Received: 16 April 2023 | Revised: 29 November 2023 | Accepted: 14 August 2024

DOI: 10.1111/dome.12340

ARTICLE

Digest of Middle East Studies WILEY

Is military spending converging across Middle Eastern countries? A comprehensive unit root test analysis

Gulbahar Ucler[1] | **Serife Ozsahin**[2]

[1]Department of Economics, Faculty of Economics and Administrative Sciences, Kirsehir Ahi Evran University, Kırsehir, Turkiye

[2]Department of Economics, Faculty of Political Sciences, Necmettin Erbakan University, Konya, Turkiye

Correspondence
Gulbahar Ucler, Department of Economics, Faculty of Economics and Administrative Sciences, Kirsehir Ahi Evran University, Kırsehir, Turkiye.
Email: gulbahar.ucler@ahievran.edu.tr

Abstract

The Middle East is a region of chronic insecurity due to internal and external tensions. These tensions and insecurity have made the Middle East one of the world's leading regions in military armaments. This study investigates the stochastic convergence of military burden in 10 selected Middle Eastern countries using comprehensive unit root analysis. Stochastic convergence for each country from 1977 to 2020 is examined using conventional, structural break, nonlinear, and Fourier-based unit root tests. Empirical results provide strong evidence of convergence with regional averages in Bahrain, Saudi Arabia, and Oman. There is also some evidence of convergence in the case of Israel, Egypt, Kuwait, Lebanon, and Turkiye. However, evidence for the existence of convergence in Iran and Jordan is weak.

KEYWORDS

convergence, defense expenditure, military

1 | INTRODUCTION

The Middle East is a leading military armament region in the world. Between 2016 and 2021, 25% of the total arms sales were made to Middle East countries (al Jazeera, 2021). Among these sales, Gulf countries were especially featured as forerunners of armament. There are several drivers of regional armament, and it can be argued that recurring regional crises have increased armament in the Middle East. For example, consecutive wars between Israel and Arab countries in the region, especially the tensions experienced in 1967 and 1973, raised security threats

in the region to a higher level (Smith, 2008). The second important watershed was the Iran-Iraq war between 1980 and 1988. In this period, both countries allocated a significant budget for armament, with regional ramifications (Karsh, 2002). Finally, Iraq's attack on Kuwait, which emerged immediately after the end of the Cold War, was another turning point for the Middle East; Saddam Hussein's assault posed a great threat not only to Kuwait but also to other Gulf nations (Nufal, 1991).

Additionally, the Sunni–Shiite divide, a very deep rift in the Middle East, may be the source of many conflicts in the future (Holtmann, 2014). In this regard, it can be concluded that the upsurge of the Shiite crescent countries after the Arab Spring especially triggered sectarian conflicts in the region. Accordingly, sectarian differences were also counted among the causes of civil wars that spilled over the region (Byman, 2014; Salloukh, 2013). These internal conflicts can also be evaluated as proxy wars between Gulf countries and Iran (Phillips & Valbjørn, 2018). Since 2010, the Arab revolts have been perceived as a threat to the security of the regime of many Gulf countries, and the international environment has become increasingly threatening, especially for the Gulf countries (Krieg, 2016; Ryan, 2015). For this reason, many regional actors have resorted to strengthening their law enforcement forces. Finally, it is necessary to draw attention to the crisis in the Gulf countries. In 2017, a blockade against Qatar was initiated under the leadership of Saudi Arabia. The 2017 crisis among Gulf countries in the region evolved swiftly into a regional security crisis (Ulrichsen, 2020; Zafirov, 2017; Zweiri et al., 2021). Undoubtedly, such intraregional tension in the Gulf is another factor affecting regional armament. For instance, the country's long-standing rivalry with Iran and the shifting intraregional power balance in recent years have turned Saudi Arabia into one of the major arms importers of the World (Elass, 2019; Wezeman & Kuimova, 2019). In summary, the recent history of the Gulf cannot be separated from military crises, and armament is a direct result of regional insecurity.

As far as the Middle East is concerned, it does not seem possible to eradicate threats and thus cut military expenditures in a way that would make it possible to achieve peace for the entire region. Theories of international relations (IR) are of vital importance to scrutinize the dynamics underlying the source of threats and the level of military expenditure. In this framework, realist and liberal theories offer two perspectives (Nordhaus et al., 2012). According to realist theories, the security dilemma is seen as one of the sources of interstate conflict, and the mistrust of states toward each other constitutes the basis of militarized conflicts (Glaser, 1997; Herz, 1950). As a region where military conflict has been so pervasive and intense, ensuring regional peace and stability has been an elusive task in the Middle East (Milton-Edwards & Hinchcliffe, 2001; Tibi, 1998). The founding premises of the realist theory in terms of external threats can also be associated with military expenditures (Nordhaus et al., 2012). Thus, it should not be surprising that military expenditures have increased rapidly in the Middle East, where the security dilemma is evident.

Unlike realist theories of IR, which generally attribute military expenditures to external factors, liberal theories focus more on domestic factors. Unlike realists, who treat states as similar units in IR, liberal IR theories highlight the distinctive impact of domestic political factors on foreign policymaking. In this framework, other factors, especially the characteristics of regimes in countries, can be central factors in conflict decision making. In this regard, one strand of liberal theory strongly emphasizes the fact that democracies are less prone to war (Doyle, 1983; Russett et al., 1995). There is no doubt that the Middle East is not a favorable region in this regard. The fact that democratization in the Middle East has not progressed as fast as expected and that authoritarianism has not declined is an issue that is often emphasized

(Diamond, 2010; Stepan & Robertson, 2003). The lack of democratic mechanisms to constrain Middle Eastern regimes is an important factor. Therefore, the nature of regimes determines military expenditures in the Middle East and elsewhere (Brauner, 2015; Nordhaus et al., 2012). Added to this, another important assumption in liberal theory is that international organizations play an important role in global politics. It is often emphasized that these institutions are effective in preventing conflicts by reducing tension (Russett et al., 2003; Shannon, 2009). Hence, they also have an impact on the likelihood of conflict and thereby constrain military expenditure. Nevertheless, it can be asserted that there has not been large scale and comprehensive security architecture has been developed to promote peace in the Middle East (Haddadi, 2015).

Against this background, the main motivation for this study is to examine the existence of stochastic convergence of the military burden in 10 Middle Eastern countries from 1977 to 2020. Hence, this study contributes to the existing literature in several ways. First, according to the SIPRI (2021) yearbook, five of the 10 countries with the highest military burdens in the world are in the Middle East. In recent years, North Africa has also seen the greatest increase in military burden. In this context, the findings will enable us to make policy recommendations for MENA countries facing heavy military burdens. Second, to test stochastic convergence, Carlino and Mills' (1993) approach is adopted and uses the natural log of the ratio of military expenditure to gross domestic product (GDP) relative to the average ratio of military expenditure to GDP. Third, most studies on the convergence of military burden in MENA countries in the empirical literature use panel data methods (Ashrafi et al., 2019; Karabıyık, 2021; Yilanci et al., 2020), and therefore, individual country characteristics are ignored. This study provides a comprehensive time-series analysis distinctively from a great part of the previous literature using the 10 unit root methods with different properties. In this context, the findings of traditional unit root tests, structural break unit root tests, nonlinear unit root tests, and unit root tests based on the Fourier approach are important contributions to the literature on the subject.

The remainder of this article is organized as follows: After briefly discussing the theory of convergence analysis, the third section focuses on a literature review on the convergence of military spending. The fourth section introduces the data and methodology. The empirical findings are presented in the fifth section, and the last section summarizes the results and offers implications for future research.

2 | THEORY OF CONVERGENCE ANALYSIS

The concept of convergence generally means approaching a point. The convergence hypothesis is defined by Abramovitz and David (1994, p. 21) as "Under certain conditions, being behind gives a productivity laggard the ability to grow faster than the early leader." The most frequently encountered concepts related to convergence are beta-sigma convergence, income convergence, conditional-unconditional convergence, global-local (club) convergence, income-total factor productivity convergence, and deterministic-stochastic convergence. Empirical studies that started chronologically with absolute and conditional convergence were followed by beta and sigma convergence (Islam, 2003, pp. 312–316).

The convergence hypothesis, whose theoretical foundation is based on the Solow (1956) neo-classical growth model, assumes the law of diminishing returns. In low-income countries where capital is scarce, marginal capital productivity is higher. Faster-growing low-income countries will catch up with high-income countries in a common steady-state equilibrium.

Thus, the income gap between underdeveloped and developed countries will eventually close (Rassekh, 1998, p. 86).

The Solow growth model calls absolute (unconditional) convergence for countries where the conditions determining steady-state income are the same (Sala-i-Martin & Barro, 1995, p. 1). Baumol (1986), De Long, (1988), Barro and Sala-i-Martin (1991), and Mankiw et al. (1992) empirically examined convergence using an equation called Barro regression (Acemoglu, 2007: 20). $g_{t,t-1}$ growth rate between t and t-1, $\ln y_{t-1}$ being the logarithm of the initial per capita income level, if the β coefficient gets a statistically significant negative sign, there will be absolute beta convergence (Sala-i-Martin, 1996, pp. 3–4).

$$g_{t,t-1} = \beta \ln y_{t-1} + X'_{t-1}\alpha + \varepsilon_t. \quad (1)$$

Sigma (σ) convergence, on the other hand, refers to the decrease in the per capita income gap between countries or regions over time (Sala-i-Martin, 1996, p. 1020). The fact that the standard deviation of per capita income tends to decrease in sigma convergence indicates that countries will reach convergence. The β convergence and the σ convergence are interrelated. While the existence of β convergence tends to create σ convergence, the prerequisite for the existence of σ convergence is the existence of β convergence (Sala-i-Martin, 1996).

The neo-classical model assumes that countries have different initial income levels to achieve absolute convergence. However, in endogenous growth models shaped by the pioneering studies of Romer (1986) and Lucas (1988), it has been revealed that the similarity of technology level and decreasing yields does not work (Rassekh, 1998, p. 92). Considering the heterogeneity of the determining factors of the steady state, each region or country will reach steady-state equilibrium faster, and in this case, conditional convergence can be mentioned (Sala-i-Martin, 1990, p. 30).

The convergence of β and σ, which is frequently used in the convergence literature, has been criticized in many ways. It has been stated by Friedman (1992), Quah (1993), Bernard and Durlauf (1995), and Evans, (1996) that beta convergence gives biased results in cross sections. Bernard and Durlauf (1995) argue that the β convergence can test the hypothesis that incomes of all analyzed countries converge. There is not much evidence on the status of income levels between countries (Bernard & Durlauf, 1995). On the other hand, Hashem Pesaran, (2007) says that β convergence is related to convergence within an economy rather than between countries.

Stochastic convergence is a concept used to express that a shock to the ratio of a country's income to the country group average will be temporary (Carlino & Mills, 1993). To test stochastic convergence, log of the ratio of per capita income relative to the group average unit root tests are applied (Dawson & Strazicich, 2010, pp. 909–910). In case the shocks to this series are temporary, stochastic convergence will occur, and the log-relative series will follow a stationary process (Bulte et al., 2007, p. 163).

$$x_{it} = \ln(y_{it}/\bar{y}_{it}). \quad (2)$$

In Equation 2, y_{it} represents a country's per capita income in period t, and $\bar{y}_{it}$ represents per capita income in the group average in the same period. The failure to reject the unit root null hypothesis in stochastic convergence provides evidence of divergence. If the unit root is rejected, there will be stochastic convergence (Dawson & Strazicich, 2010, pp. 909–910).

Countries change the level of their defense spending in parallel with possible threats or turmoil in their geographical areas. The presence of terrorism or civil unrest in the country will lead to an increase in the military expenditure of the neighboring countries. If countries in the

region have similar trends in military spending, convergence will ensue. According to unit root tests, if the variable of the military burden is stationary, the military expenditure of the country converges to the average of the region.

3 | THEORETICAL AND EMPIRICAL LITERATURE REVIEW ON THE CONVERGENCE ANALYSIS

The concept of convergence can theoretically be defined as countries advancing their average income levels over time. The empirical testing of convergence, which is a theoretical expectation, has an important place, especially in the economic growth literature. Empirical analysis studies on the convergence hypothesis began with Baumol (1986). Baumol (1986) obtained results indicating that per capita income converged in 16 Organisation for Economic Co-operation and Development (OECD) countries. Barro (1992), Barro et al. (1991), and Barro and Sala-i-Martin (1991), who examined the convergence hypothesis using a cross-sectional approach, investigated the existence of beta convergence for large country samples and added a new dimension to empirical convergence discussions. Many studies in the literature examine the convergence dynamics of different macroeconomic variables, such as income, price, public expenditures, economic growth, and institutional structure indicators.

Aubyn (1999) used Augmented Dickey-Fuller (ADF) and Kalman filter convergence tests in his paper to examine whether GDP per capita in 16 developed countries converged between 1890 and 1989. The results indicate that the countries converged to the United States after the Second World War. Li and Papell (1999) analyzed the convergence of per capita production in 16 OECD countries from 1900 to 1997. The empirical results of this article, using the concepts of deterministic and stochastic convergence, suggest that deterministic convergence exists for 10 out of 16 OECD countries and stochastic convergence for 14. Evans and Kim (2005) used the dynamic random variables model in their paper analyzing GDP per capita convergence among 17 Asian countries over 1960–1992. The paper found that regional convergence in these countries occurred at a rate of about 2% per year. Changkyu Choi (2009) examines whether bilateral trade leads to a convergence in the level of real income per capita and in growth between the exporting country and the importing country. The paper includes 63 countries in the bilateral trade data. Sixty-two partner countries are included for each exporting country. The empirical findings of this study are that as the ratio of trade intensity between countries rises, both per capita income levels and growth convergence increase. Ranjpour and Zahra (2008) used data for the period 1995–2005 in their article. They examined whether the average per capita income of the 10 new European Union (EU) member states has converged to the average of the old member states. The results of the paper, using quarterly data on real output per capita, suggest that there are absolute convergence processes toward the EU standards in the countries in the sample. Gil-Pareja and Sosvilla-Rivero (2008) examined price convergence in the European Union automobile market between 1995 and 2005. The authors find strong evidence of price convergence among EU15 countries. Panopoulou and Pantelidis (2012) used data from 1972 to 2006 in their paper, examining the convergence behavior of per capita health expenditure in 10 OECD countries. The results show that there has been convergence in per capita health expenditure in the countries under study, but not in health outcomes. Blanco et al. (2020) examined convergence of R&D expenditures in EU28 countries during the period 2004–2015. Sigma convergence analysis results show that despite government sector differences, business and higher education sector have convergence in total

expenditures. Mouteyica and Ngepah's (2023) paper evaluates health expenditure in two different categories, examining health expenditure convergence behavior in 40 African countries from 2000 to 2019. The results indicate that neither indicator shows full panel convergence. However, evidence of convergence clubs was obtained.

Although there are many studies in the literature on the convergence behavior of different economic and institutional indicators, the number of studies examining the convergence of defense expenditures for a particular region is quite limited. Apergis et al. (2013) examined the convergence relationship of public expenditures with the data of 17 EU member countries for the period 1990–2012. The paper divided public spending into 10 different categories, such as defense, economic affairs, education, environmental protection, public services, health, housing and community facilities, public order and security, culture, religion and belief, and social protection. The empirical findings of Apergis et al. (2013), in which they examined the convergence relationship of defence spending, suggest the existence of three convergence groups. The first group of countries with convergence is Cyprus, Estonia, Greece, Finland, France, Italy, Portugal, and Slovenia, while the second group is Austria, Belgium, Germany, Malta, the Netherlands, Slovakia, and Spain. The last group consists of Ireland and Luxembourg.

Arvanitidis et al. (2014) investigated the convergence relationship in defense expenditures in 128 countries in the period of 1988–2008. The findings of this study indicate that defense expenditures converge for all countries in the sample. In addition, the study stated that developing countries converged faster than underdeveloped countries. The study by Arvanitidis et al. (2014) analyzed the post-Cold War period due to the limited SIPRI (Stockholm International Peace Research Institute) data set. Upon expanding the defense expenditure data set until 1949, Arvanitidis and Kollias (2016) reconsidered the convergence relationship for the 1970–2015 period. For all countries in the SIPRI data set, both pre-Cold War and post-Cold War convergence relationships were examined. The finding obtained from this study is that there is a convergence relationship toward a lower level of defense expenditure based on its ratio to GDP. However, this convergence relationship has been showing signs of reversal/divergence in recent years. Lau et al. (2016), using the 1988–2012 period data for 37 countries, examined the existence of the convergence relationship with cross-sectional heterogeneous nonlinear and linear panel unit root tests. Empirical findings show that in 53% of countries, defense expenditures converge to the world average. Among the countries included in the model, 39% converged to Germany, 33% to China, 22% to the United States, and 11% to Russia. Another finding is that the United States, which is the world's largest defense spender, does not converge with the world average. However, nonlinear unit root test results showed that the countries included in the model converged to the defense expenditures of the United States at the 10% significance level. Sawhney et al. (2016) found that the defense expenditures of all NATO member countries, except Hungary, converged with the defense expenditures of the United States.

In another study examining the convergence of defense expenditures in NATO-allied countries, Güriş et al. (2017) applied linear and nonlinear unit root tests to the data of the 1953–2014 period. Their empirical findings indicate that the defense expenditures of Germany, Greece, Portugal, England, and Luxembourg converged to the NATO average. Arvanitidis et al. (2017) empirically examined the existence of defense policy convergence in the NATO alliance. According to the results obtained from B and σ convergence and the Markov chain, a convergence process exists in the defense policies of NATO alliance countries. Yazgan et al. (2018) examined the convergence of defense expenditures of 14 NATO countries in the 1960–2014 period using nonlinear unit root tests. It has been determined that the ratio of defense expenditures to GDP of the relevant countries converges with that of the United States, and this

convergence relationship exhibits a nonlinear structure. Das et al. (2018) investigated the convergence of defense expenditures in a total of 45 countries, 23 of which are developed and 22 of which are developing, in the period 1988–2013. The empirical findings show that there is absolute beta-convergence in defense expenditures of the countries included in the model but no sigma convergence. Solarin (2019) examined the convergence of defense spending in Asia-Pacific countries. Data sets from both SIPRI and World Military Expenditures and Arms Transfers were used in this article. The results of this study, which uses a two-stage method for stochastic and beta convergence, indicate weak convergence in the region's military spending. Saba and Ngepah (2020) examined the convergence of military spending and economic growth in a panel of 35 African countries between 1990 and 2015. Overall, the results at the African level reveal no evidence of convergence in military spending, but after robustness tests, the final club classification results support the club convergence hypothesis for the two variables. Yilanci et al. (2020) tested the convergence of military burdens in 12 MENA countries for the period 1977–2017. The results show that there is unconditional β-convergence for the panel. However, individual convergence only holds for Algeria, Egypt, Israel, Jordan, Morocco and Saudi Arabia. In addition, the study examined whether the military burden of Israel and the United States has an impact on the military burden of the countries in the panel. The results show that only the military burden of Kuwait, Morocco, Oman, Saudi Arabia, Tunisia, and Turkiye is converging toward the military burden of Israel. An individual convergence with the United States can only be observed for Jordan, Kuwait, Morocco, Oman, and Tunisia. Ucler and Bulut (2021) investigated the convergence of defense expenditures in 27 NATO member countries with unit root tests based on traditional structural break and Fourier approaches. Findings point to weak evidence for the existence of convergence. Clements et al. (2021) examined the convergence in defense expenditures in 138 developed and developing countries from 1970 to 2019. As a result of the analysis, which divided the countries into three groups, it was determined that defense expenditures converged in developed and developing countries. Karabıyık (2021) tested the convergence of defence spending in MENA countries using data for the period 1993–2019. The results of the analysis show unconditional β converging among the countries in the panel. In addition, Morocco, Tunisia, Jordan, and Turkiye converge to the group mean at 10%, Bahrain, Kuwait, and Lebanon at 5% and Saudi Arabia at 1% significance level.

On the other hand, there are different theoretical approaches to countries' defense expenditures and policies in IR literature. One of the most widely discussed approaches to defense spending in the literature is the security dilemma theory. According to the Security Dilemma theory, the anarchic structure of the international system and security concerns lead countries to increase defense expenditures. A country's increase in defense expenditures may cause other countries to perceive it as a security threat and increase their own defense expenditures. Although this does not increase security, it can lead to a cycle of distrust. Because each country believes that the increase in its defense expenditure is only for defense purposes, other countries believe that it is threatening action. In the literature, the number of studies examining defense expenditures with quantitative methods within the scope of the security dilemma theory is quite limited. Li et al. (2015) examined the impact of the security dilemma on military expenditures in China. According to the empirical findings of this study, China's security dilemma is closely related to the defense expenditures of the United States and allied countries. The defense expenditures of the United States, Japan, and South Korea positively affect China's military expenditures. The results support the hypothesis that the increase in defense expenditures of these countries creates a security dilemma for China and increases its defense expenditures. Shiddiqya et al. (2019) in their study on the Indonesian defense industry, they state that the security

dilemma and arms races in the Southeast Asian Region are a threat to Indonesia's sovereignty and that Indonesia should increase its domestic defense industry capacity. Juma'in bin Saadon (2020), examined the concept of security dilemma in the South Asian region based on realist theory. This article emphasizes that despite the increasing economic growth in Southeast Asian countries, defense expenditures have not increased significantly, no arms races exist between countries, and the concept of the security dilemma is limited for Southeast Asian countries. Liff and Ikenberry (2014) examined the rise of China, military competition, and security dilemmas in the Asia–Pacific. The findings of this article indicate that competition arising from the security dilemma is an important factor in ongoing multilateral disputes in the Asia–Pacific.

4 | DATA AND METHODOLOGY

The NATO definition of military expenditure includes all current and capital expenditure on the armed forces, expenditure on military training and equipment by defense ministries and other government agencies involved in defense projects, and military space activities. Military burden, which expresses the share of military expenditures in GDP per country, is the simplest criterion used to measure the economic burden of military expenditures. Data from 10 Middle Eastern countries (Saudi Arabia, Bahrain, Kuwait, Iran, Oman, Jordan, Egypt, Israel, Lebanon, and Turkiye) for the period 1977–2020 from SIPRI (2021) were used in this study. Carlino and Mills (1993) approach was followed to test stochastic convergence. According to Carlino and Mills (1993) approach, stochastic convergence is expressed as the stationarity of a series obtained by Equation 3.

$$x_t = \ln\left(ME_{i,t}/\bar{ME}_t\right). \tag{3}$$

Here $ME_{i,t}$ is the ratio of military expenditure to GDP for country i during period t. $\bar{ME}_t$ represents the average ratio of military expenditures to GDP for period t. Unit root tests were used to investigate stochastic convergence. In this direction, the military burden convergence in Middle Eastern countries will be examined using traditional unit root tests, structural break unit root tests, nonlinear unit root tests, and unit root tests based on the Fourier approach.

Stationary series fluctuate around a fixed long-run mean, and variance does not change over time. However, nonstationary series does not tend to follow a deterministic path in the long term. Therefore, the variance of the series changes over time (Glynn et al., 2007, p. 66). With the study conducted by Nelson and Plosser (1982) for the first time to examine the stationarity structures of a series, a rich literature testing the existence of unit roots in time series began to emerge (Cheung & Chinn, 1997, p. 68). Formal tests developed to test the stationarity of time series data are based on the studies of Dickey (1976) and Dickey and Fuller (1979, 1981).

Dickey and Fuller's (1979, 1981) ADF test is based on the AR(1) model, which includes a constant and/or trend with a lagged value of the dependent variable (Xiao & Phillips, 1998, p. 27). Other unit root tests, developed over time, are also based on the ADF model. In Equation 4, the null hypothesis of unit root $\varphi = 0$, and the alternative hypothesis indicating the stationarity of the series are tested with that of $\varphi < 0$ (Asteriou & Hall, 2007, p. 296; John et al., 2007, p. 66).

$$\Delta Y_t = \alpha_0 + \varphi Y_{t-1} + u_t. \tag{4}$$

Perron (1989) stated that in the presence of structural breaks, the standard ADF test will deviate from the null hypothesis (Kočenda & Černý, 2014, p. 76). Perron (1989) suggested allowing a known date or an exogenously determined break period in the ADF test to account for structural changes. Zivot and Andrews (1992, hereafter ZA) criticized the external predetermination of the break in the Perron (1989) method and mentioned that this would cause problems. ZA considers three models for unit root testing. Model A takes into account a single break at the level, Model B a single break at the slope, and Model C a single break at both the slope and level (Zivot & Andrews, 1992, pp. 251–254).

Lee and Strazicich (2003) (hereafter LS) criticized ADF-type unit root tests, in which the break period is determined internally, because they derive a critical value without considering the break in the null hypothesis. Considering the refraction, these methods may give trend-stationary results for nonstationary series and may create the problem of "spurious rejection" (Strazicich et al., 2004, p. 133). To avoid this problem, LS developed the two-break minimum Lagrange multiplier (LM) unit root test, in which the structural break is determined internally. In this method, two structural breaks are allowed under both null and alternative hypotheses (Glynn et al., 2007: 71). If the null hypothesis includes a break, then the rejection of the null hypothesis indicates that the series trended stationary with break (Lee & Strazicich, 2003, p. 1082).

LS (2003) represents multiple structural breaks with dummy variables. Z_t represents the vector of exogenous variables. Z_t is defined as $Z_t = [1, t, D_{1t}, D_{2t}]$ for Model A, which allows Level 2 breakouts. In Model C, which includes two breaks in level and trend, is defined as $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]$. The unit root null hypothesis is defined as $\phi = 0$ and the LM test statistic is calculated as $\tilde{\rho} = T\tilde{\phi}$ (Lee & Strazicich, 2003, pp. 1082–1083).

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + u_t. \tag{5}$$

Perron (1989, 1990), Zivot and Andrews (1992), Lumsdaine and Papell (1997), and Lee and Strazicich (2003) conducted unit root tests with structural breaks, assuming that structural change occurs suddenly and at a certain point in time (Cuestas & Ordóñez, 2014, p. 969). In these methods, structural changes are considered by creating a dummy variable belonging to the breaking period. However, structural changes occur gradually, not as suddenly and sharply as these methods assume. Leybourne et al. (1998) (hereafter LNV) stated that structural change occurs gradually and defined this situation using the logistic smooth transition function. The first method that considers nonlinearity and structural breaks in unit root analysis was developed by Kapetanios et al. (2003) (hereafter KSS). In this method, nonlinearity and nonstationarity are considered with the help of the exponential smooth transition autoregressive (ESTAR) model (KSS, 2003, p. 360).

KSS (2003) performed unit root testing with three different model types. These data were in the form of raw data, demeaned data, and demeaned and detrended data (Kapetanios et al., 2003, p. 364). The null hypothesis is a unit root, and the alternative hypothesis is nonlinear ESTAR stationarity. In the model in Equation 6, the null hypothesis is tested with $\theta = 0$, and the alternative hypothesis is tested with $\theta > 0$. However, since γ is not defined in this regression, null hypothesis testing cannot be performed. To overcome this problem, Kapetanios et al. (2003) developed the auxiliary regression model in Equation (7) by applying the first-order Taylor expansion.

$$\Delta y_t = \gamma y_{t-1}\left[1 - \exp\left(-\theta y_{t-1}^2\right)\right] + e_t. \tag{6}$$

$$\Delta y_t = \delta y_{t-1}^3 + e_t. \quad (7)$$

Equation 7 of the KSS method is estimated by OLS. The test statistic is calculated with the formula $t_{NL} = \hat{\delta}/se(\hat{\delta})$. The y_{t-1}^3 in the model represents the ESTAR nonlinearity. With the help of this regression, the null hypothesis is tested with $\delta = 0$ and the alternative hypothesis with $\delta < 0$. If the calculated t_{NL} statistic is greater than the critical value, the null hypothesis is rejected. In this case, it is concluded that the series is ESTAR stationary.

Sollis (2009), on the other hand, abandoned Kapetanios et al. (2003) assumption that shocks tending to return to the mean have symmetrical effects and developed a different test based on the fact that these effects can be separated into positive and negative (Sollis, 2009, p. 119). In this method, the asymmetric nonlinear unit root test is obtained by considering both the exponential and logistic functions together. The auxiliary regression equation considered by Sollis (2009) is shown in Equation 8.

$$\Delta y_t = \rho y_{t-1} + c_1 + c_2 t + c_3 \sin(2\pi kt/T) + c_4 \cos(2\pi kt/T) + e_t. \quad (8)$$

Enders and Lee (2012) criticized unit root tests with structural breaks because they give different results according to the structure, shape, and number of breaks, and they developed one of the Fourier unit root tests that can perform strong stationarity tests without having this information (Enders & Lee, 2012, p. 196). Enders and Lee (2012) reached Equation 9 by extending the standard DF unit root regression with Fourier terms.

$$\Delta y_t = \rho y_{t-1} + c_1 + c_2 t + c_3 \sin(2\pi kt/T) + c_4 \cos(2\pi kt/T) + e_t \quad (9)$$

Here, k represents a particular frequency, and T is the number of observations. One important point in applying this method is the correct determination of the k-frequency number. In this direction, Equation 9 is estimated as $1 \leq k \leq 5$. The regression, where the sum of squared residuals (SSR) is the smallest, will give the appropriate frequency (k). After determining the appropriate frequency value, $\rho = 0$ is checked for the null hypothesis in the unit root test. Enders and Lee (2012) calculate two different critical t statistics, τ_{DF-t} for the series with a trend and τ_{DF-C} for the series with constant (Enders & Lee, 2012, p. 197).

After determining the stationarity of the series, the equality between the trigonometric terms in Equation 9 and zero is checked to test their nonlinearity. For this, the $c_3 = c_4 = 0$ test is performed with the standard F test. If the null hypothesis cannot be rejected, then the trigonometric terms are insignificant. If the calculated F statistic is less than the critical value reported by Enders and Lee (2012, p. 197), the null hypothesis of linear trend cannot be rejected. Under these conditions, Equation 6 will turn into a standard DF regression; thus, it is more appropriate to use the ADF test (Enders & Lee, 2012, p. 197).

5 | EMPIRICAL FINDINGS

This study examines the stochastic convergence in the ratio of military expenditures to GDP in 10 Middle Eastern countries during the period of 1977–2020. Table 1 presents the descriptive statistics of the military burden series, which provides the share of military expenditures in GDP for 10 Middle Eastern countries. Saudi Arabia, Oman, Israel, and Kuwait have the highest

TABLE 1 Descriptive statistics.

Country	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Bahrain	4.681	8.5	2.1	1.149	0.525	4.528	6.309**
Egypt	3.918	13.1	1.2	2.703	1.418	4.564	19.24*
Iran	3.840	11.1	1.7	2.336	1.500	4.391	20.06*
Israel	10.30	23.1	5.2	5.556	0.877	2.363	6.394**
Jordan	7.061	12.5	4.2	2.431	0.684	2.197	4.614***
Kuwait	10.29	117.3	3	18.25	4.968	28.58	1380.9*
Lebanon	5.670	13.5	1.1	2.616	1.186	4.337	13.59*
Oman	11.48	20.9	5.7	3.499	0.710	2.878	3.731032
Saudi Arabia	11.68	19	7.2	3.375	0.514	2.036	3.639276
Turkiye	3.170	4.7	1.8	0.811	−0.201	1.731	3.244718

Note: *, **, and *** indicate rejection of the null hypothesis of normality at significance levels 1, 5, and 10, respectively.

average military burden values among these countries. The lowest average military burden was found in Turkiye, Iran, Egypt, and Bahrain. The skewness test statistics indicate that series are positively skewed in nine out of 10 countries except Turkiye. Kurtosis statistics in five countries are less than three and the series was highly platykurtic relative to the normal distribution. The Jarque-Bera statistic suggests that we can reject the null hypothesis of normality in seven cases, which include Bahrein, Egypt, Iran, Jordan, Kuwait, Lebanon, Oman, and Saudi Arabia. The series were used in the analysis by performing logarithmic transformation.

The convergence of the share of military expenditures in GDP to the group average in 10 Middle Eastern countries was checked using a total of 10 tests, including traditional, structural break, nonlinear, and Fourier unit root tests. The findings obtained using the traditional methods ADF (Augmented Dickey Fuller, 1981), PP (Phillips-Perron, 1988), and DF-GLS (Elliott, Rothenberg, and Stock, 1996), which do not take into account structural breaks and nonlinearity, are given in Table 2.

The rejection of the null hypothesis of unit root in the results presented in Table 2 means that the series are stationary and therefore converge. The null hypothesis of unit root was rejected in Bahrain, Israel, Oman, and Saudi Arabia according to the ADF unit root test and in Bahrain, Iran, and Saudi Arabia according to the PP unit root test. According to these results, the share of military expenditures in GDP converges to the regional average in four countries according to the ADF test and in three countries according to the PP test, and stochastic convergence is valid in these countries. Elliott et al. (1996) DF-GLS test gave convergence results in six countries, namely Bahrain, Israel, Jordan, Lebanon, Oman, and Saudi Arabia.

Traditional unit root tests are criticized for not taking into account the effects of shocks such as economic crises, wars, military threats, and natural disasters. These methods may provide misleading results in which the null hypothesis cannot be rejected. Considering these breaks, the convergence or divergence of the military burden was tested using ZA (1992), LS (2003), and Narayan and Popp (2010) (NP) structural break unit root tests. The findings are presented in Table 3.

The findings of the ZA unit root test with one sharp break indicate that the null hypothesis of divergence was rejected in six countries. The ratio of defense expenditures to GDP in

TABLE 2 Conventional unit root test results for stochastic convergence.

Country	ADF	PP	DF-GLS
Bahrain	−5.819***	−5.739***	−3.089*
Egypt	−2.758	−2.680	−2.657
Iran	−2.280	−6.139***	−2.160
Israel	−3.776**	−2.517	−3.672**
Jordan	−2.986	−2.995	−2.974*
Kuwait	−2.579	−1.791	−2.432
Lebanon	−3.060	−3.163	−3.067*
Oman	−3.898**	−3.130	−3.318**
Saudi Arabia	−4.183**	−3.322*	−4.287***
Turkiye	−2.525	−2.526	−2.572

Note: ***, **, and * indicate that the null hypothesis is rejected at significance levels of 99, 95, and 90, respectively. The optimal lag selection was based on the SIC for ADF and DF-GLS. The spectral estimation of PP was based on Bartlett with Newey–West bandwidth selection. All estimations include intercept and linear trends.

Abbreviation: ADF, Augmented Dickey-Fuller.

TABLE 3 Results of structural break unit root tests for stochastic convergence.

Country	Zivot and Andrews (ZA) (1992)	Lee and Strazicich (LS) (2003)	Narayan ve Pop (NP) (2010)
Bahrain	−5.271** (1994)	−4.843 (1988, 1993)	−6.631*** (1990, 1999)
Egypt	−3.586 (1999)	−5.519 (1988, 2002)	−0.888 (1991, 1995)
Iran	−5.932* (1990)	−5.733 (1988, 2008)	−5.004* (1989, 2010)
Israel	−4.670 (1990)	−6.151*** (1995, 2007)	−2.940 (1989, 1993)
Jordan	−4.583 (1996)	−5.608 (1995, 2011)	−3.138 (1989, 1995)
Kuwait	−4.107 (1990)	−5.967*** (1988, 1994)	−0.335 (1987, 1989)
Lebanon	−5.212** (1992)	−6.936* (1985, 1991)	−-5.018* (1986, 1991)
Oman	−5.956* (1990)	−6.433** (1988, 1993)	−3.669 (1989, 1991)
Saudi Arabia	−5.451** (1990)	−7.058* (1988, 1995)	−3.564 (1990, 1996)
Turkiye	−5.320** (1992)	−4.773 (1992, 2013)	−0.548 (1991, 1998)

Note: *, **, and *** indicate the rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively. Based on Model C for the ZA, we construct a break model for the LS. The maximum lag length is 4. The critical values for ZA test 1%, 5%, and 10% significance levels are 5.57, 5.08, and 4.82, respectively. The critical values for NP (2010)'s 1%, 5%, and 10% significance levels are 5949, 5,181, and 4,789, respectively.

Bahrain, Iran, Lebanon, Oman, Saudi Arabia, and Turkiye is stationary and converges to the average. In most of the Middle East countries, the year 1990, when the Gulf War occurred, and the years that followed emerged as the period of breaking. Lee and Strazicich (2003) LM unit root test results with two internal structural breaks showed stationarity in five out of 10 countries. Accordingly, the null hypothesis of divergence is rejected in Israel, Kuwait, Lebanon, Oman, and Saudi Arabia, and the share of defense expenditures in GDP converges to the

average. The test results of Narayan and Popp (2010), the version of the ADF unit root test with two internal breaks, indicate stagnation and convergence in Bahrain, Iran, and Lebanon.

The KSS (2003), Sollis (2009), and Kruse (2011) methods were applied to determine the effects of structural breaks and nonlinearity on convergence. However, before applying nonlinear unit root tests, Harvey et al. (2008—hereafter HLX) test was used to test the null hypothesis of linearity against the alternative of nonlinearity. HLX (2008) has an advantage over other methods in that it considers the stationary and nonstationary structure of a series in two different regressions. If the calculated test statistic is greater than the critical value, the null hypothesis is rejected, and the series is determined to be nonlinear. The findings regarding the stationarity structures of the military burden in the 10 Middle East countries are presented in Table 4. According to HLX (2008) test results, According to HLX (2008) test results, the null hypothesis is rejected at the 99% significance level in Bahrain, Egypt, Iran, Oman, Saudi Arabia, and Turkiye, while it is rejected at the 95% significance level in Kuwait and 90% in Israel. The military burden of the 10 Middle Eastern countries in the panel exhibits a linear structure only in Jordan and Lebanon. To test the validity of stochastic convergence with nonlinear unit root tests, the analysis continued with eight countries.

According to KSS (2003) unit root test results, the null hypothesis is rejected at the 99% significance level in Bahrain, Egypt, and Turkiye, 95% in Kuwait and Oman, and 90% in Saudi Arabia. Therefore, in the six countries, the military burden has ESTAR stationarity, and convergence with the regional average is valid. KSS (2003) reported that the nonlinear version of the ADF test and the ADF test results showed similar findings for Bahrain, Oman, and Saudi Arabia. However, Egypt, Kuwait, and Turkiye, which include unit roots in the ADF test, became stationary in the KSS (2003) test, in which nonlinearity is considered. While stationarity and convergence were valid in the ADF test for Israel, the opposite was found according to KSS (2003).

TABLE 4 HLX (2008) linearity test and nonlinear unit root test results for stochastic convergence.

Country	HLX (2008)	KSS (2003)	Sollis (2009)	Kruse (2011)
Bahrain	12.59***	−.4.387*** (12)	9.214*** (12)	20.713*** (1)
Egypt	22.49***	−4.870*** (4)	13.614*** (1)	30.713*** (4)
Iran	16.55***	−2.454 (12)	4.836 (12)	7.882 (1)
Israel	5.66*	−1.938 (2)	3.238 (2)	8.119 (2)
Jordan	0.30	-	-	-
Kuwait	8.25**	−3.592** (4)	7.632* (5)	24.719*** (1)
Lebanon	1.89	-	-	-
Oman	15.71***	−5.790** (1)	16.484*** (1)	48.267*** (1)
Saudi Arabia	13.65***	−3.343* (6)	8.982*** (5)	20.839*** (5)
Turkiye	19.08***	−5.277*** (1)	13.589*** (1)	27.420*** (1)

Note: *, **, and *** indicate the rejection of the null hypothesis at 10%, 5%, and 1% significance levels, respectively. Critical values for HLX (2008) at the 1%, 5%, and 10% level of significance are 4.60, 5.99, and 9.21, respectively. Critical values of KSS (2003) for Case 3 at the 1%, 5%, and 10% level of significance are 3.93, 3.40, and 3.13, respectively. Critical values of Sollis (2009) for 50 observations are 8.799 (1%), 6.546 (5%), and 5.415 (10%). Critical Kruse values at 1%, 5%, and 10% limits of significance were 17.10, 12.82, and 11.10.

Abbreviations: HLX, Harvey et al., KSS, Kapetanios et al.

TABLE 5 Enders and Lee (2012) flexible Fourier unit root test results for stochastic convergence.

Country	kmin	Tau-df	fj	Opt lag	%1	%5	%10
Bahrain	2	−5.313***	1.921	1	−4.69	−4.05	−3.71
Egypt	2	−4.338**	5.867	1	−4.69	−4.05	−3.71
Iran	1	−2.134	1.741	1	−4.95	−4.35	−4.05
Israel	1	−5.544***	6.342	1	−4.95	−4.35	−4.05
Jordan	4	−3.167	2.553	1	−4.29	−3.65	−3.29
Kuwait	1	−4.855**	8.489***	1	−4.95	−4.35	−4.05
Lebanon	4	−3.059	2.347	1	−4.29	−3.65	−3.29
Oman	5	−3.504*	2.690	1	−4.20	−3.56	−3.22
Saudi Arabia	3	−5.340***	5.634	1	−4.45	−3.78	−3.44
Turkiye	2	−2.991	2.2227	0	−4.69	−4.05	−3.71

Note: The critical values for the F statistic are 12.21 (1%), 9.14 (5%), and 7.78 (10%). ***, **, and * indicate that the null hypothesis is rejected at significance levels of 99, 95, and 90, respectively.

According to the Sollis (2009) test, which considers nonlinearity and asymmetric structure together, the null hypothesis is rejected in Bahrain, Egypt, Kuwait, Oman, Saudi Arabia, and Turkiye. Symmetrical or asymmetric ESTAR stationarity exists in these six countries. Kruse (2011) test results showed that the null hypothesis would be rejected, similar to Sollis (2009) and KSS (2003) findings. Convergence can be concluded as ESTAR stationarity is valid in Bahrain, Egypt, Kuwait, Oman, Saudi Arabia, and Turkiye.

Enders and Lee (2012) unit root test results based on the Fourier approach were examined to capture both sharp and gradual breaks in the series. The flexible Fourier unit root test results in Table 5 indicate that the null hypothesis is rejected at a significance level of 99% in Bahrain, Israel, and Saudi Arabia, 95% in Egypt and Kuwait, and 90% in Oman. When the significance of the Fourier terms was checked in the six countries where the stationarity finding was reached, the Fourier term was found to be significant only in Kuwait. Enders and Lee (2012) flexible Fourier unit root test pointed out that only Kuwait out of the 10 countries in the panel converged to the regional average in military expenditures.

As a result of 10 unit root tests with different specifications, the countries for which convergence to the regional average is valid in 10 Middle Eastern countries are summarized in Table 6.

When the findings in Table 6 are evaluated, it is observed that KSS, Sollis, and Kruse nonlinear unit root tests provide consistent results regarding the convergence of the share of military expenditures in GDP to the group average. Among the 10 unit root tests, there is a convergence to the group average of nine tests for Bahrain and Saudi Arabia, eight tests for Oman, and five tests for Israel. Stochastic convergence is valid in Egypt, Kuwait, Lebanon, and Turkiye, according to the findings of the four methods. Conventional and structural break unit root tests indicate divergence in Egypt, more advanced nonlinear and Fourier-based methods show convergence. A similar situation can be mentioned for Kuwait and Turkiye. While these countries have a unit root according to traditional and Fourier-based methods, they are stationary according to structural break and nonlinear unit root methods. In Libya, conventional and structural break tests have indicated convergence. Iran and Jordan converge to regional

TABLE 6 Summary of unit root results.

	ADF	PP	DF-GLS	ZA	LS	NP	KSS	Sollis	Kruse	EL
Bahrain	√	√	√	√		√	√	√	√	√
Egypt							√	√	√	√
Iran				√		√				
Israel	√	√	√		√					√
Jordan			√							√
Kuwait					√		√	√	√	
Lebanon			√	√	√	√				
Oman	√		√	√	√		√	√	√	√
Saudi Arabia	√	√	√	√	√		√	√	√	√
Turkiye				√			√	√	√	

Abbreviations: ADF, Augmented Dickey-Fuller; KSS, Kapetanios et al.; LS, Lee and Strazicich; NP, Narayan and Popp; ZA, Zivot and Andrews.

average military expenditures according to only two tests. In summary, there is strong evidence that the share of military expenditures on GDP converges to the regional average in Bahrain, Saudi Arabia, and Oman. Different methods indicate that convergence is valid for Israel, Egypt, Kuwait, Lebanon, and Turkiye. However, the evidence for the existence of convergence in Iran and Jordan is rather weak.

Defense policies and balances of power in the Middle East have a complex and dynamic structure. In addition to various conflicts and rivalries between states in the region throughout history, energy resources, geopolitical locations, and religious factors in the region can also effectively shape defense policies. Although there is a need for a collective defense organization in the region, the absence of a country or a defense organization with the capacity to undertake leadership similar to that of the United States in NATO in the Arab geography prevents the establishment of a strong defense architecture in the region. Therefore, regional countries are attempting to increase their individual defense capacities. In recent years, Saudi Arabia has increased its defense expenditures against Iran's increasing influence in the region. Some other Middle Eastern countries are also increasing their defense spending due to security concerns. The United Arab Emirates and Qatar are making significant defense investments to improve their defense capabilities against intraregional tensions and terrorist threats. On the other hand, Turkiye, as an important actor in recent years, has played an important role in the balance of power in the region. In particular, the civil wars and conflicts in Syria and Iraq have highlighted Turkiye as a regional power and have pushed Turkiye to increase its defense expenditures and defense capacity. The political and military tensions that Turkiye experienced with other actors in the region led to increased defense expenditures. However, the increase in Turkiye's military capacity has also affected the balance between elements of other power in the region.

6 | RESULT AND POLICY IMPLICATIONS

Today, many countries choose to produce chemical, biological, nuclear, and conventional weapons or purchase them from abroad to maintain or increase their regional and global status. Undoubtedly, the most important reason for this arms race is that countries view each other as a threat. In a world that is globalizing at an alarming rate, the security-threat dilemma that develops due to the paradox of insecurity forces states to increase their defense expenditures. From a neorealism perspective, one state views another state as a threat. Threat perception is the ability of a state to increase its military capabilities. According to H. Morgenthau, a representative of classical realist theory, military power is one of the most important tools for ensuring the continuity of power (Morgenthau, 1954, p. 27). A state's activities in the security field make other states insecure and push them to arm themselves. The fact that states compete for power against each other causes them to behave distrustfully toward each other and thus further increase their military power capacities. In this context, many neighboring states in the world view each other as a threat and increase their military expenditures. According to SIPRI data, worldwide defense expenditure reached 2 trillion USD 240 billion in 2022.

The Middle East is leading the global arms race. The fact that the competing states in the region, whose origins date back to ancient times, still see each other as political, economic, and cultural rivals, pushes countries in the region to arm themselves and strengthen their defense industries in the context of a security dilemma. It was during the Cold War that the Middle East turned into an arms trade market and testing ground for two hegemonic powers (USA-USSR). As of this period, the Middle East has been the most assertive region in the global arms trade. Although momentum in the arms race decreased on a global scale at the end of the Cold War, this was not the case for Middle Eastern countries. Saudi Arabia is not only among the Middle East countries but also among the top five countries that spend the most on defense worldwide. Saudi Arabia spent approximately 75 billion $ (SIPRI) in 2022, or 7.4% of its GDP on defense. In the same period, Israel's defense expenditure of $23.4 billion (SIPRI), which ranks second among the countries in the region, corresponds to approximately 4.5% of the GDP. Iran, Qatar, and Kuwait spend the most on defense in the region, respectively. Turkiye spent $10.6 billion in military expenditure in 2022. Egypt, which is the largest country in the Middle East in terms of population in 2021, allocated only 1.06% of its GDP to defense.

This article examines whether there is convergence in the defense expenditures of 10 Middle Eastern countries, geographically close to allied and rival countries, between 1977 and 2020. For this purpose, 10 different unit root tests based on traditional, structural break, nonlinear, and Fourier approaches were conducted. Among the 10 tests performed, the results of nine tests indicate that the defense expenditures of Bahrain and Saudi Arabia, and eight tests of Oman are close to the regional average. Again, five tests for Israel and four tests for Egypt, Kuwait, Lebanon, and Turkiye provide evidence of stochastic convergence in defense expenditures. However, the defense expenditures of Iran and Jordan converged to the regional average according to only two test results. Summarily, the empirical results indicate that the share of defense expenditures in GDP in Bahrain, Saudi Arabia, Oman, Israel, Egypt, Kuwait, Lebanon and Turkiye converges to the regional average. As a result, it can be said that the demand for military expenditures in the Middle East countries is a result of rival and allied countries' desire to be included in the arms race. The empirical results of this study are consistent with neorealism's approach to military force. The formation of a strategic power struggle in parallel with the conflicts between the countries of the region leads to increased defense expenditures.

The fundamental determinants of the desire for armament throughout the Middle East are security contradictions and power imbalances. The main purposes of states in increasing their military expenses are sometimes it may be to strengthen their political influence within this unbalanced structure, to maintain or change the status quo, or simply to increase their defense capabilities against their rivals. However, the clear point is that armament in the region is far from a solution; on the contrary, armament has turned into a race. The arms trade flow to the region has caused existing ethnic, religious, and identity conflicts to become more fragile and deep. In solving problems with the weapons and military equipment they acquired, states made harsh, short-term choices that were far from peaceful methods, lacked integrity in the name of regional peace, and had painful consequences for the people of the region. This cyclical situation created a suitable basis for Western states to export their weapons. In other words, the existing conflicts and disagreements have reached an even more critical level, and the region has become more fragile in terms of political, economic, and environmental security, which has led to continued arms exports by the Western states.

Most countries in regions with security risks act according to the average tendency of the country group in the region in their defense expenditures, which is affected by factors such as the increase in regional security risks and/or changes in the armament policies of neighboring countries. However, expenditures on defense bring many social and economic costs. Resources allocated to defense can be used in different areas to ensure economic growth and development. On the other hand, states in regions with high-security risks, such as the Middle East, try to approach the defense expenditures of other countries in the region as a deterrent against future attacks. Therefore, military expenditures constitute a significant burden on the economies of Middle Eastern countries. For this reason, policymakers and state administrators should choose and balance the security benefits of defense expenditures with the contributions of directing resources to more social areas, such as education and health. In addition, increasing economic cooperation and integration in the region, strengthening the influence of regional and international organizations, and carrying out political reforms related to democratization may contribute to reducing the arms race in the region.

ORCID

Gulbahar Ucler http://orcid.org/0000-0002-5872-8577
Serife Ozsahin http://orcid.org/0000-0001-8310-1816

REFERENCES

Abramovitz, M. A., & David, P. A. (1994). *Convergence and deferred catch-up: Productivity leadership and the waning of American Exceptionalism*. Center for Economics and Policy Research.

Acemoglu, D. (2007). *Introduction to Modern Economic Growth: Parts 1-5*. https://users.econ.umn.edu/~guvenen/DaronBook1.pdf

Apergis, N., Christou, C., & Hassapis, C. (2013). Convergence in public expenditures across EU countries: Evidence from club convergence. *Economics & Finance Research*, *1*(1), 45–59.

Arvanitidis, P., & Kollias, C. (2016). Converging defence burdens? Some further findings. *Peace Economics, Peace Science and Public Policy*, *22*(4), 365–375.

Arvanitidis, P., Kollias, C., & Anastasopoulos, K. (2014). Is there an international convergence in defence burdens? *Peace Economics, Peace Science and Public Policy*, *20*(4), 611–620.

Arvanitidis, P., Kollias, C., & Messis, P. (2017). Converging allies? *Peace Economics, Peace Science and Public Policy*, *23*(2), 20160044. https://doi.org/10.1515/peps-2016-0044

Ashrafi, Y., Noury, R., & Mohammadpoor, S. (2019). Defence expenditure convergence in selected MENA countries: Nonlinear NCADF approach. *Strategic Management Studies of National Defence Studies*, *9*(36), 374–353.

Asteriou, D., & Hall, S. G. (2007). *Applied econometrics: A modern approach*. Revised edition. Palgrave Macmillan.

Aubyn, M. S. (1999). Convergence across industrialised countries (1890–1989): New results using time series methods. *Empirical Economics*, *24*, 23–44.

Barro, R. J. (1992). Convergence. *Journal of Political Economy*, *100*(2), 223–251.

Barro, R. J., & Sala-i-Martin, X. (1991). Economic growth and convergence across the United States. NBER Workıng Paper Series. Working Paper No. 3419. https://www.nber.org/papers/w3419

Barro, R. J., Sala-i-Martin, X., Blanchard, O. J., & Hall, R. E. (1991). Convergence across states and regions. *Brookings Papers on Economic Activity*, *1991*, 107–182.

Baumol, W. J. (1986). Productivity growth, convergence and welfare: What the long-run data show. *The American Economic Review*, *76*(5), 1072–1085.

Bernard, A. B., & Durlauf, S. N. (1995). Convergence in international output. *Journal of Applied Econometrics*, *10*(2), 97–108.

Blanco, F. A., Delgado, F. J., & Presno, M. J. (2020). R&D expenditure in the EU: Convergence or divergence? *Economic Research-Ekonomska istraživanja*, *33*(1), 1685–1710.

Brauner, J. (2015). Military spending and democracy. *Defence and Peace Economics*, *26*(4), 409–423. https://doi.org/10.1080/10242694.2014.960245

Bulte, E., List, J. A., & Strazicich, M. C. (2007). Regulatory federalism and the distribution of air pollutant emissions. *Journal of Regional Science*, *47*(1), 155–178.

Byman, D. (2014). Sectarianism afflicts the new Middle East. *Survival*, *56*(1), 79–100.

Carlino, G. A., & Mills, L. O. (1993). Are U.S. regional incomes converging? *Journal of Monetary Economics*, *32*(2), 335–346.

Changkyu Choi, C. (2009). Does bilateral trade lead to income convergence? Panel evidence. *Journal of Economic Development*, *34*(1), 71–79.

Cheung, Y.-W., & Chinn, M. D. (1997). Further investigation of the uncertain unit root in GNP. *Journal of Business & Economic Statistics*, *15*(1), 68–73.

Clements, B. J., Gupta, S., & Khamidova, S. (2021). Is military spending converging to a low level across countries? *Economic Modelling*, *94*, 433–441.

Cuestas, J. C., & Ordóñez, J. (2014). Smooth transitions, asymmetric adjustment and unit roots. *Applied Economics Letters*, *21*(14), 969–972.

Das, R. C., Dinda, S., & Martin, F. (2018). Defence outlays across countries: Are they converging? *South Asian Journal of Macroeconomics and Public Finance*, *7*(1), 109–129.

Dawson, J. W., & Strazicich, M. C. (2010). Time-series tests of income convergence with two structural breaks: Evidence from 29 countries. *Applied Economics Letters*, *17*(9), 909–912.

Diamond, L. (2010). Democracy's past and future: Why are there no Arab democracies? *Journal of Democracy*, *21*(1), 93–112.

Dickey, D. A. (1976). *Estimation and hypothesis testing in nonstationary time series*. [Unpublished doctoral dissertation.] Iowa State University.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366a), 427–431.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, *49*, 1057–1072.

Doyle, M. W. (1983). Kant, liberal legacies, and foreign affairs. *Philosophy & Public Affairs*, *12*(3), 205–235.

Elass, J. (2019). Saudi Arabia ups defence spending in face of Iranian threats. *The Arab Weekly*, https://thearabweekly.com/saudi-arabia-ups-defence-spending-face-iranian-threats

Elliott, G., Rothenberg, T. J., & Stock, J. H. (1996). Efficient tests for an autoregressive unit root. *Econometrica*, *64*(4), 813–836.

Enders, W., & Lee, J. (2012). A unit root test using a Fourier series to approximate smooth breaks. *Oxford Bulletin of Economics and Statistics*, *74*(4), 574–599.

Evans, P. (1996). Convergence revisited. *Journal of Monetary Economics*, *37*, 249–265.

Evans, P., & Kim, J. U. (2005). Estimating convergence for Asian economies using dynamic random variable models. *Economics Letters*, *86*(2), 159–166.

Friedman, M. (1992). Do old fallacies ever die? *Journal of Economic Literature*, *30*, 2129–2132.

Gil-Pareja, S., & Sosvilla-Rivero, S. (2008). Price convergence in the European car market. *Applied Economics*, *40*(2), 241–250.

Glaser, C. L. (1997). The security dilemma revisited. *World Politics*, *50*(1), 171–201.

Glynn, J., Perera, N., & Verma, R. (2007). Unit root tests and structural breaks: A survey with applications. *Journal of Quantitative Methods for Economics and Business Administration*, *3*(1), 63–79.

Güriş, S., Güriş, B., & Tiraşoğlu, M. (2017). Do military expenditures converge in NATO countries? Linear and nonlinear unit root test evidence. *Theoretical & Applied Economics*, *24*(2), 237–248.

Haddadi, M. (2015). Regional organizations and international peace and security in the Middle East. *International Journal of Academic Research in Business and Social Sciences*, *5*(3), 277–286.

Harvey, D. I., Leybourne, S. J., & Xiao, B. (2008). A powerful test for linearity when the order of integration is unknown. *Studies in Nonlinear Dynamics & Econometrics*, *12*(3), 1–24.

Hashem Pesaran, M. (2007). A pair-wise approach to testing for output and growth convergence. *Journal of Econometrics*, *138*(1), 312–355.

Herz, J. H. (1950). Idealist internationalism and the security dilemma. *World Politics*, *2*(2), 157–180.

Holtmann, P. (2014). A primer to the Sunni-Shia conflict. *Perspectives on Terrorism*, *8*(1), 142–145.

Islam, N. (2003). What have we learnt from the convergence debate? *Journal of Economic Surveys*, *17*(3), 309–362.

Jazeera, A. (2021). *Middle East sees biggest import of arms in last 5 years: Report*. https://www.aljazeera.com/news/2021/3/15/global-arms-transfers-level-off-but-middle-east-imports-grow

John, G., Nelson, P., & Reetu, V. (2007). Unit root tests and structural breaks: A survey with applications. *Journal of Quantitative Methods for Economics and Business Administration*, *3*(1), 63–79.

Juma'in bin Saadon, R. M. A. F. (2020). A critical review of the security dilemma concept in Southeast Asia. *The Journal of Defence and Security*, *12*(1), 13-I.

Kapetanios, G., Shin, Y., & Snell, A. (2003). Testing for a unit root in the nonlinear STAR framework. *Journal of Econometrics*, *112*(2), 359–379.

Karabıyık, E. D. (2021). An empirical analysis for convergence of defence expenditures in Middle East and North Africa countries. *Kafkas University Journal of Economics and Administrative*, *12*(23), 147–159.

Karsh, E. (2002). *The Iran–Iraq War 1980–1988*. Osprey Publishing.

Kočenda, E., & Černý, A. (2014). *Elements of time series econometrics: An applied approach*. Karolinum Press.

Krieg, A. (2016). Gulf security policy after the Arab Spring: Considering changing security dynamics. In J. M. Rickli & K. S. Al Mazaini (Eds.), *The small Gulf states* (pp. 47–63). Routledge.

Kruse, R. (2011). A new unit root test against ESTAR based on a class of modified statistics. *Statistical Papers*, *52*(1), 71–85.

Lau, C. K. M., Demir, E., & Bilgin, M. H. (2016). A nonlinear model of military expenditure convergence: Evidence from estar nonlinear unit root test. *Defence and Peace Economics*, *27*(3), 392–403.

Lee, J., & Strazicich, M. C. (2003). Minimum lagrange multiplier unit root test with two structural breaks. *Review of Economics and Statistics*, *85*(4), 1082–1089.

Leybourne, S., Newbold, P., & Vougas, D. (1998). Unit roots and smooth transitions. *Journal of Time Series Analysis*, *19*(1), 83–97.

Li, L., Huang, R., & Wang, D. (2015). Military expenditure and security dilemma in China, *Industrial engineering and manufacturing technology: Proceedings of the 2014 International Conference on Industrial Engineering and Manufacturing Technology (ICIEMT 2014)* (Vol. 4, p. 153). CRC Press.

Li, Q., & Papell, D. (1999). Convergence of international output time series evidence for 16 OECD countries. *International Review of Economics & Finance*, *8*(3), 267–280.

Liff, A. P., & Ikenberry, G. J. (2014). Racing toward tragedy?: China's rise, military competition in the Asia Pacific, and the security dilemma. *International Security*, *39*(2), 52–91.

De Long, J. B. (1988). Productivity growth, convergence, and welfare: Comment. *American Economic Review*, *78*, 1138–1154.

Lucas Jr., R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3–42.

Lumsdaine, R. L., & Papell, D. H. (1997). Multiple trend breaks and the unit-root hypothesis. *Review of Economics and Statistics*, *79*(2), 212–218.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, *107*(2), 407–437.

Milton-Edwards, B., & Hinchcliffe, P. (2001). *Conflicts in the middle east since 1945*. Routledge.
Morgenthau, H. J. (1954). *Politics among Nations, 2nd ed*. New York: Alfred A. Knopf.
Mouteyica, A. E. N., & Ngepah, N. (2023). Health expenditure convergence and the roles of trade and governance in Africa. *Archives of Public Health*, *81*(1), 77.
Narayan, P. K., & Popp, S. (2010). A new unit root test with two structural breaks in level and slope at unknown time. *Journal of Applied Statistics*, *37*(9), 1425–1438.
Nelson, C. R., & Plosser, C. R. (1982). Trends and random walks in macroeconmic time series. *Journal of Monetary Economics*, *10*(2), 139–162.
Nordhaus, W., Oneal, J. R., & Russett, B. (2012). The effects of the international security environment on national military expenditures: A multicountry study. *International Organization*, *66*(3), 491–513.
Nufal, A. S. (1991). The Gulf states and the crisis over Kuwait. *Arab Studies Quarterly*, *13*(1/2), 37–51.
Panopoulou, E., & Pantelidis, T. (2012). Convergence in per capita health expenditures and health outcomes in the OECD countries. *Applied Economics*, *44*(30), 3909–3920.
Perron, P. (1989). The Great Crash, the oil price shock and the unit root hypothesis. *Econometrica*, *57*(6), 1361–1401.
Perron, P. (1990). Testing for a unit root in a time series with a changing mean. *Journal of Business & Economic Statistics*, *8*(2), 153–162.
Phillips, P.C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335–346.
Phillips, C., & Valbjørn, M. (2018). What is in a name?: The role of (different) identities in the multiple proxy wars in Syria. *Small Wars & Insurgencies*, *29*(3), 414–433.
Quah, D. (1993). Galton's fallacy and tests of the convergence hypothesis. *The Scandinavian Journal of Economics*, *95*, 427–443.
Ranjpour, R., & Zahra, T. (2008). Evaluation of the income convergence hypothesis in ten new members of the European Union. A panel unit root approach. *Panoeconomicus*, *55*(2), 157–166.
Rassekh, F. (1998). The convergence hypothesis: History, theory, and evidence. *Open Economies Review*, *9*, 85–105.
Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, *94*(5), 1002–1037.
Russett, B., Layne, C., Spiro, D. E., & Doyle, M. W. (1995). The democratic peace. *International Security*, *19*(4), 164–184.
Russett, B., Oneal, J. R., & Davis, D. R. (2003). The third leg of the Kantian tripod for peace: International organizations and militarized disputes, 1950–85. *International Organization*, *52*(3), 441–467. https://doi.org/10.1162/002081898550626
Ryan, C. R. (2015). Regime security and shifting alliances in the Middle East. *The Qatar Crisis* (35–40). Project on Middle East Political Science (POMEPS). Symposium on International Relations and a New Middle East. https://pomeps.org/regime-security-and-shifting-alliances-in-the-middle-east
Saba, C. S., & Ngepah, N. (2020). Convergence in military expenditure and economic growth in Africa and its regional economic communities: Evidence from a club clustering algorithm. *Cogent Economics & Finance*, *8*(1), 1832344. https://doi.org/10.1080/23322039.2020.1832344
Sala-i-Martin, X. (1990). Lecture notes on economic growth(I): Introduction to the literature and neoclassical models. NBER Working Papers, No. 3563. http://www.nber.org/papers/w3563.pdf
Sala-i-Martin, X. X. (1996). The classical approach to convergence analysis. *The Economic Journal*, *106*(437), 1019–1036.
Sala-i-Martin, X. X., & Barro, R. J. (1995). *Technological diffusion, convergence, and growth (No. 735)*. Center Discussion Paper. Yale University Economic Growth Center.
Salloukh, B. F. (2013). The Arab Uprisings and the geopolitics of the Middle East. *The International Spectator*, *48*(2), 32–46.
Sawhney, B., Anoruo, E., & DiPietro, W. R. (2016). The world distribution of military spending: Is there a convergence? *International Journal of Computational Economics and Econometrics*, *6*(4), 351–365.
Shannon, M. (2009). Preventing war and providing the peace? International organizations and the management of territorial disputes. *Conflict Management and Peace Science*, *26*(2), 144–163.
Shiddiqya, M. A. A., Bainusb, A., Setiabudi, W., & Sumadinatac, A. S. (2019). The development of the Indonesian defence industry as a consequence of security dilemma and arms race in the Southeast Asian region. *Development*, *10*(5), 214–226.

SIPRI (2021). SIPRI Yearbook 2021: Armaments, Disarmament and International Security. https://www.sipri.org/sites/default/files/2021-06/sipri_yb21_summary_en_v2_0.pdf

Smith, C. D. (2008). *Palestine and the Arab-Israeli conflict: A history with documents*. Bedford/St. Martin's.

Solarin, S. A. (2019). Convergence of defence burdens in Asia-Pacific economies: A residual augmented least squares approach. *Peace Economics, Peace Science and Public Policy*, *25*(2), 1–18. https://doi.org/10.1515/peps-2018-0036

Sollis, R. (2009). A simple unit root test against asymmetric STAR nonlinearity with an application to real exchange rates in Nordic countries. *Economic Modelling*, *26*(1), 118–125.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, *70*(1), 65–94.

Stepan, A. C., & Robertson, G. B. (2003). An "Arab" more than a "Muslim" democracy gap. *Journal of Democracy*, *14*(3), 30–44.

Strazicich, M. C., Lee, J., & Day, E. (2004). Are incomes converging among OECD countries? Time series evidence with two structural breaks. *Journal of Macroeconomics*, *26*(1), 131–145.

Tibi, B. (1998). *Conflict and war in the Middle East: From interstate war to new security*. Springer.

Ucler, G., & Bulut, U. (2021). Re-examination of the convergence in military expenditures across NATO countries: Do different approximations in modeling structural breaks matter? *Applied Economics Journal*, *28*(1), 43–62.

Ulrichsen, K. C. (2020). *Qatar and the Gulf crisis: A study of resilience*. Oxford University Press.

Wezeman, P. D., & Kuimova, A. (2019). Military spending and arms imports by Iran, Saudi Arabia, Qatar and the UAE. *SIPRI Fact Sheet*. Stockholm International Peace Research Institute. https://coilink.org/20.500.12592/hbdkbh

Xiao, Z., & Phillips, P. C. B. (1998). An ADF coefficient test for a unit root in ARMA models of unknown order with empirical applications to the US economy. *The Econometrics Journal*, *1*(2), 27–43.

Yazgan, Ş., Ceylan, R., & Mollavelioğlu, M. Ş. (2018). Military expenditure convergence in the selected NATO countries: Evidence from non-linear unit root tests. *Akdeniz İİBF Journal*, *18*(37), 118–132.

Yilanci, V., Eryüzlü, H., & Hopoğlu, S. (2020). Convergence of military burdens in the MENA region. *Journal of International Relations*, *17*(66), 41–59.

Zafirov, M. (2017). The Qatar crisis—Why the blockade failed. *Israel Journal of Foreign Affairs*, *11*(2), 191–201.

Zivot, E., & Andrews, D. W. K. (1992). Further evidence on the Great Crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business & Economic Statistics*, *10*(3), 251–270.

Zweiri, M., Rahman, M. M., & Kamal, A. (2021). The 2017 Gulf crisis: An introduction. In M. Sweiri, M. M. Rahman, & A. Kamal Eds, *The 2017 Gulf Crisis: an Interdisciplinary Approach* (pp. 1–18). Springer.

How to cite this article: Ucler, G., & Ozsahin, S. (2024). Is military spending converging across Middle Eastern countries? A comprehensive unit root test analysis. *Digest of Middle East Studies*, *33*, 430–450. https://doi.org/10.1111/dome.12340