreign currency but also contributes to the current account deficit. As a result of rising external debt and capital outflows, the national currency may depreciate. Given Turkey's weak economic structure, this may adversely affect economic growth. Thus, any increase in military spending has the potential to expand Turkey's current account deficit relative to its GDP. To fully understand the relationship between military expenditures and economic growth, factors such as the degree of political stability or instability, the extent of budget negotiations with neighboring states, and other geostrategic concerns must be considered. If reducing military expenditures is not an option, the armed forces could meet civilian needs through programs such as education, training, introduction of new technologies, research and development, skill development, and deployment of military personnel to provide labor in rural areas (Benoit, 1973). Conversely, an increase in military expenditures generally raises demand for defense spending, increases employment, and enhances capital stock utilization. Through the multiplier effects of labor force and capital formation, this can have a positive effect on growth rates, providing beneficial economic outcomes over the long term.

In light of the study's findings, policymakers in developing economies that import military equipment face significant responsibilities. Military spending within the country's economy and the import of the majority of military technologies contribute to the continued increase in military expenditures due to rising geopolitical risks. The economy is heavily impacted by this situation, which is also strongly reflected in macroeconomic statistics. However, the increasing use of highly advanced military technologies leads to substantial capital loss and greater dependence on external resources. The privatization of military facilities has the potential to play an important role in minimizing military spending channels and increasing efficiency. In the United States, for instance, the privatization of military facilities has been advocated as a means to transfer skills and knowledge. This is particularly relevant in eras when governments lack the resources or political determination to engage in internal conflicts or civil wars on behalf of recognized regimes. This

has contributed to the over-capacity of military personnel and public savings (Calaguas, 2006). Consequently, the growing use of military equipment not only leads to increased costs in Turkey's military expenditures but also brings numerous adverse effects, including a reduction in economic growth. Developing domestic production technologies in Turkey will reduce foreign dependency in the military sector and lower military expenditure channels. Expanding domestic production capabilities offers significant opportunities for developing countries like Turkey, which are highly dependent on foreign sources. In addition to expenses associated with the implementation of domestic technology, reducing military expenditures that can ensure internal security, military independence, sustainable growth, and national security is vital. On the other hand, increases in military expenditures without economic returns may heighten demand for more spending and increase dependence on external financing. Therefore, by reducing military expenditures and losses, adopting efficient technologies for military equipment will not only enhance the use of domestic production technologies but also result in more efficient and effective spending opportunities.

These findings indicate that among the factors examined in Turkey between 1991 and 2022, the labor force has the most significant impact on economic growth, followed by gross capital formation and military expenditures. In conclusion, while military spending has a detrimental effect on Turkey's economy, growth in labor force and capital formation has a beneficial impact.

5. Conclusion and Policy Recommendations

In 1991, Turkey contributed 0.81% of global military expenditures and held a 0.63% share of global GDP. By 2022, Turkey's GDP had nearly quadrupled, while military expenditures had approximately doubled over this period. As the nation's wealth grew, military spending declined, with the share of military expenditures in GDP showing a 68% decrease compared to 1991 levels by 2022. According to data from the World Development Indicators (WDI 2024), Turkey's per capita income increased by 500% in 2022 compared to 1991, as it reduced military expenditures relative to its rising GDP. The ratio of Turkey's military expenditures to GDP has decreased over time. The ratio of military expenditures to general public expenditures has fluctuated over the years. For example, while this ratio was 15.8% in 2000, it decreased to 4.2% in 2022. This decline shows that the share of military expenditures in general public expenditures has decreased. Turkey's recent military industrial investments have helped boost exports, but the overall impact of these investments on economic growth depends on other political and economic conditions. In conclusion, Turkey's military expenditures as a share of general government expenditures and GDP have declined significantly over the period 1991–2022. This trend indicates that the importance of military expenditures in the budget is decreasing.

The methodology used in this study is the time series approach. Initially, the study assessed

the variables' stationarity. First, standard PP and ADF tests were used to assess the series' stationarity. The newly developed RALS-ADL test was used to evaluate the relationship between variables because all series became stationary after initial differencing. Finally, the study estimated long-term coefficients. The FMOLS estimator was combined with the DOLS and CCR estimators to improve the dependability of the OLS results. All estimation results showed a consistent resemblance in the size and direction of the variables.

In the literature, studies addressing military expenditures, capital formation, and labor force parameters together for Turkey are quite limited. Officials may find the data used in this study useful for examining causal links between foreign trade, investment activity, and geopolitical risks. Consequently, this study is anticipated to contribute to the literature.

In the case of Turkey, it was found that military expenditures were associated with slower economic growth over time, while increases in capital formation and labor force supported economic growth. According to the findings of FMOLS, DOLS, and CCR analyses, a 1% increase in the labor force and capital formation resulted in a long-term increase in economic growth of approximately 0.14%, 0.28%, and 0.17%, and 0.77%, 0.86%, and 0.70%, respectively. However, findings from FMOLS, DOLS, and CCR analyses indicate that a 1% increase in military expenditures led to a long-term decrease in economic growth of approximately 0.12%, 0.38%, and 0.22%, respectively.

It is crucial to keep in mind that military spending and economic growth are inversely correlated. This implies that any decrease in military spending boosts economic growth. The study's findings indicate that while labor force participation and capital formation have a favorable effect on economic growth in Turkey over the studied period, military spending has a negative effect. Consequently, all relevant issues related to capital formation and labor should be supported within the country. Additionally, policymakers should focus on fostering new capital investments and skilled labor potential to promote economic growth. As posited by Francis (2009), human capital, in contrast to land and other natural resources, possesses the capacity to mitigate the benefits of conflict due to the challenges associated with its allocation or transfer. It is hypothesized that increasing investments in military R&D will contribute more to the value of human life and high economic returns (Navarro-Galera and Maturana, 2011; Inal *et al.*, 2024). In this regard, it is imperative to augment R&D investments that foster innovation and technological development in Turkey. This will positively impact national competitiveness and contribute to the economic growth process.

According to the findings of this study, Turkey's priorities as a developing country can be seen as capital formation and the development of a skilled labor force. However, the tendency to allocate funds to the military while engaging in these activities limits the country's ability to achieve

economic progress. Consequently, it is crucial for Turkey to sustain economic development while managing increases in military expenditures. Military activity in the Middle East, where regional tensions are ongoing, prompts Turkey to prioritize military strategies and take steps to increase its military capacity. Turkey has begun to pursue various policies to reduce its dependence on foreign sources due to the economic and strategic importance of its military industry. Accordingly, Turkey should continue an industrialization policy that promotes military technologies and encourages foreign direct investment, where military expenditures can yield economic returns.

In view of global trends, there is an ongoing increase in military expenditures both in Turkey and worldwide. Despite Turkey's considerable progress in military technology production, specialization in domestic production in the military sector is yet to be fully achieved. Therefore, investments and incentives in military spending in Turkey should be utilized more effectively. This will enable Turkey to make the best use of its existing potential and create positive momentum for military expenditures within the country. Additionally, as a result, Turkey will have significant opportunities in the field of international military technology.

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