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Analyzing the Interplay between Energy Consumption and Military Expenditure: A Comparative Study of Azerbaijan, Turkey, and Pakistan

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ABSTRACT

This study examines the complex link between energy consumption and defense expenditures in Azerbaijan, Turkey and Pakistan. The research compares these two essential characteristics and discusses their effects on the countries. Policymakers and stakeholders in these nations must understand the intricate interdependencies between energy consumption and defence expenditure. The study's conclusions help create energy and defence strategies that balance national security and sustainability. It also advances scholarly discussion on energy, security, and international affairs. This study compares energy usage and defence spending in Azerbaijan, Turkey, and Pakistan. It offers a foundation for informed decision-making and future study in this field by revealing the complex relationships between these two aspects. The impacts of defence expenditures and causality analyses of oil and natural gas usage between the years 1992 and 2021 are investigated as part of the scope of this research. According to the results, it has been found that there is no link between defence expenditures and the consumption of oil and natural gas within the context of the Azerbaijani economy. This conclusion was reached based on the findings of the investigation. On the other hand, it has been shown that the utilisation of natural gas is the driving force behind the use of oil. When Turkey and Pakistan are compared, there is no correlation between their military spending, the amount of oil they use, and the amount of natural gas they utilise.

Keywords: Energy Consumption, Military Expenditure, Comparative Analysis, Interplay, Azerbaijan, Turkey, Pakistan
JEL Classifications: C01, C40, P48, Q43

1. INTRODUCTION

The concept of defense has remained integral to ensuring safety, security, and mitigating risks throughout human history, following basic physiological needs such as breathing, eating, and drinking. Its significance lies in fostering trust and safeguarding societies in the eyes of states. Defense expenditures, particularly influenced by the advent of World War II and the rapid advancements in technology, have garnered attention due to their proportion in national income. The Cold War era witnessed states maximizing such expenditures, ultimately playing a pivotal role in budgetary allocations. Following the conclusion of the Cold War, defense expenditures globally experienced a decline, but have steadily risen since 1999. Numerous studies have delved into the relationship between defense expenditures and economic growth, resulting in divergent conclusions and sparking controversy. While some argue for a positive effect of defense expenditures on economic growth, citing positive externalities, others contend that such spending has a negative impact. This study aims to examine the conceptual and theoretical aspects of defense expenditures, focusing on three sample countries representing the regions with the highest military expenditure in the world.

Energy consumption and defence spending shape nations' economies, politics, and security in today's linked globe. Understanding the relationship between sustainable development and national security is crucial as nations seek both. This study compares energy usage and defence spending in Azerbaijan, Turkey, and Pakistan, three strategically important nations.

The theoretical relationship between energy consumption and defence expenditures is a subject studied in different disciplines. Basic theoretical approaches:

1.1. Economic Approach

There are various theories in the economic literature that there is a relationship between energy consumption and defence expenditures. According to this approach, there is a trade-off between economic growth and defence spending. When a country increases its defence spending, those expenditures draw resources from other areas, including the energy sector. With the increase in defence spending, the country's energy demand may also increase.

1.2. Security Approach

Defence expenditures are expenditures made for the security and national defence of a country. According to this approach, access to energy resources plays a critical role in a country's national security. Therefore, as a country's defence expenditures increase, its energy consumption may also increase. Investments in facilities, transport networks, and other infrastructure needed to securely access energy resources can increase energy consumption.

1.3. Geographical Approach

There may also be a geographical relationship between energy consumption and defence expenditures. Some countries may have their energy resources in close proximity to them or maintain their military presence in strategically important areas to trade energy resources. In this case, increased defence expenditures may affect energy consumption.

1.4. Technological Approach

The defence sector has been an important driving force for technological developments. Defence expenditures, such as new weapon systems and military research and development activities, can contribute to the emergence of innovative technologies and increase energy efficiency. This can affect energy consumption.

These theoretical approaches can help to understand the relationship between energy consumption and defence spending. However, it should be noted that this relationship may be different for each country and may be affected by various factors. Countries' energy policies, economic situations, security strategies, and other factors can shape the relationship between energy consumption and defence expenditures.

1.5. Purpose

This paper examines the complicated link between energy consumption and defence spending in Azerbaijan, Turkey, and Pakistan. We attempt to understand resource allocation in these nations by investigating patterns, trends, and relationships between these variables. This study also examines how energy consumption and defence spending affect country economies, security agendas, and regional dynamics.

Policymakers, economists, and security experts must understand the complex link between energy use and defence spending. This interaction reveals trade-offs, synergies, and policy consequences. This knowledge can improve resource allocation, national security, and sustainable development. This work may improve academic debate and guide future research on the energy-defense-national security nexus.

1.6. Scope

This comparative research compares Azerbaijan, Turkey, and Pakistan. These nations were picked for their distinctive geopolitical situations, energy profiles, and high defence spending. The research examines energy use, defence expenditures, economic indicators, and security situations throughout a specified period. This study compares energy consumption and defence spending in various nations to uncover similarities, discrepancies, and probable factors.

1.7. Method

The study will use a thorough and rigorous approach. Quantitative and qualitative research will be used. Government reports, international databases, and research publications will provide energy and defence expenditure statistics. Regression analysis and data visualisation will reveal patterns and trends. Qualitative analytical approaches like content analysis and case studies will help explain the relationship between energy usage and defence spending. These methods will give a complete look at energy usage and defence spending in Azerbaijan, Turkey, and Pakistan.

The relationship between energy consumption and defense expenditures is examined with econometric analyzes and empirical findings are carefully evaluated to understand the balance between these two variables.

2. LITERATURE REVIEW

Benoit (1978) conducted a study using a sample of forty-four developing nations from 1950 to 1965 and determined the correlation coefficients between defence expenditures and economic development. The study proposed that defence spending positively affects economic growth by stimulating total demand, which subsequently inspired numerous subsequent studies on the subject. Benoit's work played a significant role in encouraging further investigations into the effects of defence expenditures on economic growth.

Babin (1986) examined the relationship between these variables by collecting data from 88 developing nations and found that military stability is a crucial prerequisite for economic success. Atesoglu and Mueller (1990) employed the two-sector Feder-Ram model for the US economy and discovered a positive influence from the military sector on the civilian sector. They observed a positive effect of defence sector spending on the civilian sector. Stewart (1991) analysed the Keynesian demand function for a group of impoverished nations and concluded that both defence and non-defence expenditures are positively associated with economic development. However, non-defence spending exhibited a larger impact on growth compared to defence expenditures.

Mueller and Ateşolu (1993) used the two-sector Feder-Ram model for the US economy and concluded that increased defence spending leads to higher economic growth. They considered technological progress in their analysis. Sezgin (1997, 2001) investigated the defence-growth link in Turkey using the Feder-Ram and Deger-type multi-equation models, respectively. His research indicated that defence spending has a beneficial influence on economic development.

Yıldırım et al. (2005) employed a dynamic panel data technique to examine the impact of military spending on economic development in the Middle East and Turkey. They found that military expenditures contribute to increased economic growth. Kollias et al. (2007), using panel data analysis methodologies, also concluded that military expenditures have a positive short-term impact on growth and exhibit a positive feedback effect between these factors in the long run.

The scientific work of Hasanov (2008) shows the general provisions of national defense expenses. In the scientific work, the constituent parts of the security system of the armed forces related to defense costs are reviewed. It can also be concluded that the allocation of public funds to defense costs can be seen as a determining factor of economic efficiency.

Efendiyev's (2010) scientific work shows that one of the constituent parts of the national security policy of the Republic of Azerbaijanis the defense policy of the Republic of Azerbaijan aimed at ensuring national interests in the military and other fields. In the study, including the country's defense policy issues related to the economy have been considered.

Jafarli (2018) shows in his research that the strengthening of the economy opens wide opportunities for the increase of the military sector. It is possible to see the process of building an army, which is accelerated by the increase of military expenses, in the example of all the military units of the country. At the same time in the study, it is noted that 18.5% of the 2019 state budget expenses are aimed at maintaining defense and security, judicial power, law enforcement agencies and the prosecutor's office. Defense spending is an important component of research budget expenditures emphasizes its importance.

SIPRI's database (2023, April) shows that according to the law "On the 2022 state budget of the Republic of Azerbaijan," 5.08 billion manats were spent on defense and security. This is a huge sum that highlights the importance attached to protecting a nation's interests.

Similarly, studies conducted by Wijeweera and Webb (2011), Yıldırım and cal (2016), Augier et al. (2017), Daddi et al. (2018), Ifnan Khan et al. (2018), Hatemi-J et al. (2018), and Dimitraki and Win (2021) consistently suggest that defence spending has a favourable impact on economic expansion. In his research, Muradzada (2022) examined Russia's oil and gas industries and how global oil prices affect the country's key economic metrics. He also exemplified the concept of Dutch disease, which expresses the potential negative effects that natural resource wealth such as oil and gas can have on a country's economy.

Muradzadə (2022) examines the energy trade between Azerbaijan and Turkey, evaluating its size, interaction, and importance. The study analyses current data and literature to understand the dynamics of energy trade between the two countries. Sarkhanov (2022) focuses on the effect of oil prices on the Azerbaijani economy. The study highlights the relationship between oil price fluctuations and key economic indicators such as GDP and oil production, emphasising the strong impact of oil prices on the economy. Muradzadə (2022) investigates how global oil prices impact Russia's key economic metrics. The study also addresses the concept of the Dutch disease, which refers to the potential adverse effects of natural resource wealth (such as oil and gas) on a country's economy. The joint study by Sarkhanov and Muradzada (2023) offers a detailed analysis of the role of energy resources in the Gulf Basin in the context of EU energy security. It recognises the significant contribution of the Gulf area to the world's energy supply but emphasises the need to diversify energy sources and mitigate overreliance on the region's resources. The study highlights the importance of renewable energy sources, energy efficiency, and reducing dependency on the Gulf as quickly as possible. It also emphasises the significance of communication and collaboration between the Gulf governments and the EU for a reliable and long-term energy supply. Overall, these studies provide valuable insights into energy trade, the impact of oil prices on economies, and the importance of energy security and diversification in both regional and global contexts.

3. METHODOLOGY

In this part of the study, the objective and scope of the study, variables used in the study, study models, and time series analysis techniques used in data analysis are mentioned.

3.1. Objective and Scope of the Study

The objective of the study is to examine the effects of defense expenditures on national income per capita in countries in terms of short-term, long-term, and causality. The scope of the study covers the economies of Azerbaijan, Turkey, and Pakistan for the period 1992-2021.

3.2. Variables Used in the Study

The variables included in the study for the objective of the study, explanations of the variables, data sources, and symbols to be used in the equations are as in Table 1.

3.3. Study Models

It is desired to estimate the relations between the per capita income and the defense industry expenditures of the countries that are the subject of the study, on a country basis. In this context, the study has planned to establish and estimate three different models. The economic representations of these study models are as follows;

$$G_{AZE} = f\left(S_{AZE}\right) \tag{1}$$

$$G_{TUR} = f\left(S_{TUR}\right) \tag{2}$$

$$G_{PAK} = f\left(S_{PAK}\right) \tag{3}$$

Table 1: Variables used in the study

Variable	Explanation	Symbol		
		Azerbaijan	Turkey	Pakistan
Oil: Consumption	Oil: Consumption - Barrels	OIL_{AZE}	OIL_{TUR}	OIL_{PAK}
Gas: Consumption	Gas: Consumption - Bcm	NG_{AZE}	NG_{TUR}	NG_{PAK}
Military expenditure	Military expenditure	ME_{AZE}	ME_{TUR}	ME_{PAK}

Upon analysing equations (1), (2), and (3), we observe that there are three distinct models encompassing a single independent variable and one dependent variable. These models pertain to measurements of the same data type in various countries. While conventional econometric analysis typically resolves such scenarios using a single model and panel data methods, the limited number of countries (i = 3) available for the panel data dimension poses a constraint on panel data analysis. Consequently, there is a demand for conducting separate analyses for per capita income and defence industry expenditures in each country, leading to the adoption of time series analysis with three distinct models.

Equations (1), (2), and (3) represent the economic models aimed at examining the relationships under investigation. These models depict the relationship between defence industry expenditures and per capita income in different countries. It is significant to note that factors other than spending by the defence industry affect per capita income. However, due to the limitations of the study's scope, the estimations were focused solely on the relationship between the defence industry and per capita income. Consequently, it is anticipated that the forthcoming econometric analysis of the equations will yield low explanatory coefficients (R). While defence industry expenditures are believed to have an impact on per capita income, it is not feasible to explain per capita income exclusively based on defence industry expenditures. Therefore, it is reasonable to expect that the models will possess limited explanatory power, except for meaningful parameter estimates that align with economic theory. Thus, econometric models were modified as follows:

$$G_{AZE,t} = \beta_{0t} + \beta_{1t}\left(S_{AZE,t}\right) + £_t \tag{4}$$

$$G_{TUR,t} = \beta_{0t} + \beta_{1t}\left(S_{TUR,t}\right) + £_t \tag{5}$$

$$G_{PAK,t} = \beta_{0t} + \beta_{1t}\left(S_{PAK,t}\right) + £_t \tag{6}$$

In models (4), (5), and (6), the t indices correspond to the time periods in the time series data, while the £ parameters represent the error terms or residual terms of the model. The parameter β0t denotes the intercept term in the models, indicating that if defence industry expenditures are zero, per capita income does not necessarily start from zero. In other words, the equations do not pass through the origin. The parameter to be estimated in each model is β1t, which represents the effect of changes in defence industry expenditures on per capita income in the respective countries.

Upon examining the models, it is evident that they all consist of one dependent variable and one independent variable. In econometrics, models that aim to explain a dependent variable using a single independent variable are referred to as simple regression models. It is widely recognised that applying logarithmic transformations to the variables in established econometric models offers several advantages. Firstly, taking the logarithm of variables tends to bring them closer to a normal distribution. Secondly, employing logarithms allows for a straightforward interpretation of the estimated parameters in terms of percentage changes for the logged variables. Thus, models (4), (5), and (6) were updated using natural logarithms:

$$\log\left(G_{AZE,t}\right) = \beta_{0t} + \beta_{1t}\left(\log\left(S_{AZE,t}\right)\right) + £_t \tag{7}$$

$$\log\left(G_{TUR,t}\right) = \beta_{0t} + \beta_{1t}\left(\log\left(S_{TUR,t}\right)\right) + £_t \tag{8}$$

$$\log\left(G_{PAK,t}\right) = \beta_{0t} + \beta_{1t}\left(\log\left(S_{PAK,t}\right)\right) + £_t \tag{9}$$

Log-log models are the models that are produced when a logarithmic transformation is applied not only to the dependent variable but also to the independent variable. Without the need for any additional transformation, it is feasible, when working with log-log models, to interpret the estimated parameters in terms of percentage changes for the independent variable and the equivalent estimates in the dependent variable. This is made possible by the fact that log-log models are used. Because of this, it is possible to represent, in percentage terms, the influence that changes in the independent variable have on the variable that is being studied in a clear manner.

3.4. Data Analysis

Log-log models are obtained when both the dependent and independent variables undergo logarithmic transformations. These models enable the estimation parameters to be interpreted in relation to percentage changes in the independent variable and the corresponding effects on the dependent variable, without necessitating additional transformations. Consequently, log-log models facilitate a direct representation of the impact of variations in the independent variable on the dependent variable in terms of percentages.

4. FINDINGS OF THE STUDY

This section of the study presents the results derived from the data analysis, accompanied by tables and accompanying commentary.

4.1. Descriptive Statistics

The descriptive statistics of the variables used in the study are as in Tables 2 and 3.

The descriptive data that are shown in Table 2 give an overview of the consumption of oil and gas across six different categories, which are OILAZE, OILTUR, OILPAK, NGAZE, and NGTUR, respectively. These statistical measures, such as central tendency, dispersion, skewness, kurtosis, and normality tests, provide valuable insight into a variety of properties of the data.

Table 2: Oil and gas consumption descriptive statistics

Basic stats	OILAZE	OILTUR	OILPAK	NGAZE	NGTUR	NGPAK
Mean	−0.010515	0.024702	0.024524	0.003693	0.089300	0.049134
Median	−0.010152	0.026015	0.033186	0.018692	0.081550	0.041964
Maximum	0.287682	0.175598	0.147546	0.360441	0.262364	0.222167
Minimum	−0.418044	−0.076302	−0.165820	−0.313658	−0.089128	−0.077051
SD	0.128094	0.056639	0.073104	0.129539	0.091295	0.062239
Skewness	−0.681645	0.647757	−0.704027	−0.233370	−0.191219	0.872879
Kurtosis	5.424206	3.540666	3.350833	4.907141	2.318039	4.139150
Jarque-Bera	9.346865	2.381233	2.544386	4.658167	0.738690	5.250612
Probability	0.009340	0.304034	0.280216	0.097385	0.691187	0.072418
Sum	−0.304924	0.716345	0.711202	0.107098	2.589686	1.424892
Sum SD	0.459429	0.089822	0.149639	0.469851	0.233376	0.108464
Observations	29	29	29	29	29	29

Table 3: Military expenditure descriptive statistics

Basic stats	MEAZE	MEPAK	METUR
Mean	0.189584	0.041543	0.031784
Median	0.103346	0.050407	0.060671
Maximum	1.946279	0.151911	0.226499
Minimum	−0.730596	−0.121649	−0.325650
SD	0.457518	0.074371	0.132974
Skewness	1.753310	−0.244612	−1.103309
Kurtosis	9.200695	1.974585	3.897196
Jarque-Bera	61.31689	1.559734	6.856238
Probability	0.000000	0.458467	0.032448
Sum	5.497934	1.204761	0.921731
Sum SD	5.861042	0.154867	0.495096
Observations	29	29	29

When looking at the mean values, we can see that OILTUR, OILPAK, NGTUR, and NGPAK all have positive means, which indicates that there is a general tendency towards consumption. On the other hand, both OILAZE and NGAZE have mean values that are negative, which indicates a tendency towards considerably decreased use.

The median values are an additional measure of central tendency, and they typically line with the means for each group. This indicates that the distributions are broadly symmetrical.

After looking at the highest and lowest possible values, it seems that OILAZE and NGAZE have the most variable range of values, whilst OILTUR and NGTUR have ranges that are somewhat more constrained.

When compared to the other categories, OILAZE, NGAZE, and NGTUR have considerably greater variability as shown by the standard deviation, which reflects the dispersion of the data.

The value of skewness indicates how asymmetrical the distribution is. Both OILTUR and NGPAK have a positive skewness, which indicates that they have a tail towards higher consumption levels. The consumption rates for OILAZE, OILPAK, and NGAZE all have a negative skewness, which indicates a tail towards lower consumption levels. NGTUR demonstrates a skewness that is not very extreme.

The kurtosis statistic is used to determine how peaky a distribution is. All of the categories have positive kurtosis values, which indicates that they all have considerable peaks in their distributions; the categories with the highest values are OILAZE and NGAZE.

The Jarque-Bera test is used to determine how much one deviates from the norm. A deviation from a normal distribution may be inferred from the fact that OILAZE, OILPAK, NGAZE, and NGPAK all have test values and probabilities that are considerably higher than average.

These data provide a brief overview of the distribution and characteristics of oil and gas consumption across the six categories, offering insights into the trends, variability, skewness, kurtosis, and departure from normality. In conclusion, these statistics give a succinct description of the distribution and characteristics of oil and gas consumption.

Table 3 descriptive data give crucial information on military expenditures across three categories: MEAZE, MEPAK, and METUR. These categories are shown in the table. These statistical analyses provide light on a variety of facets of the data, including the central tendency, dispersion, skewness, kurtosis, and normality tests, amongst others. It would seem that MEAZE has the greatest mean, maximum, and positive skewness, all of which point to a possible concentration of higher values. Overall, MEPAK has lower values, and the skewness is in the negative direction. METUR not only has the lowest mean and minimum value, but it also has the most amount of negative skewness. According to the values of the Kurtosis statistic, MEAZE has a peak that is considerably higher, but MEPAK and METUR both exhibit distributions that are relatively flatter. The findings of the Jarque-Bera test indicate that MEAZE and METUR may diverge greatly from a normal distribution, although it seems that MEPAK may follow a pattern that is rather normal. These figures, when taken as a whole, give an overview of the characteristics of the distribution of military expenditures across the three categories.

In Tables 2 and 3, descriptive statistics and Jarque-Berra normal distribution test are given for the study variables. The null hypotheses and alternative hypotheses for the Jarque-Berra normal distribution test, which is used to control the compliance of the variables with the normal distribution assumption, are as follows;
H_0: The series is normally distributed.
H_1: The series is not normally distributed.

When the probability values (P) of the Jarque-Berra test statistics are examined, it can be said that the G_{AZE} and S_{AZE} variables conform to the normal distribution at the 1% significance level ($P > 0.01$), and the G_{TUR}, S_{TUR}, G_{PAK}, and S_{PAK} conform to the normal distribution at the 5% significance level (P > 0.05). On the other hand, when the skewness coefficients of the variables are examined, it is seen that they have low skewness coefficients so as not to disturb the normal distribution. The graphs of the annual per capita income variables of the countries are as in Figures 1-3.

Figure 1: Military expenditure charts

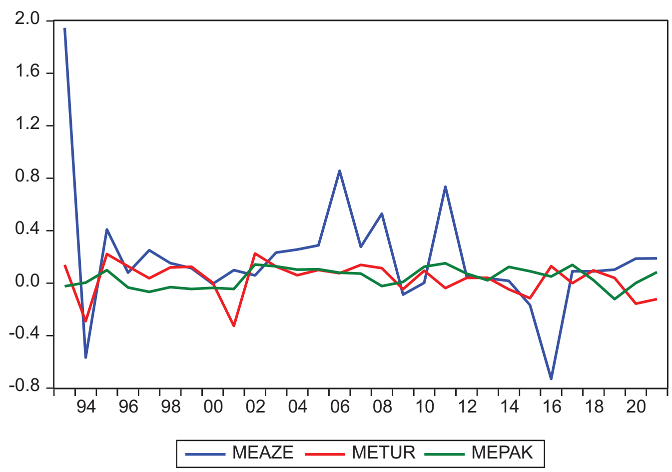


Figure 2: Oil: Consumption expenditures charts

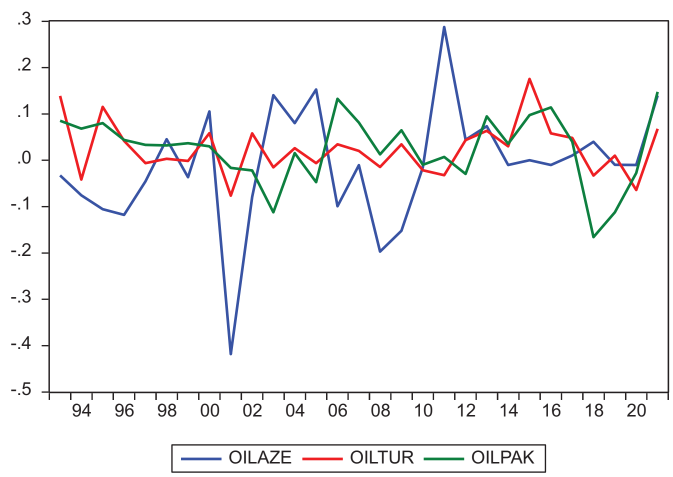
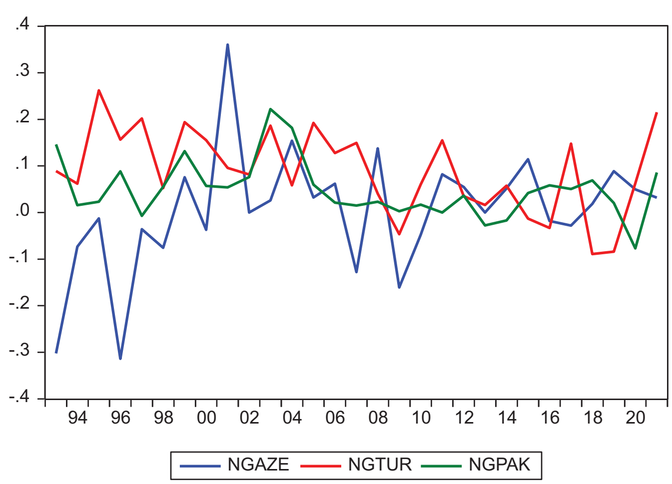


Figure 3: Gas: Consumption expenditures charts



The three countries of Azerbaijan, Turkey, and Pakistan all display a shifting tendency in their yearly defence spending, as can be seen in the graphs. When the graphs are looked at in order to form a hypothesis about the stationarity of the variables, it is evident that the variables are not stationary in their level values. This is apparent when the graphs are reviewed. The results of the unit root test will be analysed to see whether or not they provide conclusive evidence about stationarity conditions (Figure 1).

In light of the fact that changing patterns have been seen in the yearly consumption of oil in Azerbaijan, Turkey, and Pakistan, it is recommended that unit root tests be carried out in order to ascertain whether or not the variables are stationarized in their level values (Figure 2).

It has been recommended, on the basis of the observation of changing patterns in the yearly consumption of petrol in Azerbaijan, Turkey, and Pakistan, that unit root tests be carried out in order to ascertain whether or not the variables are stationarized in their level values (Figure 3). The results of unit root tests, such as the Augmented Dickey-Fuller (ADF) or the Phillips-Perron (PP), may give conclusive evidence for the stationarity of the variables. You will be able to assess if the variables display stationary behaviour by analysing the results of the unit root test or whether they need further differencing in order to achieve stationarity.

4.2. Unit Root Tests

An important assumption in regression analysis involving time series data is that the considered time series is stationary. In general, the time series is stationary if its mean and variance are constant over time, and if the covariance value between two periods does not depend on the actual period for which this covariance is calculated but only on the distance or gap between the two periods (Gujarati, 2016: 319). In the study, the stationarity of the series will be tested with the ADF (Augmented Dickey-Fuller) test. ADF unit root test is a unit root test that determines whether the series is stationary or not. The method is an improved version of the Dickey-Fuller (DF) unit root test. The ADF unit root test has taken into account the autocorrelation problem compared to the DF unit root test. With the ADF unit root test, three equations are proposed to be solved to answer whether a Y_t series is stationary at its level.

For $Y_t \sim I(0)$;

An equation without constant term and without trend: $\Delta Y_t = \beta_1 Y_{t-1} + \sum_{i=1}^{p} \sigma_i \Delta Y_{t-1}$

An equation with constant term: $\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \sum_{i=1}^{p} \sigma_i \Delta Y_{t-1}$

An equation with constant term and with trend: $\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Trend + \sum_{i=1}^{p} \sigma_i \Delta Y_{t-1}$

The ADF test requires the estimation of one or more or all of the above regression specifications with the Least Squares (LS) method. The null hypothesis and an alternative hypothesis for the ADF test are as follows;

H_0: There is a unit root in the series. (The series is not stationary at the level.)

H_1: There is no unit root in the series. (The series is stationary at the level.)

In most of the specifications, determinants are constant and trend. Adding a constant or trend variable unnecessarily will reduce the power of the test. This may lead to the decision that the stationary series is not stationary. The dependent variable lags in the equation are intended to eliminate the possible autocorrelation problem in the error terms. As a result of the test, if all three specifications point to the unit root in the same place or if they indicate that there is no unit root, a decision is made (Yamak and Erdem, 2017: 101). Otherwise, the mismatch is resolved by deciding between specifications. The cutoff term and the trend of the series can be read from the series chart to decide between specifications. When the charts of both per capita income and defense industry expenditures series are examined, it is seen that the series contain a cutoff term (not starting from the origin) and a trend (increasing trend). In this respect, in case of incompatibility between PP and ADF equation specifications, it would be appropriate to consider the test statistics of the equation with constant term and with trend. ADF and PP test statistics for all variables in the study, without constant term and without trend, with constant term, and with constant term and with trend, are as in Tables 4-9. According to the findings of the statistical analysis, all of the variables that are connected to oil consumption have unit roots. This suggests that their levels are not constant during their journey. When the initial differences of these variables are considered, however, it becomes clear that they have reached a stationary state. This is shown by the substantial t-statistics and probabilities that are near to zero. In general, this seems to indicate that the variables are more effectively analysed in terms of the changes that occur in them over time as opposed to their values in absolute terms.

The findings of the statistical analysis for petrol consumption point to the same conclusion as the one reached in the earlier investigation on oil consumption: The variables are not stationary at the level. However, when the initial differences are taken into consideration, the variables assume a stationary position. The stationarity of the variables in their differentiated form is further supported by the fact that the t-statistics are statistically significant and the probability are low. As a result, it is preferable to examine the shifts that have occurred in petrol consumption over the course of time as opposed to the absolute amounts (Table 5).

According to the results of the unit root test, the variables in question are non-stationary at the level. This conclusion may be drawn from the data. However, once the initial differences of the variables are taken into consideration, they assume a stationary state. The stationarity of the variables in their differenced form may be deduced from the fact that the t-statistics are statistically significant and the probability are low. As a result, it is more pertinent to examine the shifts that have taken place in military

Table 4: Oil: Consumption PP unit root test statistics

At level	Variables	With constant		With constant and trend		Without constant and trend	
		t-statistic	Prob.	t-statistic	Prob.	t-statistic	Prob.
	OILAZE	−4,3544	0.0020***	−8,8884	0.0000***	−4,4503	0.0001***
	OILTUR	−6,5577	0.0000***	−6,3881	0.0001***	−5,671	0.0000***
	OILPAK	−3,3433	0.0223**	−2,5906	0.2868	−2,8828	0.0056***
At first difference	d (OILAZE)	−14,3321	0.0000***	−13,8229	0.0000***	−14.2280***	0.0000
	d (OILTUR)	−13,6104	0.0000***	−13,3189	0.0000	−13.9165***	0.0000
	d (OILPAK)	−5,7523	0.0001***	−5,7029	0.0004	−5.8777***	0.0000

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided P values

Table 5: Gas: Consumption PP unit root test statistics

At level	Variables	With constant		With constant and trend		Without constant and trend	
		t-statistic	Prob.	t-statistic	Prob.	t-statistic	Prob.
	NGAZE	−5,6795	0.0001***	−5,7726	0.0003***	−5,7183	0.0000***
	NGTUR	−3,8395	0.007***0	−7,0052	0.0000***	−2,1288	0.0341**
	NGPAK	−3,7763	0.0081***	−3,7553	0.0348**	−2,8897	0.0055***
At first difference	d (NGAZE)	−23,9199	0.0001***	−31,7492	0.0000	−18.9410***	0.0000
	d (NGTUR)	−10,8504	0.0000***	−10,7436	0.0000	−12.6414***	0.0000
	d (NGPAK)	−9,9034	0.0000***	−9,5285	0.0000	−10,7273	0.0000***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided P values

Table 6: Military expenditure PP unit root test statistics

At level	Variables	With constant		With constant and trend		Without constant and trend	
		t-statistic	Prob.	t-statistic	Prob.	t-statistic	Prob.
	MEAZE	−7,8886	0.0000***	−7,7783	0.0000***	−7,0346	0.0000***
	METUR	−6,1387	0.0000***	−6,8795	0.0000***	−5,8292	0.0000***
	MEPAK	−3,2701	0.0263**	−3,2582	0.0941*	−2,6514	0.0100***
At First Difference	d (MEAZE)	−23,9611	0.0001***	−22,7017	0.0000	−24,665	0.0000***
	d (METUR)	−15,9083	0.0000	−29,1534	0.0000	−16,3387	0.0000***
	d (MEPAK)	−11,3851	0.0000***	−11,0122	0.0000***	−10,453	0.0000***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided P values

Table 7: Oil: Consumption ADF unit root test statistics

At level	Variables	With constant		With constant and trend		Without constant and trend	
		t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
	OILAZE	−4,4541	0.0015***	−4,7624	0.0036***	−4,5256	0.0001***
	OILTUR	−6,5577	0.0000***	−1,6249	0.7494	−2,2501	0.026**1
	OILPAK	−4,668	0.0010***	−4,4468	0.0082***	−3,9553	0.0003***
At first difference	d (OILAZE)	−7,5115	0.0000***	−7,3631	0.0000***	−7,6485	0.0000***
	d (OILTUR)	−12,18	0.0000***	−5,6718	0.0008***	−12,4646	0.0000***
	d (OILPAK)	−5,7523	0.0001***	−5,7029	0.0004***	−5,8795	0.0000***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided P values

Table 8: Gas: Consumption ADF unit root test statistics

At level	Variables	With constant		With constant and trend		Without constant and trend	
		t-statistic	Prob.	t-statistic	Prob.	t-statistic	Prob.
	NGAZE	−4,9413	0.0007***	−5,8126	0.0003***	−5,7565	0.0000***
	NGTUR	−3,8464	0.0069***	−5,2119	0.0013***	−2,3032	0.0230**
	NGPAK	−3,7763	0.0081***	−3,7553	0.0348**	−2,9171	0.0051***
At First Difference	d (NGAZE)	−3,1136	0.0402**	−2,9958	0.1553	−3,1507	0.0031***
	d (NGTUR)	−5,4957	0.0001***	−5,2085	0.0016***	−5,528	0.0000***
	d (NGPAK)	−5,8567	0.0001***	−5,7057	0.0005***	−6,0056	0.0000***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided P values

Table 9: Military expenditure ADF unit root test statistics

At level	Variables	With constant		With constant and trend		Without constant and trend	
		t-statistic	Prob.	t-statistic	Prob.	t-statistic	Prob.
	MEAZE	−9,144	0.0000***	−8,904	0.0000***	−8,0982	0.0000***
	METUR	−6,0612	0.0000***	−6,1507	0.0001***	−5,8467	0.0000***
	MEPAK	−3,3042	0.0243**	−3,3248	0.0829*	−2,6514	0.0100***
At First Difference	d (MEAZE)	−14,227	0.0000***	−13,7109	0.0000***	−14,5901	0.0000***
	d (METUR)	−6,8559	0.0000***	−6,7816	0.0000***	−6,9799	0.0000***
	d (MEPAK)	−6,3115	0.0000***	−6,0893	0.0002***	−6,4396	0.0000***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided P values

expenditures through time as opposed to the absolute numbers (Table 6).

The results of the ADF unit root test statistics for oil consumption indicate that the variables are non-stationary at the level for all instances except than OILTUR, for which the t-statistic is insignificant. However, once the initial differences of the variables are taken into consideration, they assume a stationary state. The stationarity of the variables in their differenced form may be deduced from the fact that the t-statistics are statistically significant and the probability are low. Therefore, it is more acceptable to analyse the variations in oil consumption over time as opposed to analysing the absolute amounts of oil consumption (Table 7).

According to the results of the ADF unit root test data for petrol consumption, the variables at this level are non-stationary in every instance. This is the conclusion reached by the test. However, once the initial differences of the variables are taken into consideration, they assume a stationary state. The stationarity of the variables in their differentiated form is supported by the substantial t-statistics and low probability found in the analysis. As a result, it is more pertinent to investigate the shifts that have occurred in petrol consumption through time as opposed to the absolute amounts (Table 8).

According to the results of the ADF unit root test data for military spending, the variables at the level are all non-stationary. This is the case for all of the instances. However, once the initial differences of the variables are taken into consideration, they assume a stationary state. The stationarity of the variables in their differentiated form is supported by the substantial t-statistics and low probability found in the analysis. As a result, it is more pertinent to examine the shifts that have taken place in military expenditures through time as opposed to the absolute numbers (Table 9).

At the 1% significance level, it was found that the variable was not stationary in the model without constant terms or trend, and that the model itself was not stable. Additionally, it was found that the model was not stable. Fixed term and not trending (Yt I[0]) (P > 0.01), but stationary (Yt I[0]) in the constant term model. fixed term and not trending (Yt I[0]) (P > 0.01). When the results of the ADF unit root tests are considered as a whole, it is clear that none of the series are stationary at the level value (they are not I[0]), but they do become stationary at the first difference (they are I[1] series). In this particular instance, the stationarity assumption in the time series estimate should be derived from the initial difference of all series. The following is a list of the working models that will be used after the initial differences in the series have been taken: According to the results of the ADF unit root test data for military spending, the variables at the level are all non-stationary. This is the case for all of the instances. However, once the initial differences of the variables are taken into consideration, they assume a stationary state. The stationarity of the variables in their differentiated form is supported by the substantial t-statistics and low probability found in the analysis. As a result, it is more pertinent to examine the shifts that have taken place in military expenditures through time as opposed to the absolute numbers.

4.3. Co-Integration Analysis

In order to examine the long-term course of the relationship between defense expenditures and per capita income in the economies of Azerbaijan, Pakistan, and Turkey, long-term co-integration relations can be examined. Co-integration was first introduced by Engle and Granger (1987). Co-integration of variables refers to the equilibrium relationship between variables. An equilibrium relationship means that the variables do not act independently of each other. In the co-integrated relationship, the trends of the variables are related to each other. In other words, the stochastic trends of the variables are related to each other. Co-integration means the linear combination of the series and indicates the existence of long-run equilibrium. It is a test based on error terms. It is based on the unit root test of the static least squares error terms of the long-term regression equation, and the hypotheses of the test are as follows (Yamak and Erdem, 2017: 101).

H_0: Series are not cointegrated.

H_1: Series are cointegrated.

Co-integration analysis statistics for model 1, model 2, and model 3 are presented in Tables 10-12.

Based on the provided information, it seems like you are looking at the results of some statistical tests, specifically the dependent tau-statistic, the associated probabilities, z-statistic, and their probabilities. The variables being analyzed are MEAZE, OILAZE, and NGAZE. The dependent tau-statistic measures the strength of the relationship between two variables in a time series context, taking into account their interdependencies. The associated probabilities indicate the statistical significance of the tau-statistic. The z-statistic is another measure of the relationship between variables, often used in hypothesis testing. Similarly, the associated probabilities provide a measure of statistical significance for the z-statistic. The intermediate results provide additional information related to the variables being analyzed. Rho represents the estimated coefficient for each variable, while Rho S.E. represents the standard error of the coefficient. Residual variance refers to the amount of unexplained variability in the data after accounting for the variables in the model. Long-run residual variance represents the estimated variance in the long run. The number of lags indicates the number of lagged values of the variables included in the analysis. The number of observations represents the number of data points used in the analysis. Lastly, the number of stochastic trends in the asymptotic distribution refers to the number of trends assumed to be present in the long run. Overall, without further context or a specific question, it is difficult to provide a more detailed interpretation or analysis of these results (Table 10).

It seems that the information gave is a statistics Table 11 for the Co-Integration Analysis, and it is particular to Turkey. It displays the outcomes for the variables METUR, OILTUR, and NGTUR respectively. The strength of the co-integrating connection between the variables is evaluated using the tau-statistic, which takes into consideration the interdependencies of the variables. The statistical significance of the tau-statistic may be interpreted based on the related probability. In a similar fashion, the z-statistic quantifies the co-integrating connection between the variables, and the accompanying probabilities offer a measure of the statistical significance of the findings. Additional information on the variables is provided in the section that discusses the intermediate outcomes. Rho is shorthand for the estimated coefficient associated with each variable, while Rho S.E. is shorthand for the standard error of the estimated coefficient. The amount of variability in the data that remains unexplained after taking into account all of the variables in the model is referred to as the residual variance. The term "long-run residual variance" refers to the estimated variation that occurs during the long run. The amount of lags provides an indication of the number of data that have been

Table 10: Co-integration analysis statistics (Azerbaijan)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
MEAZE	−8.850166	0.0000	−34.41800	0.0001
OILAZE	−4.214498	0.0370	−22.78520	0.0238
NGAZE	−5.351914	0.0033	−27.38937	0.0043
Intermediate results:		MEAZE	OILAZE	NGAZE
Rho -1		−1.229214	−0.813757	−0.978192
Rho S.E.		0.138892	0.193085	0.182774
Residual variance		0.108403	0.015930	0.014773
Long-run residual variance		0.108403	0.015930	0.014773
Number of lags		0	0	0
Number of observations		28	28	28
Number of stochastic trends**		3	3	3

**Number of stochastic trends in asymptotic distribution
*MacKinnon (1996) P values

Table 11: Co-integration analysis statistics (Turkey)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
METUR	−5.152255	0.0052	−29.24194	0.0019
OILTUR	−5.453656	0.0026	−28.29138	0.0029
NGTUR	−3.962380	0.0599	−21.88314	0.0320
Intermediate results:		METUR	OILTUR	NGTUR
Rho - 1		−1.044355	−1.010406	−0.781541
Rho S.E.		0.202699	0.185271	0.197240
Residual variance		0.016093	0.002620	0.008093
Long-run residual variance		0.016093	0.002620	0.008093
Number of lags		0	0	0
Number of observations		28	28	28
Number of stochastic trends**		3	3	3

*MacKinnon (1996) P values
**Number of stochastic trends in asymptotic distribution

Table 12: Co-integration analysis statistics (Pakistan)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
MEPAK	−3.530082	0.1287	−17.01850	0.1284
OILPAK	−4.232240	0.0389	40.00861	0.9999
NGPAK	−4.157316	0.0413	−20.34684	0.0515
Intermediate results:		MEPAK	OILPAK	NGPAK
Rho -1		−0.607803	−1.637762	−0.726673
Rho S.E.		0.172178	0.386973	0.174794
Residual variance		0.004472	0.003932	0.003093
Long-run residual variance		0.004472	0.003754	0.003093
Number of lags		0	3	0
Number of observations		28	25	28
Number of stochastic trends**		3	3	3

*MacKinnon (1996) P values
**Number of stochastic trends in asymptotic distribution

pushed back in time and included into the analysis. The number of observations is equal to the number of individual data points that were considered for the study. In conclusion, the number of stochastic trends in the asymptotic distribution is the number of trends that are presumed to exist in the long run. It is difficult to offer a thorough explanation of these data without providing further information or responding to a particular query.

The Table 12 provided is a Co-Integration Analysis Statistics table specifically for Pakistan. It presents the results for the variables MEPAK, OILPAK, and NGPAK. The tau-statistic measures the strength of the co-integrating relationship between the variables, considering their interdependencies. The associated probabilities indicate the statistical significance of the tau-statistic. The z-statistic also measures the co-integrating relationship between the variables, and the associated probabilities provide a measure of statistical significance. In the intermediate results section, Rho represents the estimated coefficient for each variable, and Rho S.E. represents the standard error of the coefficient. Residual variance refers to the amount of unexplained variability in the data after accounting for the variables in the model. Long-run residual variance represents the estimated variance in the long run. The number of lags indicates the number of lagged values of the variables included in the analysis. The number of observations represents the number of data points used in the analysis. Lastly, the number of stochastic trends in the asymptotic distribution refers to the number of trends assumed to be present in the long run. Without further context or a specific question, it is challenging to provide a detailed interpretation of these results.

4.5. Causality Analysis

The existence of a long-term equilibrium relationship in the economies of Azerbaijan, Pakistan, and Turkey was determined by cointegration analysis. The existence of long-term equilibrium allows us to examine the causal relationships between these variables. The causal relationships between the variables can be examined with the Granger causality test. The hypotheses for the Engle-Granger test are as follows;

H_0: X is not the cause of Y.

H_1: X is the cause of Y.

Granger causality test statistics are as in Table 13.

Table 13: Granger causality test statistics

Model	Hypothesis	F	P-value
Model 1a: Azerbaijan	OILAZE→MEAZE	0.72331	0.4963
	MEAZE→OILAZE	0.48202	0.6239
Model 1b: Azerbaijan	NGAZE→MEAZE	0.86338	0.4355
	MEAZE→NGAZE	0.54035	0.5901
Model 1c: Azerbaijan	NGAZE→OILAZE	0.55027	0.5845
	OILAZE→NGAZE	3.14033	0.0631
Model 2a: Türkiye	OILTUR→METUR	0.18676	0.8309
	METUR→OILTUR	2.57897	0.0986
Model 2b: Türkiye	NGTUR→METUR	2.30654	0.1232
	METUR→NGTUR	0.40036	0.6749
Model 2c: Türkiye	NGTUR→OILTUR	0.18720	0.8306
	OILTUR→NGTUR	0.29828	0.7450
Model 3a: Pakistan	OILPAK→MEPAK	2.32588	0.1212
	MEPAK→OILPAK	0.20687	0.8147
Model 3b: Pakistan	NGPAK→MEPAK	0.54670	0.5865
	MEPAK→NGPAK	18.5577	2.E-05
Model 3c: Pakistan	OILPAK→NGPAK	0.79629	0.4636
	NGPAK→OILPAK	0.02507	0.9753

The Granger causality test statistics for Model 1a, Model 1b, and Model 1c are provided in Table 13. These statistics illustrate the correlations between the variables that are being tested. However, based on the data that have been provided, none of the models provide any convincing evidence that there is a causal relationship between the variables. All of the hypotheses' F-tests have high P-values, which indicates that the variables do not substantially impact one another. It's possible that further research and analysis will be required before it will be possible to make any conclusions regarding the factors in Azerbaijan that are useful.

In terms of Turkey, Models 2a, 2b, and 2c illustrate the correlations between the variables that are being examined in this study. However, based on the data that have been provided, none of the models provide any convincing evidence that there is a causal relationship between the variables. All of the hypotheses' F-tests have high P-values, which indicates that the variables do not substantially impact one another. To assess whether or not there are any relevant causal correlations between the variables in Turkey, it's possible that further research and analysis is going to be required.

The links between the variables under investigation are shown by Pakistan's Models 3a, 3b, and 3c, respectively. On the basis of the numbers that have been provided, there is some indication of causation in Model 3b. The F-test for the hypothesis "MEPAK NGPAK" has a very low P-value (2.E-05), showing a strong effect of the variable MEPAK on NGPAK. This is supported by the finding that there is a positive correlation between MEPAK and NGPAK. The F-tests, on the other hand, do not give convincing evidence that there is a causal relationship between the variables in Models 3a and 3c. It's possible that further research and analysis is going to be needed in order to have a deeper understanding of the ways in which the variables in Pakistan are connected to one another.

5. CONCLUSION

Understanding the intricate workings of national dynamics and the factors that go into strategic planning requires an in-depth examination of the dynamic relationship that exists between a nation's energy consumption and its military spending. The availability of energy sources is one of the most important factors determining the safety and consistency of a nation. The amount of energy used and the money spent on defence have a direct bearing on a country's level of economic growth. The necessity to preserve energy infrastructure in the face of rising energy demand may have an impact on expenditure patterns in the defence sector. The dynamic relationship between rising energy prices and rising military spending shines a spotlight on the difficulty of effectively managing and allocating resources. To protect their national interests and ensure economic development, countries need to find a balance between assuring energy security, which is a key driver of economic growth, and maintaining a strong defence posture. Conducting a comparative research, such as the one that focused on Azerbaijan, Turkey, and Pakistan, gives useful insights into the unique ways that different nations employ in managing the energy-defense nexus.

In the framework of the Azerbaijani economy, it is generally acknowledged that there is no link between spending on defence and consumption of oil and natural gas. This is the case despite the fact that the two factors are closely related. It is a well-known fact that the use of oil does not immediately result in the consumption of natural gas. On the other hand, it is generally agreed upon that the use of natural gas is causally tied to the consumption of oil. On the other hand, there is evidence to support the theory that the economies of Turkey and Pakistan do not exhibit any correlation between their military spending, oil consumption, and natural gas use.

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