Chapter 1

The Relationship Between Defense Expenditure and Economic Growth: Empirical Evidence From Countries With High Defense Expenditure (1992-2022)

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Abstract

This study aims to investigate the impact of defense expenditures on economic growth for the period 1992-2022, in the sample of 10 countries with the highest defense expenditures (USA, China, Russia, India, Saudi Arabia, United Kingdom, Germany, France, Japan and South Korea). The AMG (Augmented Mean Group Estimator) test approach is preferred İn the panel data research process of the study. The findings of the study show that defense expenditure positively affects economic growth in certain country samples. The effect of the control variables of the research model, population growth rate and inflation, on economic growth varies across country samples. The results of this study, which are supported by the literature, show that defense expenditures may contribute to economic growth and development process if they are directed towards domestic production and integrated with modern technology.

1. Introduction

Countries need some military power to ensure security against internal and external threats. However, any use of resources in the military sphere creates an opportunity cost as it prevents these resources from being used more efficiently. This is particularly important for developing countries, where most of the post-Cold War wars took place. The end of the Cold

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War led to significant reductions in military expenditures worldwide, but not at the same level in all parts of the world. However, some countries have increased their military expenditure because of insecurity, arms races and pressure from developed countries to export arms (Dunne, 2000, p. 2). Particularly in developing countries, the complexity of defense-related factors arises from their stage of development, the geopolitical position of their neighbors, their military burden, the presence or absence of a domestic arms industry, and the degree of military involvement in governance (Dunne & Tian, 2013, p. 6). Between 1960 and 1987, developing countries' military expenditures increased three times faster than those of developed countries. Military aid from superpowers, the search for export markets by major arms manufacturers, and a series of regional conflicts and instability have all contributed to this growth. In third-world countries, military spending is declining due to factors such as poverty, economic security, environmental security, and food security. Some of the world's poorest countries allocate their limited foreign exchange resources to purchasing weapons and prioritizing military investments over public education and healthcare. The cost of military security at the expense of economic and social development is substantial and often lacks justification in terms of national security (Dunne, 2000, p. 2). To develop disarmament policies, the role of military expenditure in the economy should be carefully examined.

The relationship between military expenditures and economic growth was first discussed in Benoit's (1973) studies, which argued that there is a positive relationship between the two variables in developing countries. Benoit argued that an increase in the education level of the labor force would also increase their human capital, which in turn would support economic growth. Ball (1983) provided a comprehensive critique of Benoit's work and obtained alternative conclusions. Although this paved the way for important research activities and led to many econometric analyses to overcome the shortcomings, the relationship between military expenditures and economic growth is still a controversial issue among economic managers and policymakers (Dunne & Nikolaidou, 2012, p. 537). Since the beginning of the debate in literature in the 1970s, there has been no consensus on whether military expenditures affect growth, and if so, whether directly or indirectly (Sandler & Harley, 2007). This disagreement in the literature is caused by differences in the theories, methodologies and estimation techniques used. Those who argue that the relationship between military expenditures and economic growth is positive are based on supply-side policies and aggregate demand, while those who argue that the relationship is negative are based on

public expenditures and the crowding-out effect (Arshad, Syed, & Shabbir, 2017, p. 162).

In the existing literature, four main theories have been proposed regarding the relationship between military spending and economic growth, which are applicable to both developed and developing nations. The first of these is the neoclassical theory. According to the neoclassical perspective, the state is seen as a rational entity that weighs the opportunity cost of defense spending against the security benefits it provides. In terms of social welfare, defense expenditures are considered a form of public spending, and the economic impact of military outlays depends on the balance between opportunity costs and other forms of expenditure. Inefficient allocation of state resources to defense, when these resources could be better utilized in other sectors, can lead to negative consequences for economic growth (Yılgör, Karagöl, & Saygılı, 2014, p. 194).

The Keynesian approach regards the state as an active participant in the economy, utilizing military expenditure as part of government spending to boost economic output via the multiplier effect, especially in times of inadequate aggregate demand (Stewart, 1991; Faini et al., 1984). Military expenditures can help stimulate economic activity, particularly during periods of high unemployment, through the Keynesian multiplier. Keynes argued that such spending drives growth, which subsequently leads to increased profits and promotes further investment. As a result, rapid growth rates can be achieved through short-term multiplier effects (Benoit, 1978).

The theoretical framework, which merges radical and liberal perspectives with a Keynesian view, emphasizes that while military spending can stimulate growth, it may also lead to industrial inefficiencies and foster the creation of influential interest groups composed of individuals, companies, and organizations. From a Marxist standpoint, military expenditures are seen as a significant factor in capitalist development. According to this theory, while military spending is vital on its own, it also serves as an essential part of the broader theoretical analysis. Developed by Baran and Sweezy (1966), this approach asserts that military expenditure plays a crucial role in addressing economic crises and safeguarding profits.

Theoretical literature suggests that military spending can influence economic growth through various channels. However, the actual magnitude, nature, and direction of these effects need to be determined by empirical studies. One key channel is the labor force. Military expenditures can have both positive and negative consequences for growth. On the positive side, the military may train individuals in technical and managerial skills that are

transferable to civilian life. On the other hand, it may divert skilled labor and resources from the civilian industrial sector, potentially hindering growth (Benoit, 1978). The second channel is related to capital. If military spending is funded through taxes, reducing such expenditures over time can encourage saving. However, in nations where raising tax revenue is challenging, military expenditures might be financed by expanding the money supply, which could reduce savings and contribute to inflation (Dunne, 2000, p. 11). The impact of military spending on economic growth can also be linked to external factors, such as the balance of payments. This impact depends on whether a country produces its own weapons or relies on imports and whether it receives military aid. For developing countries, particularly those with limited foreign exchange, arms imports can impose a significant economic burden and contribute to trade deficits. However, military expenditure can also enhance security and attract foreign investment. Another channel through which military expenditure affects growth is the demand channel. Increased military spending can stimulate aggregate demand, leading to higher output, especially in situations of underemployment, with the multiplier effect enhancing income and investment (Adams, Behrman, & Boldin, 1991). Lastly, from a socio-political perspective, military spending can create an environment conducive to development. The military's role in controlling and disciplining labor, minimizing internal conflicts, and modernizing society can support economic progress. It can also equip conscripts with skills valuable for the industrial workforce once they transition to civilian life (Dunne, 2000, p. 11).

Although there is no consensus on the economic impact of military spending, the prevailing view is that it either has little to no effect on economic growth or negatively impacts it (Dunne, 2000, p. 14). Following Benoit's (1973) assertion of a positive link between military spending and economic growth, only a few studies have supported this idea. Hassan, Waheeduzzaman, and Rahman (2003) suggested that military expenditure could stimulate economic growth by boosting aggregate demand or enhancing security, but it could also harm growth by reducing investment. According to Değer and Smith (1983), an increase in military spending may obstruct economic progress. This increase in spending could divert resources such as capital and technology, which are crucial for growth-oriented consumption and investment, potentially creating bottlenecks and hindering overall development in a constrained economy.

A primary concern regarding military expenditures is that many nations continue to allocate substantial funds to their military sectors. These countries often justify the increase in defense spending by the belief that

maintaining high military budgets is crucial for global peace and that it will not necessarily lead to war. However, the necessity of raising taxes to fund these expenditures is believed to negatively affect long-term economic growth (Hirnissa, 2008). Studies indicate that the relationship between military spending and economic growth can vary across countries and government types, with the factors influencing this relationship being unique to each nation and not easily generalized. While economic theory suggests that reducing military spending could improve economic performance or provide a "peace dividend" for developing nations, the existing literature does not provide a clear answer on whether military spending is an economic burden or if it brings positive outcomes.

The impact of defense expenditure on economic growth has been critically important in the development strategies of many developing countries. Defense expenditures are linked to economic growth and development through various channels such as technological development, employment and infrastructure investments. It is believed that the long-term effects of defense expenditures on technological development and infrastructure will directly affect economic sustainability, which remains one of the important economic goals of today. In the light of this motivation, this study investigates the impact of defense expenditures on economic growth for the period 1992-2022, in the sample of countries with the highest defense expenditures (USA, China, Russia, India, Saudi Arabia, United Kingdom, Germany, France, Japan and South Korea). For this purpose, the AMG (Augmented Mean Group Estimator) test approach is employed. This method is preferred because it accounts for cross-sectional dependence and parameter heterogeneity, while also providing long-run coefficient estimates for each cross-sectional unit. A review of the literature reveals that empirical studies on the relationship between defense expenditure and economic growth have largely focused on earlier periods. In today's context, where the concept of sustainable development has gained more importance, it is thought that evaluating the effect of the increase in defense investments on economic growth in light of recent developments is expected to provide a novel contribution to the related field. For this purpose, emphasis has been placed on discussing the empirical findings on a country-specific basis. The policy recommendations proposed at the end of the study aim to contribute to economic sustainability, especially for developing countries. Following the introduction, the paper proceeds with a literature review, model specification and data, methodology, empirical findings and discussion, and concludes with final remarks.

2. Literature Review

The impact of defense expenditure on economic growth has long been a subject of academic inquiry. This line of research began with the pioneering work of Benoit (1973) and has since been extended by numerous empirical studies. Despite the considerable volume of literature, there is still no clear consensus on the nature and direction of the relationship between defense expenditure and economic growth.

Table 1: Some Empirical Studies on the Relationship between Defense Expenditures and Economic Growth

Author(s)	Period	Sample	Method	Result(s)
Benoit (1973, 1978)	1950-1965	44 developing countries	3SLS	DE[3] positively affects EGROWTH[4].
Değer and Smith (1983)	1965-1973	50 underdeveloped countries	3SLS	DE has a small positive effect on EGROWTH. It has no negative effect.
Cappelen, Gleditsch, and Bjerkholt (1984)	1960-1980	17 OECD countries	2SLS	DE has a negative effect on EGROWTH.
Biswas and Ram (1986)	1960-1970 ve 1970-1977	58 underdeveloped countries	Traditional and Feder-2 Sector Models	No significant association was found between DE and EGROWTH.
Kinsella (1990)	1943-1989	United States	VAR	No causality is found between DE and EGROWTH.
Chowdhury (1991)	1961-1987	55 developing countries	Granger causality test	There is no general comparison between DE and EGROWTH.
Galvin (2003)	1999	64 developing countries	SLS, 2SLS, 3SLS	There is a unidirectional causality from DE to EGROWTH.
Kollias, Manolas, and Paleologou (2004)	1961-2000	AB countries	VECM	The relationship between DE and EGROWTH cannot be generalized.
Lee and Chen (2007)	1988-2003	89 countries	Panel co-integration and long-term causality test	There is a long-run relationship between DE and EGROWTH.
Hirnissa (2008)	1965-2006	5 Asia countries	ARDL ve DOLS	The causality between DE and EGROWTH cannot be generalized.

3 DE stands for defense expenditure.

4 EGROWTH stands for economic growth.

Chang, Huang, and Yang (2011)	1992-2006	90 countries	Granger causality test	The relationship between DE and EGROWTH cannot be generalized.
Dunne and Nikolaidou (2012)	1961-2007	AB countries	Panel data analysis	DE supports EGROWTH.
Chen, Lee, and Chiu (2014)	1988-2005	137 countries	GMM	There is a short-run causality from DE to EGROWTH in low, middle and high-income countries.
Yılgör, Karagöl, and Saygılı (2014)	1980-2007	developed countries	Granger causality test	DE positively affects EGROWTH.
Gökmenoğlu, Taşpınar, and Sadeghieh (2015)	1988-2013	Türkiye	Johansen co-integration and Granger causality test	In the long run, there is a co-integration relationship between DE and EGROWTH but no causality relationship.
Topçu and Aras (2015)	1973-2010	AB countries	Granger causality test	There are countries where there is bidirectional causality between DE and EGROWTH and countries where there is no causality.
Destek (2016)	1988-2014	14 NATO countries	Panel data analysis	There is bidirectional causality between DE and EGROWTH.
Arshad, Syed, and Shabbir (2017)	1988-2015	61 countries	Panel data analysis	DE can slow down EGROWTH.
Kılıç, Açdoyuran, and Beşer (2018)	1992-2016	G8 countries	Emirmahmutoğlu and Köse (2011) causality test	There is a bidirectional causality between DE and EGROWTH.
Kollias, Paleologou, Tzeremes, and Tzeremes (2018)	1961-2014	13 Latin America countries	Linear and non-linear causality test	No strong causality relationship is found between DE and EGROWTH.
Turan, Karakaş, and Özer (2018)	1988-2016	12 low-income countries 29 high-income countries	Westerlund (2007) co-integration and Dumitrescu-Hurlin causality test	There is co-integration between DE and EGROWTH. There is bidirectional causality between DE and EGROWTH for low-income countries and unidirectional causality from DE to EGROWTH for high-income countries.

Ceyhan and Asıloğulları (2019)	2000-2016	35 OECD countries	Panel Pedroni co-integration test	1% increase in DE reduces EGROWTH by 5%.
Sağdıç, Tekin, and Yıldız (2019)	2005-2017	21 AB countries	Panel data analysis	There is bidirectional causality between DE and EGROWTH.
Yantur and Gürson (2019)	1960-2017	ABD, Japan ve France	Time series analysis	While there is an equilibrium between DE and EGROWTH in the long run, bidirectional causality is found.
Gölpek, Köse, and Doğan (2020)		G8 countries	Dumitrescu-Hurlin causality test	There is no causal relationship between DE and EGROWTH.
Su, Chang, Lobont, and Liu (2020)	1952-2014	China	Granger causality test	There is a positive bidirectional causality between DE and EGROWTH.
Koçbulut and Altıntaş (2021)	1995-2018	17 OECD countries	Panel Threshold Regression	It was found that the effect of DE on EGROWTH may vary depending on the threshold value.
Özcan (2021)	2000-2018	G-20 countries	Panel data analysis	While there is no significant relationship between DE and EGROWTH in developed countries, DE positively affects EGROWTH in developing countries.
Torun, Eroğlu, and Bayrak (2021)	1991-2016	26 NATO countries	Panel data analysis	Fixed capital investment and employment have a positive effect on growth and a negative effect on DE.
Zülfüoğlu (2021)	2005-2019	35 OECD countries	Panel data analysis	DE affects EGROWTH negatively in the long run.
Oğul (2022)	2000-2020	ABD, China, India, Russia and United Kingdom	FMOLS and DOLS	There is a co-integration relationship between DE and EGROWTH. Across the panel, DE increases EGROWTH.
Koçak (2023)	2000-2021	Türkiye and selected world countries	Panel data analysis	There is a negative relationship between DE and EGROWTH.

Some studies on the related topic suggest that defense expenditures have a positive impact on economic growth. Numerous studies, including Benoit (1973, 1978), Değer and Smith (1983), Dunne and Nikolaidou (2012), Yılgör et al. (2014), Su et al. (2020) and Oğul (2022) have investigated the

impact of defense expenditure on economic growth across different sample groups and time periods. Their findings suggest that this effect tends to be more pronounced in developing countries. Nevertheless, other studies have reported that the impact may be negative or statistically insignificant, highlighting the lack of consensus in empirical literature. Studies such as Cappelen et al. (1984), Arshad et al. (2017), Ceyhan and Asıloğulları (2019), Zülfüoğlu (2021) and Koçak (2023) argue that defense expenditure has a negative effect on economic growth and this effect is very limited. The findings of these studies support the theoretical approaches suggesting that defense expenditures may cause resource inefficiency. Studies such as Topçu and Aras (2015), Turan et al. (2018), Koçbulut and Altıntaş (2021) argue that the effect of defense expenditures on economic growth cannot be explained by an indisputable result and that there are different variables that may affect the direction and degree of this relationship. According to these studies, the sample and period examined, the income and economic development level of countries, the economic structure of countries, the monetary value of defense expenditure may be direct or indirect determinants of the relationship between defense expenditures and economic growth. Undoubtedly, the use of different methodological techniques may also be effective in the emergence of different results between these two variables. A review of the literature on the subject reveals that a variety of methodological approaches have been employed, including 2SLS, 3SLS, Granger Causality Test, co-integration tests, as well as time series and panel data analysis.

As a result of the literature review, it is observed that in addition to findings indicating positive, negative and statistically insignificant relationship between defense expenditure and economic growth, several studies also reveal the existence of both unidirectional and bidirectional causality from defense expenditure and economic growth. In order to understand the impact of defense expenditure on economic growth, it is clear that more comprehensive analyses that consider country-specific, cyclical and structural factors are needed. For this reason, this study opts for conducting a panel data analysis using the AMG approach, focusing on a sample of the 10 countries with the highest defense expenditure. The objective of this study is to assess the relationship between defense expenditures and economic growth from a novel and distinct perspective, drawing on the results for each country in the sample group.

3. Model, Data Set, and Method

This study aims to explore the effect of defense spending on economic growth in a sample of 10 countries with the highest defense budgets (USA,

China, Russia, India, Saudi Arabia, United Kingdom, Germany, France, Japan, and South Korea) over the period from 1992 to 2022. The control variables in the research model include population and inflation. To examine how independent variables influence the dependent variable, the AMG (Augmented Mean Group Estimator) test, developed by Eberhardt and Bond (2009), is employed. The research model is formulated using a semi-logarithmic approach, with economic growth as the dependent variable and defense expenditure in its logarithmic form. Population and inflation are included as independent variables in their linear forms. In developing the model, the studies of Benoit (1978), Dunne and Nikolaidou (2012), and Arshad et al. (2017), which focus on similar areas of research, are referenced.

$$LEGROWTH_{it} = \beta_0 + \beta_1 LDE_{it} + \beta_2 POP_{it} + \beta_3 INF_{it} + u_{it} \qquad (1)$$

In equation 1, EGROWTH stands for economic growth; DE stands for defense expenditures; POP stands for population; INF stands for inflation. Among the parameters to be obtained as a result of the estimation of the model, β_0 represents the constant term; β_1 represents the effect coefficient of defense expenditures; β_2 represents the effect coefficient of population; β_3 represents the effect coefficient of inflation on the dependent variable; and u_{it} represents the error term of the model. The source information of the variables used in the research model is shown in Table 2 below:

Table 2: Description of the Data

Abbreviation	Description	Source
LEGROWTH	Logarithm of GDP at 2015 constant prices	WB – World Bank Development Indicators
LDE	Logarithm of defense expenditure at 2022 constant prices	SIPRI – Stockholm International Peace Research Institute
POP	Population growth rate	WB – World Bank Development Indicators
INF	GDP deflator % annual	WB – World Bank Development Indicators

In estimating the research model, cross-section dependence test, panel unit root test, homogeneity test, co-integration test and long-run coefficient estimation stages were followed in accordance with the panel data analysis process. E-views, Gauss and Stata programs were used in the analysis stages. In this section of the study, methodological information about the tests used in the research method will be provided.

3.1. Cross-Section Dependence

In panel data analysis, the cross-section dependence test is utilized to assess whether a shock impacting one sample also influences the other samples in the dataset. Taking cross-section dependence into account during the analysis helps determine the appropriate unit root test to apply. If such dependence is detected, second-generation unit root tests are preferred, as they provide more reliable coefficient estimates for model estimation (Baltagi and Pesaran, 2007). Literature offers several approaches for testing cross-section dependence. Among the most used are the Breusch-Pagan (1980) Lagrange Multiplier CD_{LM1} and the Pesaran (2004) Scaled Lagrange Multiplier CD_{LM2} tests. These tests, typically employed when $T > N$, examine the correlation between the error terms across cross-sections. The null hypothesis for these tests assumes that there is no cross-sectional dependence.

3.2. Panel Unit Root Test

The concept of stationarity, which can be defined as the constancy of the mean, variance and auto-covariance of a series over time, means that the series converges to a value in the long run or fluctuates around the expected value. Failure to perform a unit root test or not choosing the right test techniques in the analysis process will increase the likelihood of spurious regression problem because of working with non-stationary series. If cross-section dependence is detected in the panel data analysis process, second-generation unit root tests should be preferred (Yerdelen Tatoğlu, 2017). In this study, the CIPS test developed by Pesaran (2007), one of the second-generation unit root tests, is preferred to be used considering the cross-section dependence. The CIPS test is calculated over the model numbered 2 below and the test statistics obtained are compared with the critical values obtained using Monte Carlo simulation.

$$CIPS\left(N,T\right) = N^{-1}\sum_{i=1}^{N} t_i\left(N,T\right) \tag{2}$$

The H_0 hypothesis of the CIPS unit root test asserts that the series is non-stationary. If the CIPS test statistics are greater than the critical values in absolute value, the H_0 hypothesis is rejected, and the series is stationary.

3.3. Homogeneity Test

In panel data analysis, the homogeneity test is used to determine whether the slope parameters are homogeneous across units. The most commonly

used approach for homogeneity testing is the delta test. The delta test is a modern function of the Swamy (1970) homogeneity test developed by Pesaran and Yamagata (2008). The delta homogeneity test, which provides effective results for different values of N and T, has two equation models that can be used in large and small samples.

The delta homogeneity test modelling used in panel data analyses with large samples is shown in equation 3.

$$\Delta = \sqrt{N}\ \left(\frac{N^{-1}\hat{S} - k}{\sqrt{2k}}\right) \tag{3}$$

The adjusted delta homogeneity test modelling used in panel data analyses with small samples is shown in equation 4.

$$\Delta_{adj}\ =\ \sqrt{N}\ \left(\frac{N^{-1}\hat{S} - k}{V\left(T,k\right)}\right. \tag{4}$$

In these models, N is the sample size, S is the Swamy test statistic, k is the number of explanatory variables and V(T, k) is the standard error. The H_0 hypothesis of the Delta homogeneity test asserts that the slope coefficient is homogeneous. Acceptance of the H_0 hypothesis means that panel statistics can be used instead of group statistics in interpreting the relationship between the series.

3.4. Co-integration Test

In the study's panel data analysis, the Durbin-Hausman test, developed by Westerlund (2008), is utilized to assess the presence of a co-integration relationship between the variables. This test is applicable when the dependent variable in the model is stationary at the first difference, while the independent variables may be stationary at either the level or first difference. Additionally, the test accounts for cross-sectional dependence and evaluates whether the parameters are homogeneous or heterogeneous.

In the Durbin-Hausman co-integration test, two different co-integration tests are proposed, one for the panel as a whole and the other for each sample group forming the panel. The co-integration statistic for the panel as a whole (DH_p) assumes that the series in the panel are homogeneous, while the co-integration statistic for each sample group (DH_g) assumes that the series in the sample groups are heterogeneously distributed. At this

stage, while the DH_p test assumes that the autoregressive parameters are the same for all cross-sections forming the panel, the DH_g test assumes that the autoregressive parameters differ from cross-section to cross-section. The H_0^P and H_0^g hypotheses for the panel and group statistics of the Durbin-Hausman co-integration test, respectively, suggest that there is no co-integration relationship (Westerlund, 2008, p. 203).

The acceptance or rejection of hypotheses using the Durbin-Hausman co-integration test statistic for both panel data and sample groups involve comparing the computed statistic to critical values derived from the normal distribution table and the significance levels of the test. If the computed value exceeds the critical value from the table and shows statistical significance, the null hypothesis (H0) is rejected, suggesting the existence of a co-integration relationship for both the panel and the sample groups. Rejecting the null hypothesis based on the panel's co-integration statistic implies that a co-integration relationship is present across all sections within the panel. Conversely, rejecting the null hypothesis based on the co-integration statistics of the sample groups signals a co-integration relationship in at least one of the groups. When a co-integration relationship is found within the sample groups, it indicates a long-term connection between the series in the panel, ensuring that analyzing these series at their level values avoids the risk of spurious regression.

3.5. Long Run Coefficient Estimation

In the research model of the study, the AMG estimator is used to estimate the long-run coefficient of independent variables on the dependent variable. This estimator, developed by Eberhardt and Bond (2009), considers cross-sectional dependence and heterogeneity of the parameters and estimates the long-run coefficient for both the panel as a whole and for each cross-section. The AMG estimator is an approach that considers dynamic effects and common factors in variables. It can also provide reliable results in unbalanced panel analyses in case of endogeneity problems arising from error terms.

The equation models developed for the AMG estimator (5) are shown as follows:

$$
\begin{aligned}
&Y_{it} = \beta_i^{'} X_{it} + u_{it} \qquad u_{it} = \alpha_i + \lambda_i^{'} f_t + \varepsilon_{it} \\
&x_{mit} = \pi_{mi} + \delta_{mi}^{'} g_{mt} + p_{1mi} f_{1mt} + \ldots + p_{nmi} f_{nmt} + v_{mit} \\
&f_t = \boxtimes' f_{t-1} + \varepsilon_{it} \quad \text{ve} \quad g_t = K' g_{t-1} + \varepsilon_t \\
&Y_{it} = \alpha_0 + \beta_L (L_{it}) + \alpha_k (K_{it}) + \alpha_R (R_{it}) + u_{it}
\end{aligned} \tag{5}
$$

In these equation models, i = 1,..N; t = 1,...T; m = 1,...k and $f_{mt} \subset f_t$. Furthermore, X_t^i represents the vector of observable covariates; α_i shows the combination of group-specific effects; λ^i refers to the country-specific factor loadings; f_t and g_t represent unobservable common factors.

4. Empirical Findings

The panel data analysis process consists of cross-section dependence test, panel unit root test, homogeneity test and co-integration test analyses, which are considered as pre-tests. This process is completed with the estimation of the long-run coefficient related to panel data analysis.

Table 3: Cross-Section Dependence Test Results

Cross-section Dependence Tests				
Variables	**Breusch – Pagan LM Test (CD_{LM1})**		**Pesaran Scaled LM Test (CD_{LM2})**	
	Test Statistic	**Probability**	**Test Statistic**	**Probability**
LEGROWTH	1281.431***	0.000	130.3313***	0.000
LDE	585.5062***	0.000	56.9743***	0.000
POP	370.6961***	0.000	34.3313***	0.000
INF	158.6755***	0.000	11.9824***	0.000
Model Equation	191.1719***	0.000	15.4078***	0.000

Description: *** indicates 1% statistical significance level.

The cross-section dependence test serves as an initial assessment to determine the appropriate unit root test for panel data analysis. Upon reviewing the test statistics and probability values presented in Table 3, it is observed that there is cross-section dependence in the model variables and equations at the 1% significance level. This indicates that a shock in one sample in the cross-sectional dimension could potentially impact other samples. Consequently, to ensure the scientific accuracy and reliability of the study, the panel data analysis should proceed with second-generation unit root tests.

Table 4: Panel Unit Root Test Results

CIPS Panel Unit Root Test				
Variables	**Test Statistic**	**Table Critical Values**		
		%1	**%5**	**%10**
LEGROWTH	-2.580	-3.11	-2.86	-2.73
LEGROWTH (1)	-3.502***			
LDE	-2.381			
LDE(1)	3.674***			
POP	-2.873**			
INF	-2.961**			

Description: *** and ** indicate 1% and 5% statistical significance level, respectively.

Table 4 shows the CIPS panel accumulation root test statistics calculated for the model with constant and trend. When the test statistics calculated for the variables are analyzed, it is seen that LEGROWTH, the dependent variable of the model, and LDE, the main independent variable of the model, are stationary at first difference, while POP and INF, the control variables of the model, are stationary at level. Determining at which level the model variables are stationary is a decision criterion for the co-integration test to be preferred in the analysis process.

Table 5: Homogeneity Test Results

Delta Homogeneity Test		
Delta Test	**Test Statistic**	**Probability**
Δ	14.576***	0.000
Δ_{adj}	15.916***	0.000

Description: *** indicates 1% statistical significance level.

Another pre-test of the panel data analysis process is the homogeneity test. The homogeneity test examines the homogeneity or heterogeneity of the slope parameters for each sample in the cross-section. Homogeneity of slope parameters implies that the independent variable has the same effect on the dependent variable for the sample group. The delta test statistics and probability values in Table 5 show that the slope parameters of the model

are heterogeneous at the 1% significance level. This result means that the independent variables have a different effect on the dependent variable for each sample in the cross-sectional dimension.

Table 6: Panel Co-integration Test Results

Durbin-Hausman Co-integration Test		
	Test Statistic	**Probability**
DH_g	2.503***	0.006
DH_p	4.085***	0.000

Description: *** indicates 1% statistical significance level.

In the research model, the fact that the dependent variable LEGOWTH is stationary at the first difference and the independent variables LDE, POP and INF are stationary at the first difference and at the level has been decisive in choosing the Durbin-Hausman test as the co-integration test. When the co-integration test statistics and probability values in Table 6 are analyzed, it is evident that there is a co-integration relationship between the variables at the 1% significance level for at least one group in the panel and for the overall panel. Detection of co-integration relationship between variables in the panel co-integration test is a critical stage for the long-run coefficient estimation. Following this stage, the long-run coefficient estimation of the research model can proceed.

Table 7: Long Run Coefficient Estimation Results

AMG Test Results			
Countries	**LDE**	**POP**	**INF**
USA	-0.035	0.011	0.003*
China	0.345***	0.017	0.000
Russia	0.225***	-0.008	0.000**
India	0.243*	-0.205***	-0.002*
Saudi Arabia	0.298***	-0.017**	0.000
United Kingdom	-0.027	0.028**	-0.002*
Germany	0.106***	0.001	-0.000
France	0.046	0.063***	-0.000
Japan	0.074	0.041***	-0.000
South Korea	-0.157	-0.006	-0.000

Description: ***, **, and * indicate 1%, 5%, and 10% statistical significance level, respectively.

Table 7 presents the results of long-run coefficient estimation using the AMG method from the panel data analysis. Analyzing these results reveals that the independent variables have varying impacts on the dependent variable. Specifically, defense spending (LDE) positively affects economic growth (LEGROWTH) in China, Russia, India, Saudi Arabia, and Germany, with China showing the most substantial effect. In China, a 1% increase in defense spending leads to a 0.345% rise in economic growth. Conversely, there is no statistically significant relationship between defense spending and economic growth in the USA, United Kingdom, France, Japan, and South Korea. The findings in this study align with the conclusions of Benoit (1973, 1978), Değer and Smith (1983), Dunne and Nikolaidou (2012), and Su et al. (2020), supporting the idea that defense expenditures can influence economic growth.

The effect of population growth rate (POP), one of the control variables of the model, on economic growth differs from country to country within the sample group. While the population growth rate positively affects economic growth in the United Kingdom, France and Japan, it negatively affects economic growth in India and Saudi Arabia. The biggest impact of population growth rate on economic growth is observed in the case of India. In India, a one-unit increase in population has a negative effect of 0.205% on economic growth.

Similar to the population growth rate, the increase in the inflation rate (INF), which is another control variable of the model, has different effects on the dependent variable of the model, economic growth. However, the results obtained for the INF variable show that the increase in the inflation rate has a very limited effect on economic growth. While the increase in inflation has a limited positive effect on economic growth in the USA and Russia, this effect is quite limited and negative in the cases of India and the United Kingdom.

The variation in the positive impact coefficient of defense expenditures on economic growth across countries is directly linked to the nature of the defense expenditure itself. Defense expenditure directed towards technology, R&D and infrastructure investments are expected to have a more positive impact on economic growth. China, where the positive impact of defense expenditure on economic growth is the highest, has increasingly prioritized technology-oriented domestic production in recent years. China is a country that provides significant support to domestic firms in defense expenditures. Domestic production in the field of defense has a positive impact on production and employment through the multiplier mechanism. In addition,

the increase in defense expenditure contributes to the growth of domestic firms, the development of technology and the expansion of the supply chain, thus increasing its positive impact on economic growth. Russia is one of the countries with the highest defense expenditures in the world. The defense industry in Russia is a sector that develops under the control of the state and is the locomotive of the economy. In recent years, defense investments in space technology, nuclear energy infrastructure, aviation and heavy industry have made significant contributions to the development of the country in terms of production and income. The conclusion drawn from the examples of China and Russia is that defense investments are focused on domestic investment, modern technology and employment in the production process. Saudi Arabia can be cited as an important example in this perspective, especially in recent years. Saudi Arabia places special emphasis on the defense industry as part of its 2030 industrialization target. The establishment of new military bases and logistics centres in the field of defense in Saudi Arabia are investments that encourage domestic production in the economy. Nevertheless, the quality and efficiency of domestic investment should be carefully evaluated in countries where the impact of defense expenditures on economic growth is relatively low. It is economically expected that defense expenditures, which do not focus on modern technology and face challenges in integration with other sectors of the production process, will have a limited positive impact on economic growth.

Population and human capital are among the most important dynamics of economic growth. Nevertheless, technological developments increase their effectiveness on economic growth over time. At this stage, the question of whether population or technological development is a more effective actor on economic growth has not yet been clearly answered. However, population also supports economic growth with the effect of the demand it creates. Therefore, population is expected to have a positive effect on economic growth. In the empirical findings of this study, it is noteworthy that population has a negative effect on economic growth in India and Saudi Arabia. India, one of the most populous countries in the world, has made significant progress in education, particularly in recent years. Currently, India is among the countries with the highest higher education volume after China and the USA. Despite these developments, at the beginning of the 21st century, India faced significant disparities in literacy rates between rural and urban areas, as well as between males and females. The country also experienced a low schooling rate, high grade repetition, and a literacy rate that was far from satisfactory. These recent educational setbacks are considered to be the main reasons for the negative impact on economic growth during the

research period of this study. However, the education campaigns that have been effective in India in recent years are expected to have positive effects on economic growth. In Saudi Arabia, the main dynamic of economic growth is oil. A significant portion of the population is employed in the public sector, while foreign labor is predominantly employed in the private sector, particularly in industries with higher productivity. The stagnation in education and technological development is likely to be the main reason for the negative impact of population on economic growth.

When the effect of inflation, one of the control variables of the research model, on economic growth is analyzed, it is concluded that inflation has a positive effect on economic growth in USA and Russia, while it has a negative effect on economic growth in India and United Kingdom. In all four countries in the sample, the effect of inflation on economic growth is very limited. Economic theories argue that stable and low-rate inflation has a positive effect on economic growth while unstable and high-rate inflation has a negative effect on economic growth. There are many transmission channels that can explain the effect of inflation on economic growth. These include changes in real income, income inequality, production, consumption and saving decisions, and the effectiveness of monetary and fiscal policies. However, in conclusion, the effect of inflation on economic growth is mainly related to the expectations, confidence and psychology of economic actors.

5. Conclusion

This study aims to investigate the impact of defense expenditure on economic growth for the period 1992-2022, in a sample of 10 countries with the highest defense expenditure. The results of the panel data analysis indicate that defense expenditure has a positive impact on economic growth in China, Russia, India, Saudi Arabia and Germany. This result is in line with the Benoit hypothesis and the Keynesian view that defense expenditure supports economic growth. Moreover, the control variables of the research model, population and inflation, are found to have effects on economic growth in different directions and at different levels for different country samples. However, the effect of inflation on economic growth is very limited for the countries in the research sample.

The question of whether military investments should be made, or defense expenditure should be increased is an important political economic decision that cannot be explained by a single factor. In addition to economic capabilities, the geo-political position of the country and international political relations are also important factors in this decision. In the last

century, EU countries have not faced any significant security risks. However, it is difficult to talk about the same security situation in the former Soviet and Middle East regions. Therefore, it may be necessary for the countries of this region to spend more on defense. However, defense spending cannot be expected to produce similar economic results for each country. The most important reason for this observation can be explained by the concepts of defense investment and defense expenditure. Defense investment is defense expenditure, but defense expenditure is not always defense investment. Defense investment is a long-term investment associated with many fields such as education and technology, chemistry, aviation and space industry, construction and infrastructure, logistics and transportation, manufacturing, metal and alloy industry. As a result of this investment, economic growth is expected to be realized through the multiplier mechanism as proposed by Keynesian economics. The lack of economic growth as a result of defense investment may be due to a situation that can be explained by opportunity cost and inefficient use of factors of production, as explained by neo-classical economics. Nevertheless, for many countries, defense expenditure is a short-term and operational expenditure that focuses on imports. Therefore, it would be erroneous to expect defense expenditure to uniformly support economic growth across all countries and time periods.

As Donald Trump stated in his first term (2017-2021), today's wars are economic and trade wars. Despite this, every country, especially the USA, makes a certain level of defense investment and defense expenditure both due to internal and external security concerns and in order to be ready for a possible world war. In addition to the need for security, defense investment is an important economic element that has a significant investment relationship with other industries. For this reason, the existence and effectiveness of the defense industry will continue as it has continued for centuries. Especially developed countries will continue to add significant added value to their economic growth processes by using their advanced technology investments in the defense industry. Developing countries, on the other hand, should closely follow the developing and changing technology in the digitalizing world to increase the effectiveness of defense investments on economic growth.

As in all scientific studies, this study also has some limitations. The primary limitations of this study are related to the period, country group and the preferred methodology. Studies that will investigate the impact of defense expenditure on economic growth can contribute to the emergence of more original results on the subject by categorizing countries into those that rely on defense expenditures for imports while selecting the sample group.

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