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Sustainability of Turkish-Greek Relations in Political Economy: Time Series Analysis

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ABSTRACT

Türkiye and Greece are neighboring countries that, despite their shared cultural heritage, experience tension from time to time due to political disagreements and historical prejudices. This study aims to evaluate Turkish-Greek relations by considering them within the political economy framework. Long-term relationships between energy imports, foreign direct investments and defense expenditures for the two countries were examined using Johansen cointegration and Granger causality tests. Economic relations are not realized at the potential level due to strategic disagreements and efforts to dominate the Eastern Mediterranean and the Aegean Sea. While a single cointegration relationship was found among the variables examined in Türkiye, three cointegration relationships were found in Greece. Granger causality tests revealed that energy imports in Türkiye were caused by foreign direct investments and a bidirectional causality relationship was found between defense expenditures and foreign direct investments. Bidirectional causality was found between defense expenditures and foreign direct investments in Greece.

Keywords: *Cultural Diplomacy, Interdependence, Soft Power.*

Politik Ekonomide Türk-Yunan İlişkilerinin Sürdürülebilirliği: Zaman Serisi Analizi

ÖZET

Türkiye ve Yunanistan, ortak kültürel miraslarına rağmen, siyasi anlaşmazlıklar ve tarihsel önyargılar nedeniyle zaman zaman gerginlik yaşayan komşu ülkelerdir. Bu çalışma, Türk-Yunan ilişkilerini politik ekonomi çerçevesinde ele alarak değerlendirmeyi amaçlamaktadır. İki ülke için enerji ithalatı, doğrudan yabancı yatırımlar ve savunma harcamaları arasındaki uzun vadeli ilişkiler Johansen eşbütünleşme ve Granger nedensellik testleri kullanılarak incelenmiştir. Ekonomik ilişkiler, stratejik anlaşmazlıklar ve Doğu Akdeniz ve Ege Denizi'ne hakim olma çabaları nedeniyle potansiyel düzeyde gerçekleşmemektedir. Türkiye'de incelenen değişkenler arasında tek eşbütünleşme ilişkisi bulunurken, Yunanistan'da üç eşbütünleşme ilişkisi bulunmuştur. Granger nedensellik testleri, Türkiye'de enerji ithalatının doğrudan yabancı yatırımlardan kaynaklandığını ve savunma harcamaları ile doğrudan yabancı yatırımlar arasında çift yönlü nedensellik ilişkisi

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bulunduğunu ortaya koymuştur. Yunanistan'da ise savunma harcamaları ile doğrudan yabancı yatırımlar arasında çift yönlü nedensellik bulunmuştur.

Anahtar Kelimeler: *Kültürel Diplomasi, Karşılıklı Bağımlılık, Yumuşak Güç.*

1. INTRODUCTION

Understanding this complex dynamic necessitates a political economy perspective that integrates security concerns, economic interdependence, and socio-cultural factors. While traditional realist interpretations emphasize the primacy of security and power competition, the growing role of economic cooperation and soft power instruments suggests that economic rationality and cultural diplomacy also play an increasingly important role in shaping bilateral relations (Çekiç, 2022; Güvenbaş, 2020).

Accordingly, this study aims to investigate the interplay between economic variables—energy imports (EI), foreign direct investment (FDI), and military expenditures (ME)—and their relationship with broader political and socio-cultural dynamics between Türkiye and Greece. Utilizing Johansen cointegration analysis and Granger causality testing over a long-term time series (1974–2023), the study seeks to determine whether economic factors can serve as stabilizers in the face of political and security challenges.

The hypotheses of the study are formulated as follows: (H1): Socio-cultural prejudices negatively affect the economic cooperation between Türkiye and Greece. (H2): Soft power elements such as cultural diplomacy contribute to building trust in Turkish-Greek economic relations. (H3): There is a long-term cointegration relationship among energy imports (EI), foreign direct investments (FDI), and military expenditures (ME) between Türkiye and Greece. (H4): In Türkiye, energy imports (EI) are a causal determinant of foreign direct investment (FDI). (H5):. There is a bidirectional causality relationship between military expenditures (ME) and foreign direct investments (FDI) in Greece. (H6): Turkish-Greek economic relations have not developed to their full potential.

By testing these hypotheses, the study seeks to provide empirical evidence on whether economic and soft power initiatives can mitigate the effects of political rivalry or whether strategic and cultural antagonisms continue to overshadow economic rationality. In doing so, it contributes both theoretically and methodologically to the literature on political economy, conflict resolution, and bilateral relations in the Eastern Mediterranean context.

2. LITERATURE REVIEW

The relationship between economic cooperation and soft power improves the perceptions of the two countries towards each other and contributes to the creation of a peaceful relationship model that is free from conflicts. Economic cooperation not only provides commercial gains, but also establishes social ties between peoples and prepares a positive ground for political relations between countries. A positive course in economic relations allows countries to use soft power elements more effectively. The effectiveness of

economic cooperation and soft power depends on both countries accepting these elements as a strategy and taking steps in this direction. Cultural diplomacy, in particular, has the potential to bring young generations closer to each other. In this direction, the Turkish and Greek governments can create a long-term peace environment in relations by increasing cultural and educational cooperation projects.

It is understood from the literature that the economic relations between Türkiye and Greece are not sufficient. There is no comprehensive study on this subject in the literature. In particular, the number of existing studies within the scope of the methods used in this study is very few. The following studies can be given as examples.

Given the lack of consensus in the empirical literature on the relationship between military expenditures, a linear Bayesian Vector Autoregression (BVAR) modeling approach is used to examine potential interdependence relationships using four different proxies of states' physical weapons stocks. The analysis based on annual datasets from 1960 to 2020 shows that military expenditure shocks to a country do not have a significant impact on the defense expenditures of the rival country. This finding suggests that instead of costly competitive strategies aimed at maintaining strategic balance, the relevant countries should prioritize cooperation in the joint promotion of peace and economic development in the wider Mediterranean region (Kechrinioti & Karamanis, 2024).

In Tütüncü and Şahingöz's study (2020), the Bootstrap causality test results reveal that Greece's defense expenditures have a one-way causality effect on Türkiye's defense expenditures. In contrast, the asymmetric causality test findings indicate the existence of a mutual causality relationship between the two countries. In addition, time-varying causality analyses show that there is a distinct arms race between the two countries for the periods 1975-1990 and 2000-2014.

According to another study (Dunne, etc., 2001), Standard Granger causality tests reveal that the change in military expenditures has a positive effect on economic growth in the case of Greece. However, when the cointegration between output and military expenditures is taken into account, it is observed that this relationship does not maintain its stability.

In another study, the dynamics of the relationship between defense expenditures and economic growth were examined using the vector error correction model (VECM) and the Johansen cointegration test. The results obtained reveal that there is no long-term cointegration relationship between the two variables examined (Dritsakis, 2004).

Kollias examines whether the arms race hypothesis between Greece and Türkiye can be empirically confirmed using cointegration and causality tests. The findings do not reject an arms race between the two NATO member states at a 91% confidence level. However, empirical confirmation of the Greek-Turkish arms race hypothesis is dependent on identifying a policy regime change envisaged in 1985. This regime change is attributed to the series of austerity stabilization programs implemented in Greece in 1985, which led to

a gradual decrease in defense expenditures as a percentage of GDP over the last decade (Kollias & Makrydakis, 1997).

The complex nature of Turkish-Greek relations cannot be fully captured through a singular theoretical lens. While much of the literature gravitates toward frameworks such as interdependence theory, realism, or the security dilemma, each of these perspectives—when applied in isolation—falls short in explaining the inconsistencies between economic potential and geopolitical realities (Kömür, 2020). A nuanced understanding emerges only when these approaches are synthesized and critically evaluated against the empirical evidence presented in this study.

The realist perspective provides a compelling counterpoint by framing state behavior as driven primarily by power, security, and national interest. This approach is particularly useful in explaining Türkiye's assertive energy exploration in the Eastern Mediterranean and Greece's reliance on EU and NATO platforms to counterbalance Turkish influence. Our Granger causality tests support this logic (Grigoriadis, 2014).

Moreover, the security dilemma offers additional explanatory power. Both Türkiye and Greece perceive each other's defensive postures as latent threats, perpetuating an arms race logic despite shared NATO membership. The empirical finding that military expenditures in Türkiye remain statistically disconnected from economic metrics underscores how deeply entrenched this security dilemma is (Bektaş etc., 2021).

Taken together, the empirical outcomes of this study—cointegration asymmetries, causality directions, and the structure of economic-military linkages—highlight the limitations of any one theory when used in isolation. The Turkish case, dominated by security-oriented rationales, conforms more closely to realist and security dilemma frameworks, while the Greek case demonstrates partial alignment with liberal expectations under economic interdependence (Choulis etc., 2023).

Therefore, theoretical pluralism is essential to understanding the enduring gap between economic potential and strategic reality in Turkish-Greek relations. While Turkish-Greek relations have been extensively studied from a historical, political, and diplomatic perspective, the intersection of economic variables with security dynamics remains significantly underexplored in the quantitative literature.

There is a notable absence of longitudinal, country-comparative analyses that employ Johansen cointegration and Granger causality tests to examine how defense expenditures interact with foreign direct investment (FDI) and energy imports—two variables that are critically important to economic policy but rarely studied in relation to national security outcomes in this dyadic context.

This study directly addresses this gap by combining these three variables within a time-series econometric model, covering the 1974–2023 period. The use of long-run equilibrium testing (cointegration), paired with causality analysis, allows us to assess whether strategic decisions in the defense sector are economically motivated, or predominantly shaped by

external security threats and geopolitical pressures. Moreover, the inclusion of both countries in a parallel framework facilitates a comparative insight into how structural and political asymmetries (e.g., EU membership, geopolitical alliances) influence the degree of economic-security linkages.

In doing so, the study contributes not only to filling a methodological gap—by applying advanced econometric tools to an under-researched variable trio—but also provides substantive insight into the limits of liberal theories of interdependence in a regional rivalry context.

3. METHODS

The original data used in the study belong to the period 1974-2023. These are the annual series of energy imports, foreign direct investments and defense expenditures of Türkiye and Greece. These data were obtained from the World Data Bank. The calculation was made by taking the first differences of the logarithms of the series used in the study. First of all, it is necessary to test whether the time series used in the model are stationary. A time series is stationary if its mean and variance do not change over time and the common variance between two periods does not depend on the period in which this common variance was calculated but only on the distance between the two periods (Gujarati, 2010). As Granger and Newbold showed (1974), a spurious regression problem can be encountered when working with non-stationary time series. In this case, the result obtained by regression analysis does not reflect the real relationship. Regression analyses performed with non-stationary time series can reflect the true relationship only if there is a cointegration relationship between these series. The stationarity analysis of the time series considered in this study was performed using the "Extended Dickey-Fuller" (ADF) unit root test developed by Dickey and Fuller (1981) and PP (Phillips & Perron, 1988). The following equation is used in the ADF unit root test analysis.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

Here, ΔYt is the first difference of the variable that is analyzed to be stationary, t is the general trend variable, ΔY_(t-i) is the lagged difference terms. The reason for including the lagged difference terms is to ensure that the error term is consecutively independent.

The simplest model for the PP test is as follows.

$$Y_t = \mu_1 + \phi Y_{t-1} + e_1 \quad (2)$$

$$(1-\phi L)\, Y_t = \mu + e_1 \quad (3)$$

Here t=1,2,…T, and the unit root for the model is found with 1/□1. When □1 =1, it is interpreted as there is a unit root in the series.

LOGEI, LOGFDI and LOGME variables being I(1) is accepted as a prerequisite for investigating the long-term balance relationship between variables. The existence of the long-term balance relationship is done with the cointegration test. In the study, whether

there is a cointegration relationship between variables was developed by Johansen (1988) and Johansen & Juselius (1990) and was done with the Johansen cointegration analysis. Here, two tests are proposed to examine whether the characteristic roots are equal to zero and therefore the existence of the cointegration relationship. These tests are the maximum eigenvalue test statistic and the trace test statistic. The characteristic roots or eigenvalues obtained from equations and matrices, T, represent the number of observations. The basic hypothesis that there are equal or less than r is evaluated against a general alternative. When the value of all characteristic roots is zero, the value of the test will also be zero. In the second test, the claim that there are r cointegrating vectors in the basic hypothesis is tested against the alternative hypothesis that there are r+1. If the characteristic roots are equal to zero, the value will be small.

The regression relationship between two variables does not reveal a cause-effect relationship between these variables. However, in a distributed lag model, for example, in a relationship between Yt and Xt, both variables can affect each other. In such a model, it can be said that Yt affects Xt (Yt → Xt) or vice versa (Xt →Yt). If there is a lagged relationship between two variables, the "causality relationship" between these variables can be investigated. For this, the Granger test is used. The Granger causality relationship is expressed as "Yt is not the Granger cause of Xt" or vice versa in the form of the H0 hypothesis for certain lags.

$$Y_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{i=1}^{n} \beta_i X_{t-i} + u_{1t} \quad (4)$$

$$X_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{i=1}^{n} \beta_i X_{t-i} + u_{2t} \quad (5)$$

Here, the terms u_1t and u_2thata are assumed to be unrelated. The equations in (4) and (5) depend on the past values of the variables as well as being a function of their own past values (Maiti, 2021).

4. ANALYSIS AND RESULTS

4.1. Dataset and Variables

This study attempts to reveal the relationships between Türkiye's and Greece's energy imports, foreign direct investments, and military expenditures using annual data between 1974 and 2023. LOGEI, used in the analysis, shows the logarithmic form of energy imports. LOGFDI, shows the logarithmic form of foreign direct investments. LOGME, shows the logarithmic form of military expenditures. Data were compiled from the World Data Bank (WDI) website. The variables included in the analysis, the dataset sources of these variables, and their explanations are presented in Table 1.

Tablo 1. Variables and Data Set

Data Icon	Data	Source
LOGEI	Energy imports, net (% of energy use)	World Data Bank (World Developments Indicators; WDI)
LOGFDI	Foreign direct investment, net inflows (% of GDP)	
LOGME	Military expenditure (current LCU)	

Source: The table was derived by the authors.

First, limitations need to be stated. It is acknowledged that the data presented in Table 1—energy imports, foreign direct investment inflows (as a percentage of GDP), and military expenditures—reflect aggregate national figures rather than bilateral flows between Türkiye and Greece. This constitutes a limitation with respect to directly measuring economic interdependence between the two countries. The use of total national indicators was necessitated by the lack of comprehensive, consistent bilateral time series data covering the period from 1974 to 2023, particularly in areas such as bilateral FDI and energy trade.

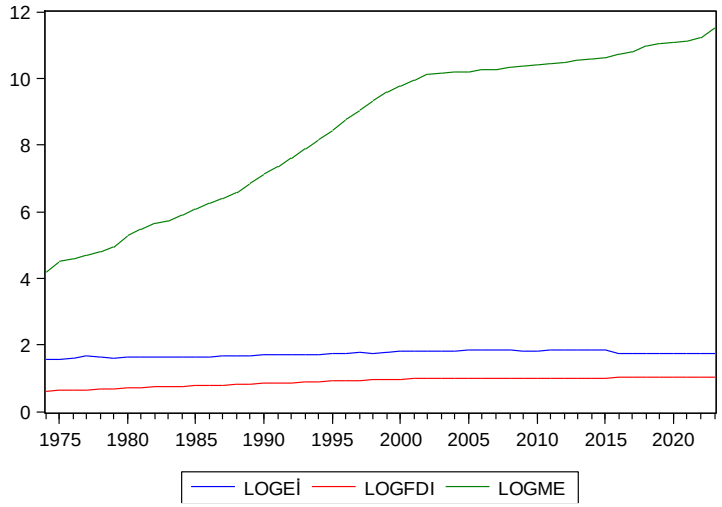
Nonetheless, the choice of aggregate indicators is still analytically relevant. They capture macroeconomic patterns and investment climates that indirectly affect bilateral relations. For instance, increases in overall FDI inflows and energy imports can enhance a country's economic resilience and bargaining power in regional interactions, thereby influencing its approach toward bilateral cooperation and competition. In this context, the national-level data are used as proxies for broader economic conditions that shape bilateral strategic behavior.

Regarding the use of FDI inflows as a percentage of GDP and their logarithmic transformation, this methodological choice was made to normalize the data across different scales and account for heteroskedasticity issues commonly encountered in long-term macroeconomic time series. Using FDI as a share of GDP allows for comparability across time and between countries, despite differences in economic size. The log transformation further stabilizes variance and mitigates the impact of extreme values.

Future research could enhance the robustness of the analysis by employing bilateral FDI and energy trade data, provided that long-term and reliable datasets become available. Incorporating direct bilateral economic flows would enable a more precise assessment of interdependence mechanisms and their impact on security dynamics.

Changes in data for Türkiye over time are shown in Figure 1, and changes in data for Greece over time are shown in Figure 2.

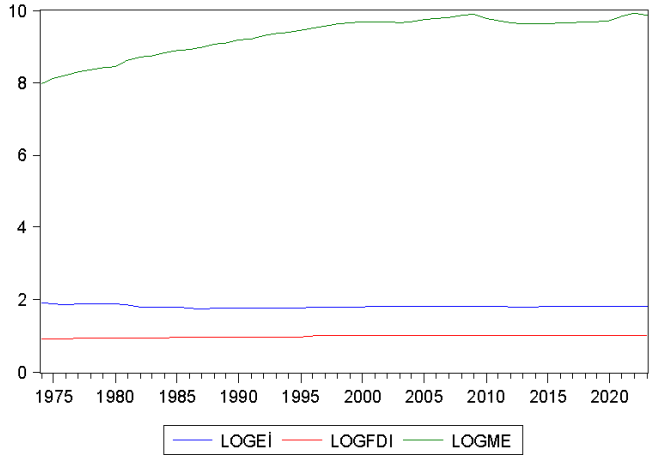
Figure 1. Course of variables for Türkiye between 1974-2023



Source: The Figure was derived by the authors.

In Figure 1, the blue line represents energy imports, the red line represents foreign direct investments, and the green line represents military expenditures. When the series for Türkiye between 1974 and 2023 are examined, it is seen that while the military expenditure variable continues to increase over the years, the energy import and foreign direct investments variables follow a similar, more stable course. In addition, it is seen from the figure that the increase in military expenditures has continued to decrease since the 2000s.

Figure 2. Course of Variables for Greece Between 1974-2023



Source: The Figure was derived by the authors.

In Figure 2, the blue line represents energy imports, the red line represents foreign direct investment, and the green line represents military expenditures. When the series of Greece between 1974 and 2023 are examined, it is seen that, similar to Türkiye, the military expenditure variable continues to increase over the years, while the energy import and foreign direct investment variables follow a stationary course. However, it is possible to see from Figure 2 that, unlike Türkiye, the increase in military expenditures in Greece has decreased somewhat after 2009.

4.2. Unit Root Tests

Since the variables have a unit root, indicating that they are not stationary, in this case the unit root test is performed again by taking the differences of the variables. It was tested with ADF and PP that the variables do not have a stationary structure at the level and do not show a distribution around a certain mean. Table 2 shows the ADF and PP unit root test results of the variables belonging to Türkiye and Greece. Here, it is seen that all four variables are not stationary at the level and are I (1).

Table 2. ADF and PP Unit Root Tests of Variables Belonging to Türkiye and Greece

Variables	**ADF**	**PP**
Türkiye		
LOGEI	-1.071 (0)	-2.179 (3)
LOGDYY	-0.486 (1)	-4.073 (3)
LOGME	-1.478 (1)	-1.998 (5)
ΔLOGEI	-7.114*** (0)	-6.764*** (2)
ΔLOGDYY	-4.579*** (0)	-4.778*** (1)
ΔLOGME	-2.667* (0)	-2.799* (2)
Test critical values %1 level	-3.574	-3.571
%5 level	-2.923	-2.922
%10 level	-2.599	-2.599
Greece		
LOGEI	-2.187 (0)	-2.558 (2)
LOGDYY	-1.495(1)	-2.386 (1)
LOGME	-1.360 (1)	-2.013 2)
ΔLOGEI	-4.954** (0)	-4.862*** (1)
ΔLOGDYY	-5.203*** (0)	-5.234*** (27)
ΔLOGME	-4.995*** (0)	-5.042*** (1)

Test critical values %1 level	-4.161	-4.161
%5 level	-3.506	-3.506
%10 level	-3.183	-3.183

Source: The Table was derived by the authors.

4.3. Cointegration Test

To proceed to the cointegration analysis, which statistically shows the long-term relationship between the series used in the application; first of all, it is necessary to look at the stationarity levels of the variables. The series must be stationary of the same degree. When we look at the variables used in the application, the fact that the variables for Türkiye and Greece do not contain a unit root in their first differences allows the examination of the cointegration relationship. The results of this test are presented in Table 3. When the cointegration analysis results are examined; three significant cointegrations were detected between the variables. Max-Eigenvalue and trace statistics show that there is cointegration equality between these variables. Thus, while 1 cointegration relationship was detected for Türkiye, 3 cointegration relationships were detected for Greece. There is a limited long-term relationship between energy imports, foreign direct investments and military expenditures for Türkiye.

The findings in Table 3 indicate that Türkiye's military expenditures do not exhibit long-run cointegration with energy exports or foreign direct investment, nor is there evidence of short-run Granger causality. This suggests that defense spending in Türkiye is not significantly determined by the economic variables analyzed in this model. While existing literature often links Türkiye's military behavior to regional geopolitical dynamics, our model does not include direct measures of threat perception or security tension. Therefore, it would be more accurate to state that Turkey's military expenditures appear autonomous from economic factors within the scope of this analysis, without making causal claims regarding alternative, non-economic drivers. Future research should incorporate indicators of geopolitical risk to more comprehensively evaluate the determinants of defense spending. This shows that Türkiye's defense expenditures are independent of economic variables and are shaped more by security, geopolitical and regional threats, while in Greece there is a long-term relationship between these variables and this shows that Greece's defense expenditures are more sensitive to economic factors and are affected by energy revenues and foreign direct investments. These results lead to the conclusion that Türkiye's military expenditures are more strategic and security-oriented, while Greece's are more intertwined with economic factors.

Table 3. Johansen Cointegration Test

Ho Hypothesiz	Eigenvalue Statistic	Trace Statistic	%5 Critical Value	Prob.*	Max-Eigenvalue Statistic	%5 Critical Value	Prob.*
Türkiye							
r=0*	0.3754	33.275	35.010	0.075	22.565	24.252	0.082
r ≤ 1	0.190	10.710	18.397	0.415	10.159	17.147	0.382
r ≤ 2	0.011	0.550	3.841	0.458	0.550	3.841	0.458
Greece							
r=0*	0.547	62.966	29.797	0.000	38.103	21.131	0.000
r ≤ 1	0.335	24.862	15.494	0.001	19.596	14.264	0.006
r ≤ 2	0.103	5.266	3.841	0.021	5.266	3.841	0.021

Max- Eigenvalue Test indicates 3 cointegration egn(s) at the 0.05 level.

*Denotes rejection of the hypothesis at the 0.05 level **MacKinnon- Haug-Michelis (1999) p-values.

Source: The Table was derived by the authors.

According to the Johansen cointegration test results presented in Table 3, both the trace and maximum eigenvalue statistics indicate the presence of a cointegration relationship for Türkiye at the 10% significance level. This finding suggests the existence of a long-term equilibrium relationship among the analyzed variables in Türkiye. In the case of Greece, both the trace and maximum eigenvalue test statistics are significant at the 5% level, confirming a stronger long-term cointegration relationship. Based on these results, it becomes necessary to estimate the long-run cointegration coefficients for both Türkiye and Greece. For this purpose, short- and long-run coefficient estimations were conducted within the framework of the Vector Error Correction Model (VECM). The long-run coefficients reveal the direction and magnitude of the equilibrium relationship among the variables. Table 4 presents the estimated short- and long-run coefficient results for Türkiye and Greece.

Tablo 4. Vector Error Correction Model (VECM) Long- and Short-run Estimation Results for Türkiye and Greece

Country	Variable	Long-run Coefficient	t-Statistic	Short-run Coefficient (Δ)	t-Statistic	Prob.	ECT (-1)	t-Statistic
Türkiye	FDI	-7.2565	-1.433	0.0074	3.491	0.001	0.0055	0.414
	ME	0.0681	0.241	0.0762	2.026	0.046		
Greece	FDI	-187.108	-2.335	0.0034	2.579	0.013	-0.008	-1.117
	ME	7.7628	2.075	0.0651	2.289	0.027		

Source: The Table was derived by the authors.

For Table 4, for Türkiye in the long run, neither FDI nor military expenditures significantly affect energy consumption. The long-run coefficients are statistically insignificant,

indicating that structural or institutional factors may dominate long-term energy dynamics. In the short run, however, both foreign direct investment (FDI) and military expenditures (ME) have statistically significant positive effects on energy use. This implies that short-run increases in investment and defense spending lead to higher energy consumption, likely through production expansion and higher demand pressures. The error correction term (ECT) is positive and insignificant, suggesting that deviations from the long-run equilibrium are not corrected quickly—indicating weak long-term adjustment mechanisms in Türkiye's economy. In contrast, Greece exhibits both short-run and long-run causality between the variables. The long-run coefficient for FDI is negative and statistically significant, implying that higher FDI may contribute to improved energy efficiency or technological progress, thereby reducing energy consumption over time. The long-run effect of ME is positive and significant, reflecting that military expenditures tend to increase energy use, likely due to defense-related production and logistics demands. In the short run, both FDI and ME positively influence energy use, confirming a dynamic short-term interdependence between economic and defense activities and energy demand. The ECT (−1) is negative (as expected) but only marginally significant, suggesting that the system converges slowly towards its long-run equilibrium. The VECM results indicate that: Türkiye's energy consumption dynamics are dominated by short-run effects, with weak long-run adjustment. Greece displays a clearer long-run equilibrium, where FDI improves energy efficiency while military expenditures increase energy demand both in the short and long term. These findings underline the importance of sustainable investment policies and energy-efficient defense strategies to balance economic and energy objectives in both countries.

4.4. Granger Causality Test

The Block Granger Causality Test is used to determine whether there is a causal relationship between the variables used in the study, and if there is a causal relationship, whether this relationship is one-way or two-way, and to determine whether the variable is significant in predicting the other. The results are presented in Table 5.

Table 5, presents short-run Granger causality results derived from the Vector Error Correction Model (VECM) framework, as recommended by the referee.

Table 5: VECM-based Granger Causality

Dependent Variable	Excluded Variable	Chi-sguare	Prob.
Türkiye			
EI			
	FDI	0.1407	0.932
	ME	11.920	0.865
FDI			
	EI	2.963	0.227
	ME	18.727	0.000

ME			
	EI	3.636	0.162
	FDI	13.059	0.001
Greece			
EI			
	FDI	12.530	0.001
	ME	12.625	0.001
FDI			
	EI	3.050	0.217
	ME	5.165	0.075
ME			
	EI		0.206
	FDI		0.084

Source: The Table was derived by the authors.

According to the Table 5 (VECM - based Granger Causality results), the short-run Granger causality relationships among the variables in Türkiye are as follows: For Energy Imports (EI), neither Foreign Direct Investment (FDI) nor Military Expenditures (ME) exhibits a statistically significant causal effect (Prob. > 0.05). This indicates that, in the short run, energy imports are not influenced by foreign investment inflows or defense spending. FDI is significantly affected by ME (Prob. = 0.000 < 0.05), implying that higher military expenditures may stimulate or coincide with changes in foreign investment patterns. Regarding ME, a statistically significant causal effect is observed from FDI (Prob. = 0.001), whereas the effect from EI (Prob. = 0.162) is insignificant. This suggests that inward FDI flows exert a positive influence on military spending in Türkiye.

Findings for Greece The VECM- based Granger Causality results for Greece indicate stronger and more interconnected causal relationships: Energy Imports (EI) are significantly influenced by both FDI (Prob. = 0.001) and ME (Prob. = 0.001). This finding suggests that energy imports in Greece are responsive to variations in foreign investment inflows and defense spending. For FDI, there is a marginally significant causal effect from ME (Prob. = 0.075), suggesting that higher military expenditures might partially influence foreign investment decisions. The causality tests for ME (Prob. = 0.206 and 0.084) do not show strong significance, though they approach the 10% threshold, implying weak evidence of feedback effects.

Table 6: Granger Causality Test results

Vector Error Correction Estimates
Date: 11/24/25 Time: 15:32
Sample (adjusted): 1977 2023
Included observations: 47 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOGE (-1)	1.000000
LOGFDI(-1)	-7.256540 (5.06157) [-1.43365]
LOGME(-1)	0.068055 (0.28183) [0.24147]
C	4.329032

Error Correction:	D(LOGE)	D(LOGFDI)	D(LOGME)
CointEq1	0.005502 (0.01330) [0.41377]	0.007387 (0.00212) [3.49145]	0.076237 (0.03762) [2.02634]
D(LOGE (-1))	-0.111849 (0.14963) [-0.74748]	-0.020999 (0.02381) [-0.88204]	-0.139127 (0.42333) [-0.32865]
D(LOGE (-2))	-0.179997 (0.15000) [-1.19998]	-0.024699 (0.02387) [-1.03490]	-0.417913 (0.42437) [-0.98479]
D(LOGFDI(-1))	-4.086641 (3.38985) [-1.20555]	-0.429578 (0.53934) [-0.79649]	-16.03238 (9.59029) [-1.67173]
D(LOGFDI(-2))	2.364864 (2.33587) [1.01241]	-0.252205 (0.37165) [-0.67862]	-0.149296 (6.60847) [-0.02259]
D(LOGME(-1))	0.241345 (0.22007) [1.09665]	0.065204 (0.03501) [1.86220]	1.765859 (0.62262) [2.83619]
D(LOGME(-2))	-0.073724 (0.17438) [-0.42278]	0.004870 (0.02774) [0.17553]	-0.182572 (0.49335) [-0.37007]
C	-0.006820 (0.00766) [-0.89063]	0.004508 (0.00122) [3.70021]	0.060677 (0.02166) [2.80090]
R-squared	0.193035	0.734985	0.658244
Adj. R-squared	0.048195	0.687419	0.596903
Sum sq. resids	0.019836	0.000502	0.158764
S.E. equation	0.022552	0.003588	0.063803
F-statistic	1.332746	15.45167	10.73094
Log likelihood	115.9146	202.3099	67.03619
Akaike AIC	-4.592113	-8.268507	-2.512178
Schwarz SC	-4.277194	-7.953588	-2.197260
Mean dependent	0.002625	0.008502	0.148035
S.D. dependent	0.023116	0.006418	0.100494

Determinant resid covariance (dof adj.)	2.16E-12
Determinant resid covariance	1.23E-12
Log likelihood	444.3107
Akaike information criterion	-17.75790
Schwarz criterion	-16.69505
Number of coefficients	27

Vector Error Correction Estimates
Date: 11/24/25 Time: 15:33
Sample (adjusted): 1977 2023
Included observations: 47 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOGE (-1)	1.000000
LOGFDI(-1)	-187.1084
	(80.1296)
	[-2.33507]
LOGME(-1)	7.762772
	(3.74050)
	[2.07533]
C	107.1517

Error Correction:	D(LOGE)	D(LOGFDI)	D(LOGME)
CointEq1	-0.008405	0.003353	0.065093
	(0.00752)	(0.00130)	(0.02844)
	[-1.11737]	[2.57920]	[2.28876]
D(LOGE (-1))	0.295468	0.018343	0.449173
	(0.16460)	(0.02845)	(0.62232)
	[1.79505]	[0.64480]	[0.72177]
D(LOGE (-2))	-0.048888	-0.010857	-0.235520
	(0.15767)	(0.02725)	(0.59612)
	[-0.31006]	[-0.39841]	[-0.39509]
D(LOGFDI(-1))	-20.92993	-4.764919	-102.6059
	(17.8482)	(3.08466)	(67.4800)
	[-1.17266]	[-1.54471]	[-1.52054]
D(LOGFDI(-2))	23.66928	-0.113467	3.102313
	(13.6091)	(2.35203)	(51.4530)
	[1.73922]	[-0.04824]	[0.06029]
D(LOGME(-1))	0.991254	0.238386	5.156879
	(0.82348)	(0.14232)	(3.11337)
	[1.20375]	[1.67502]	[1.65637]
D(LOGME(-2))	-1.084236	-0.005547	-0.386780
	(0.63628)	(0.10997)	(2.40561)
	[-1.70404]	[-0.05044]	[-0.16078]
C	-0.003061	0.001806	0.036596
	(0.00329)	(0.00057)	(0.01245)
	[-0.92986]	[3.17352]	[2.94009]
R-squared	0.249021	0.427601	0.392600
Adj. R-squared	0.114230	0.324862	0.283579
Sum sq. resids	0.004991	0.000149	0.071347
S.E. equation	0.011313	0.001955	0.042771
F-statistic	1.847459	4.162036	3.601151
Log likelihood	148.3397	230.8465	85.83318
Akaike AIC	-5.971904	-9.482829	-3.312050
Schwarz SC	-5.656985	-9.167910	-2.997132
Mean dependent	-0.001158	0.001672	0.034711
S.D. dependent	0.012020	0.002380	0.050532

Determinant resid covariance (dof adj.)	1.99E-15
Determinant resid covariance	1.14E-15
Log likelihood	608.6034
Akaike information criterion	-24.74908
Schwarz criterion	-23.68623
Number of coefficients	27

Source: The Table was derived by the authors.

According to the Granger Causality Test results, for Türkiye, the fourth and fifth hypotheses were rejected at a significance level of 5%, and the sixth hypothesis was rejected at a significance level of 1%. In this case, the EI variable is the cause of FDI for Türkiye, and there is a one-way causality. A bidirectional causality relationship was also determined for the ME and FDI variables. For Türkiye, energy imports generally affect foreign direct investments and military expenditures, foreign direct investments affect military expenditures, but do not directly affect energy imports, and military expenditures can affect both foreign direct investments and energy imports. As a result, the energy sector and military expenditures are important factors that directly affect each other in Türkiye. For Greece, the fifth and sixth hypotheses were rejected at a significance level of 10%. In this case, a bidirectional causality relationship was found between the ME and FDI variables. This shows that economic factors are not directly dependent on each other in Greece, but there may be a weak relationship between military expenditures and foreign direct investments.

In Türkiye, energy imports and military expenditures are important factors affecting foreign direct investment. In Greece, there is no strong causality between economic variables, but there may be a weak link between military expenditures and FDI. This shows that Türkiye's energy and defense sectors have a direct impact on the economy, while in Greece these effects are more indirect and weak.

Overall, the results of studies on defense expenditures, economic growth, and bilateral relations between Türkiye and Greece can vary depending on the methodology used, the period analyzed, and the variable definitions. This highlights the complexity of research in this area and the need for ongoing studies.

5. DISCUSSION

The economic relations between Türkiye and Greece have not reached their potential. There are many reasons for this, most of which are non-economic factors (Alam & Zaid, 2023). To prove this or support this view, the long-term relations between energy imports, foreign direct investments and defense expenditures of Türkiye and Greece have been examined. The results of the Johansen cointegration tests show that there is no significant long-term relationship between the variables examined for Türkiye (Carminati, 2022). On the other hand, three different cointegration relations have been identified between energy imports, foreign direct investments and defense expenditures in Greece. This situation reveals that defense expenditures in Türkiye are shaped by geopolitical and security-oriented dynamics rather than economic factors, while defense expenditures in Greece are more intertwined with economic performance and investment environment.

Granger causality tests show that there is a one-way causality relationship between energy imports and foreign direct investments in the case of Türkiye, and also that there is a two-way interaction between defense expenditures and foreign direct investments. In Greece,

although findings of two-way causality between economic variables are similar, the strength and direction of this relationship differ from the dynamics observed in Türkiye. These results indicate that the factors determining defense expenditures in the two countries are structurally different, and that while Türkiye shapes its defense policies within the framework of external threats and regional security concerns, Greece's defense expenditures are more closely related to economic performance and investment flows.

In the literature, the relationship between defense expenditures and macroeconomic indicators such as economic growth, investment and energy trade has been addressed in various studies (Ditsakis, 2004; Dunne etc., 2001). However, the current findings clearly show that this relationship varies by country (Becker etc., 2016). It has been observed that economic fundamentals play a more limited role in Türkiye's defense expenditures, strategic and geopolitical factors come to the fore, while in Greece, the reflections of economic dynamics on defense policies are more pronounced. These differences are based on the historical experiences, foreign policy priorities and strategic positions of the two countries in the region, as well as their domestic economic structures.

For Turkish-Greek relations to develop sustainably, it is crucial to address the negative effects of military spending on social welfare. Both countries should adopt an approach that prioritizes redirecting resources from military competition toward shared social and economic objectives. Reducing the defense burden and investing in human capital, infrastructure, and economic integration would strengthen societal resilience and support long-term political stability. In this regard, a political economy framework that links national security goals with societal well-being could contribute to building lasting peace and cooperation between Türkiye and Greece (Alım, 2019).

The contribution of the findings to the academic literature is valuable in terms of revealing how important country-based differences play a role in determining defense policies. The study emphasizes that in the field of international relations and political economy, defense expenditures cannot be explained only by economic growth or investment indicators, but also by geopolitical risk, security perception and regional strategic dynamics. This situation prepares the ground for expanding existing theoretical approaches and developing new modeling specific to countries (Topalidis etc., 2024).

However, the limitations of the study, such as the long-term nature of the data set and the fact that potential structural breaks could not be fully integrated into the model, are points that should be taken into consideration when interpreting the results. In future studies, it would be useful to examine the interaction between economic and defense policies in more depth by using structural break analyses and different model specifications.

The empirical results of this study provide important insights when situated within the broader corpus of research on Turkish-Greek defense economics and interdependence theory. Notably, the absence of a robust long-term cointegration relationship among energy imports, FDI, and military expenditures for Türkiye is consistent with Dunne, who found that although short-run causality from military expenditures to economic growth exists in Greece, such a relationship fails to maintain stability when cointegration is considered. In the model, while Türkiye exhibits no long-term equilibrium among the three variables, Greece presents three distinct cointegration vectors, reinforcing the conclusion that defense expenditures in Greece are more economically embedded and sensitive to variations in energy and investment flows.

Moreover, our findings diverge significantly from the linear Bayesian VAR results reported in, which argue that arms competition between rival states lacks empirical significance over time. By contrast, our Granger causality analysis identifies statistically significant causal linkages—particularly the bidirectional causality between FDI and military expenditures in Türkiye and marginally significant effects in Greece—thus highlighting endogenous policy feedback mechanisms that such structural models may obscure.

Tütüncü's application of bootstrap and asymmetric causality methods identifies a one-way causality from Greece's defense expenditures to Türkiye's, suggesting a reactive military strategy on the part of Türkiye. However, our results, which reveal internal causality patterns—such as energy imports leading to FDI and mutual causality between FDI and military expenditures in Türkiye—challenge the notion of a purely externally driven defense policy. Instead, they reflect a hybrid model in which both domestic economic imperatives and geopolitical considerations shape military outlays.

In addition, the VECM-based analysis presented in (Dritsakis, 2004) posits no cointegration between economic growth and defense expenditures in either country, but confirms a two-way causality between their respective defense budgets. While our Johansen-based approach does not explicitly test cross-country military spending interactions, it does provide a differentiated country-level structure showing Greece's military expenditures to be more economically reactive, while Türkiye's appear structurally detached from economic indicators and oriented more toward security policy under strategic uncertainty.

Kollias & Makrydakis (1997) examining structural changes post-1985, highlights that arms race dynamics in Greek-Turkish relations are conditional on fiscal regimes. Our study contributes to this interpretation by confirming that Greece's military expenditures are more economically conditioned than Türkiye's, particularly through cointegration with FDI and energy flows, suggesting that fiscal- military linkages in Greece remain intact

despite austerity episodes. These findings point to a regime-contingent defense-economic nexus, which is more prominent in Greece and more security-driven in Türkiye.

One of the inherent challenges in empirical analyses involving defense expenditures, foreign direct investment (FDI), and energy imports is the possibility of endogeneity. This issue arises particularly due to the simultaneity between defense spending and FDI, where causality may run in both directions: higher defense spending may attract or deter investment depending on the security perception, while increasing FDI may shape the defense posture through fiscal capacity or strategic influence. Similarly, energy imports may be influenced by geopolitical stability, which itself is shaped by military expenditures. Ignoring these reciprocal effects could lead to biased and inconsistent estimators.

Although these instruments are not directly implemented in the current model due to data constraints and the methodological scope of the study, the recognition of this issue is crucial. Future research should incorporate IV estimation or SVAR modeling to confirm the robustness of the relationships identified here. Such extensions would significantly improve causal inference and provide a stronger empirical foundation for policy recommendations.

6. CONCLUSIONS

The relations between Greece and Türkiye have been peaceful at times, and have experienced periods of intense competition and conflict at times. The defense expenditures of both countries are a representative indicator of historical fluctuations in bilateral relations. The Greek-Turkish arms race has attracted the attention of many researchers in the field of defense economics. Understanding the time series dynamics between energy imports, foreign direct investments and military expenditure variables has attracted great attention in the literature in recent years. In particular, many studies have attempted to analyze the empirical-econometric dimension of the arms competition of these countries, and significant differences have emerged in the general results. In this study, not only the causality relationship between these three variables for the two countries was examined, but also the long-term relationships between the variables of energy imports, foreign direct investments and military expenditure of the two countries were examined with Johansen Cointegration tests. The results of the study showed that there was one cointegration relationship among the variables examined for Türkiye, while there were three cointegration relationships among the variables examined for Greece. Therefore, there is a long-term relationship between the two countries' energy imports, foreign direct investments and military expenditure variables. In addition, Granger causality tests show that for Türkiye, there is a unidirectional causality relationship as EI variable is the cause of FDI and for ME and FDI variables, there is a bidirectional causality relationship between ME and FDI variables for Greece. This result is predictable because Greek and Turkish

energy imports, foreign direct investments and military expenditures largely affect each other.

The results of the hypotheses in this study are as follows:

For H1, the findings support this hypothesis. Historical biases and political conflicts are shown to limit the development of economic relations in strategic areas such as energy and investment. For H2, the study indicates that cultural diplomacy plays a key role in fostering trust, thereby supporting the development of economic ties. For H3, according to Johansen cointegration tests, one cointegration relationship was identified for Türkiye and three for Greece, confirming a long-term linkage among the variables. For H4, Granger causality tests indicate a unidirectional causality from EI to FDI in the case of Türkiye. For H5, the study reveals a bidirectional causality between ME and FDI in Greece, as per the Granger test results. For H6, the findings suggest that the economic relations between the two countries fall short of their potential, largely due to lack of mutual trust and unresolved geopolitical tensions.

While most existing research on Turkish-Greek relations focuses on political, military, or historical dynamics, this study quantitatively examines how socio-cultural prejudices and trust issues affect economic indicators such as energy imports, foreign direct investments, and military expenditures. By employing time series analysis methods (Johansen Cointegration and Granger Causality), the study goes beyond the qualitative interpretations common in the field and offers empirical evidence of how "soft power" mechanisms, like cultural diplomacy, influence hard economic outcomes. Thus, the research bridges the gap between cultural-political narratives and economic modeling, showing that trust and perception are integral to sustainable economic cooperation.

The following suggestions can be made to ensure the sustainability of these countries in the economic and political arena.

-Joint digital trade platforms and e-commerce cooperation projects can be developed to facilitate cross-border trade of SMEs. In this regard, Germany and France have launched a joint data infrastructure project called ‘GAIA-X’ to promote the digitalization of SMEs. This initiative aims to increase cross-border trade by facilitating access to digital services for businesses. In 2022, the trade volume between Germany and France reached 160 billion Euros. This high trade volume was made possible by the contribution of digitalization and e-commerce applications (H4, H5, and interdependence theory) (Tardieu, 2022).

- Investment incentive programs can be developed in strategic sectors by establishing joint investment funds in the technology, energy and agriculture sectors. China and Singapore are cooperating in the fields of logistics, finance and information technologies by establishing joint investment funds within the scope of the ‘Chongqing Connectivity Initiative’. With this initiative, economic ties between the two countries have been

strengthened. In 2021, the bilateral trade volume between China and Singapore exceeded 100 billion US dollars. Joint investments have a significant share in this increase (H3 and realist theory) (Teo, 2021).

-Cooperation can be made for the joint exploration and use of energy resources in the Eastern Mediterranean. For example, Norway and Russia signed agreements in 2010 for the joint use of energy resources in the Barents Sea and developed cross-border energy projects. This cooperation contributed to the energy security of both countries. Energy trade between Norway and Russia continued until the Russia-Ukraine war in 2022. Joint projects were effective in increasing the trade volume of the two countries until they remained in force (H3, H5, and the security dilemma) (Vylegzhanin etc., 2017).

-Cooperation can be made on similar agricultural products such as olives, grapes and honey. Agricultural productivity can be increased by developing organic agriculture and sustainable water management projects and environmental sustainability can be ensured in this context. Within the scope of free trade agreements that include the USA, Canada and later Mexico, joint projects in agricultural production and trade have been developed and agricultural productivity has been increased. Thus, the USA is Canada's most important trading partner and has the largest share in agricultural products trade. Joint projects have played an important role in increasing trade volume (H1, H6, soft power) (Ministry of Trade, 2025).

While this study provides a macro-level empirical foundation, future research would benefit from incorporating direct measures of geopolitical threat perception, bilateral economic flows, and structural break models to more accurately capture the evolving dynamics of Turkish-Greek relations. Such an integrative approach would strengthen both the explanatory power of empirical models and the precision of applied policy recommendations.

Statement on Research and Publication Ethics

Throughout the entire process of this article, the research and publication ethics principles of the Manisa Celal Bayar University Social Sciences Institute Journal have been followed.

Authors' Contribution Percentage to the Article

The entire article was written by Ahmet Yavuz Çamlı and Pınar Çomuk. The authors contributed equally to the study.

Disclosure of Interest

The authors have no conflict of interest with any person or organization.

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