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The Relationship Between Energy Security, Exports and Economic Growth: The Case of Middle Eastern Countries

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Abstract

This study aims to examine the relationship between energy security, growth, and exports for 16 Middle Eastern countries between 1980 and 2016 by taking into account the four dimensions of energy security (4A's of energy security that are availability, affordability, accessibility, and acceptability). Unlike other studies on Middle Eastern countries, this study covers more Middle Eastern countries and a wider period considering cross-sectional dependence. The results of the empirical analysis conducted by using second-generation unit-root and cointegration methods demonstrate that there is a cointegration relationship between the variables. According to the results obtained from the Augmented Mean Group estimator (AMG), which also considers cross-section dependence; the 1% increase in energy security risk level reduces the economic growth by approximately 0.66%, while the 1% increase in exports increases the economic growth by 0.41%. Finally, Granger non-causality test results demonstrate that there is a bi-directional causality relationship between variables. The results highlight the importance of policies to ensure energy security. In this regard, following policies can be recommended; developing policies to decrease the share of energy revenues/expenses in regional economies, choosing safe trade routes in oil and gas trade, ensuring the security of important crossing routes and reserve areas in the region, diversification of country and crossing routes in energy import/export, ensuring energy efficiency and savings, and finally both protecting the environment and ensuring resource diversity in energy by ensuring the use of renewable energy resources.

Keywords: Energy Security, Economic Growth, Cross-Section Dependence, Middle Eastern Countries, Panel Cointegration, Panel Causality

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Enerji Güvenliği, İhracat ve Ekonomik Büyüme İlişkisi: Orta Doğu Ülkeleri Örneği

Gökhan Kartal*

Öz

Bu çalışmada enerji güvenliğin 4 boyutu (enerji güvenliğinin 4 A'sı: elde bulunabilir, uygun fiyatlı, erişilebilir, kabul edilebilir) dikkate alınarak 1980-2016 yılları arasında 16 Ortadoğu ülkesi için enerji güvenliği, büyüme ve ihracat arasındaki ilişkinin incelenmesi amaçlanmaktadır. Konuyla ilgili Orta Doğu ülkeleri üzerine yapılan diğer çalışmalardan farklı olarak bu çalışma daha fazla Ortadoğu ülkesini ve daha geniş bir veri dönemini kapsamakta ve yatay kesit bağımlılığı dikkate alınmaktadır. İkinci nesil birim kök ve eşbütünleşme yöntemleri kullanılarak gerçekleştirilen ampirik analiz sonuçları, değişkenler arasında eşbütünleşme ilişkisinin olduğunu göstermektedir. Yatay kesit bağımlılığını da dikkate alan Augmented Mean Group (AMG) tahmincisinden elde edilen sonuçlara göre ise enerji güvenliği risk seviyesinde %1 artışın ekonomik büyümeyi yaklaşık olarak %0,66 oranında azaltırken, ihracatta %1 artış büyümeyi %0,41 artırdığını göstermektedir. Son olarak, Granger Non-Causality test sonuçları, değişkenler arasında çift yönlü nedensellik ilişkisinin varlığını göstermektedir. Elde edilen sonuçlar, enerji güvenliğini sağlamaya yönelik politikaların önemini vurgulamaktadır. Bu doğrultuda bölge ekonomilerinde enerji gelirlerinin/giderlerinin payını azaltacak politikalar geliştirilmesi, petrol ve doğal gaz ticaretinde güvenli ticaret yollarının seçilmesi, bölgedeki önemli rezerv alanlarının ve geçiş noktalarının güvenliğinin sağlanması, enerji ithalatı/ihracatında ülke ve geçiş güzergahlarının çeşitlendirilmesi, enerji verimliliğinin ve tasarrufunun sağlanması, son olarak yenilenebilir enerji kaynaklarının kullanımı sağlanarak hem çevreyi korunması hem de enerjide kaynak çeşitliliğinin sağlanmasına yönelik politikalar önerilebilir.

Anahtar Kelimeler: Enerji Güvenliği, Ekonomik Büyüme, Kesit Bağımlılığı, Orta Doğu Ülkeleri, Panel Eşbütünleşme, Panel Nedensellik

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1. Introduction

Energy is the most important input of modern world economies. Hence, energy is defined as the "oxygen" of the economy and the "life-blood" of growth by Voser[1] and its importance has been pointed out for world economy. Moreover, energy is an important element of social welfare. The current significance of energy has unearthed the notion of energy security by making the inaccessibility to energy a 'nightmare' for modern world economy. At the beginning of the First World War, Winston Churchill, who was the First Lord of the Admiralty, made a historic decision by shifting the power supply from coal to oil on ships in the British navy. The reason for this historic decision was to make the British navy faster than the German navy, thus maintaining its effectiveness on global issues. This transition meant that the Royal Navy was based not on coal in Wales but on insecure oil from Persia.[2] Thus, the increasing importance of energy for states and societies in the historical process made energy security a matter of national strategy by revealing the concept of energy security. Energy security has been one of the main issues of international policy and security which has been crucial since this historic decision.[3] The Oil Crisis of 1973 was the factor that shaped the energy security perception of the modern era.[4] In addition, the oil crises of the 1970s and 1980s showed dependence on oil exporting countries in the Middle East.[5]

The energy security perception of the modern era is briefly referred to with the "4A of Energy Security" including availability, affordability, accessibility and acceptability. The "availability" dimension means that the existence of extractable fossil energy resources such as oil, natural gas, and coal, etc. and/or renewable energy resources such as hydroelectricity, solar energy, thermal energy, etc. Having more energy resources than the country needs makes a country an energy exporter, while having less than the need makes

[1] Peter Voser, "Energy: The Oxygen of the Economy," *World Economic Forum Energy for Economic Growth Energy Vision Update,* 2012.

[2] Daniel Yergin, "Ensuring Energy Security," *Foreign Affairs* 85, no. 2 (2006): 69, https://doi.org/10.2307/20031912; Mitat Çelikpala, "Enerji Güvenliği: NATO'nun Yeni Tehdit Algısı," *Uluslararası İlişkiler* 10, no. 40 (2014): 79.

[3] Gökhan Kartal, *Politik Istikrarsizlik ve Enerji Güvenliği Ekseninde Orta Doğu Ekonomileri* (İstanbul: Hiperyayın, 2020), 81.

[4] Çelikpala, "Enerji Güvenliği: NATO'nun Yeni Tehdit Algısı," 79.

[5] Bert Kruyt et al., "Indicators for Energy Security," *Energy Policy* 37, no. 6 (2009): 2167, https://doi.org/10.1016/j.enpol.2009.02.006.

a country an energy importer. The "affordability" dimension means that the price of energy resources is affordable. While this dimension of energy resources is related to production costs for energy exporter countries, it is related to the ability to import energy resources at the most affordable price for energy importer countries. The "accessibility" dimension means that it is the continuity of the ability to access energy whether through owned energy resources or through energy trade. This dimension of energy security is related to the physical security of areas with energy sources and the security of energy trade routes and energy exporter/importer countries. The acceptability dimension means that environmental sensitivities are taken into account in the energy consumption. Accordingly, energy security is defined by the International Energy Agency (IEA)[6] as "the uninterrupted availability of energy sources at an affordable price". However, it may be argued that while the energy security definition of the IEA covers the availability, affordability and accessibility dimensions of energy security, the acceptability dimension is neglected. In this context, considering the dimensions of energy security, the IEA's definition of energy security can be expanded as the uninterrupted availability of energy sources that are acceptable including their environmental effects at an affordable price.

Energy security nowadays covers a wide spectrum, especially the concepts of available, affordable, reliable, efficient, eco-friendly, good governance and socially acceptable energy services.[7] In this direction, many definitions are made in the literature considering the multidimensional nature of energy security. In this context, Ang et al.[8] examined 104 studies between 2001 and 2014 to detect how energy security is defined, what the dimensions and scope of energy security are, and which indicators and indices are utilized to evaluate energy security. As a result of the review by the authors, based on 83 definitions of energy security in the literature, seven main energy security themes (or dimensions) have been identified: energy availability, infrastructure, energy prices, societal effects, environment, governance, and

6 International Energy Agency, "Energy Security," 2020, accessed June 28, 2021, https://www.iea.org/topics/energy-security.

7 Martin J. Pasqualetti and Benjamin K. Sovacool, "The Importance of Scale to Energy Security," *Journal of Integrative Environmental Sciences* 9, no. 3 (2012): 167, https://doi.org/10.1080/1943815X.2012.691520.

8 Beng Wah Ang, Wei Lim Choong, and Tsan Sheng Ng, "Energy Security: Definitions, Dimensions and Indexes," *Renewable and Sustainable Energy Reviews* 42 (2015): 1077-93, https://doi.org/10.1016/j.rser.2014.10.064.

energy efficiency. According to the authors, "few studies cover all these seven dimensions". After explaining the energy security themes, the authors stated that 83 studies that include energy security definitions include: in 82 studies (99% of studies) "energy availability", in 60 studies (72% of studies) "infrastructure", in 59 studies (71% of studies) "energy prices", in 28 studies (34% of studies) "environment", in 31 studies (37% of studies) "societal effects", in 21 studies (25% of studies) "governance", in 18 studies (22% of studies) "energy efficiency". The concept of energy security, which was previously evaluated in several dimensions, has increasingly expanded by integrating with themes including environment, governance and energy efficiency. For example, energy security has been examined as a multidimensional concept consisting of 14 dimensions[9] and 42 parameters by Azzuni and Breyer,[10] and thus the ever-increasing elements of energy security are revealed.[11]

Despite the importance of energy security, few quantitative studies have focused on this issue. Moreover, while the recent studies have generally focused on energy supply stability, environmental and social dimensions are not largely considered. In addition, studies that consider environmental and social dimensions are generally descriptive and explanatory, but in these studies, there are little to no empirical analysis.[12] In addition, recent quantitative research has mostly focused on changes at the level of energy security but not on its direct impact on economy.[13] In the review conducted by Ang et al.,[14] in which a total of 83 studies on energy security, it has been indicated that 51 of 83 studies were quantitative and the rest of studies were qualitative. This study also confirms the view that quantitative studies

9 Availability, Diversity, Cost, Technology & Efficiency, Location, Timeframe, Resilience, Environment, Health, Culture, Literacy, Employment, Policy, Military.

10 Abdelrahman Azzuni and Christian Breyer, "Energy Security and Energy Storage Technologies," *Energy Procedia* 155 (2018): 237-58, https://doi.org/10.1016/j.egypro.2018.11.053.

11 For details of dimensions and parameters, see Azzuni and Breyer, 238-40.

12 Thai Ha Le and Canh Phuc Nguyen, "Is Energy Security a Driver for Economic Growth? Evidence from a Global Sample," *Energy Policy* 129 (2019): 437-38, https://doi.org/10.1016/j.enpol.2019.02.038.

13 Vaidotas Šumskis and Vincentas Giedraitis, "Economic Implications of Energy Security in the Short Run," *Ekonomika* 94, no. 3 (2015): 122, https://doi.org/10.15388/Ekon.2015.3.8791.

14 Ang, Choong, and Ng, "Energy Security: Definitions, Dimensions and Indexes," 1083.

expressed by Šumskis and Giedraitis[15] focus on changes in the energy security index.

Hamilton,[16] who examined the fluctuations on oil prices, which has been one of the most important components of energy security throughout the historical process, lists the dates of significant dates of oil shocks in the aftermath of World War II as follows: The Suez Crisis (1956-1957), the OPEC Oil Embargo (1973-1974), the Iranian Revolution (1978-1979), the Iran-Iraq War (1980-1988), the Gulf War (1990-1991), and the Oil Price Rise (2007-2008). This ranking also demonstrates the importance of Middle Eastern countries in terms of global energy security. According to BP,[17] as of 2018, 16 countries in the Middle East region have been holding 51.87% of overall world oil reserves with 897.22 billion tons. The share of Middle Eastern countries in world oil production is 36.60% with 1.637.55 million tons. The region, which is also rich in natural gas, holds 42.21% of the world's natural gas reserves with 83.09 trillion m^3. The share of Middle Eastern countries (16 countries) in the world's gas production is 21.92% with 847.93 billion cubic meters. In addition, the region harbors important transit routes of strategic importance regarding oil transportation to the rest of the world, such as the Suez Canal, the Bab el Mandeb Strait, the Persian Gulf and the Strait of Hormuz. When the data of regions and countries, which have a significant share in oil trade, are examined, it is also observed that the Middle East dominates 43.72% of world crude oil trade. In terms of countries, Saudi Arabia ranks first in the world with 367.42 million tons and 16.24% share in crude oil exports. Four countries including the United Arab Emirates (UAE), Iraq, and Kuwait together with Saudi Arabia, have a 35.23% share in world oil exports. Moreover, Table 1 indicates that fuels export revenues are high in most countries vis-à-vis their GDP and export data. In sum, while the Middle East region has the world's most important energy resources and important transition points in the world, the economies of the region have also an excessive dependence on the revenues obtained from energy resources.

15 Šumskis and Giedraitis, "Economic Implications of Energy Security in the Short Run," 122.

16 James D Hamilton, "Historical Oil Shocks," *NBER Working Paper Series, Working Paper 16790*, 2011.

17 BP, "Statistical Review of World Energy," 2019, accessed July 03, 2020 https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

For this reason, the Middle East region is selected in this study, which empirically investigates the relationship between energy security and growth.

However, it should be specifically stated that there is no consensus on whether Turkey is among Middle Eastern countries or not. Accordingly, Turkey is evaluated among the countries of "Europe and Central Asia" by the World Bank, in "Europe" by BP and in "Western Asia" by the United Nations (UN), whereas it is evaluated among the countries of the Middle East and North Africa by the International Country Risk Guide (ICRG). Moreover, in many studies examining Middle Eastern economies theoretically[18] as well as in many studies, in which Middle Eastern economies are subject of empirical analysis,[19] Turkey is considered among Middle Eastern countries. In this direction, Turkey has been included in the analysis among the Middle East countries in this study because of the fact that Turkey is evaluated among them by some international institutions/organizations, and in many theoretical and empirical studies in the literature as well as given the fact that there are also historical ties and geographical proximity to the region.

[18] For example, see. Roderic H. Davison, "Where Is the Middle East?," *Foreign Affairs* 38, no. 4 (1960): 665, https://doi.org/10.2307/20029452; Roger Owen and Şevket Pamuk, *A History of Middle East Economies in the Twentieth Century* (Cambridge, Massachusetts: Harvard University Press, 1999).

[19] For example, see. Gökhan Kartal and Serdar Öztürk, "Politik Istikrarsızlık, Enerji Güvenliği ve Ekonomik Büyüme Ilişkisi: Orta Doğu Ülkeleri Üzerine Ampirik Bir Inceleme," *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi* 8, no. İktisadi ve İdari Bilimler (2020): 65-78, https://doi.org/10.18506/anemon.629534; Gökhan Kartal, "Orta Doğu Ülkelerinde Politik Istikrarsızlık, Enerji Güvenliği ve Ekonomik Büyüme Ilişkisi" (PhD diss., Nevşehir Hacı Bektaş Veli Üniversitesi, 2018); Muhsin Kar, Şaban Nazlıoğlu, and Hüseyin Ağır, "Financial Development and Economic Growth Nexus in the MENA Countries: Bootstrap Panel Granger Causality Analysis," *Economic Modelling* 28, no. 1-2 (2011): 685-93, https://doi.org/10.1016/j.econmod.2010.05.015.

Table 1. The Importance of Energy Resources in the Middle East

	Country	GDP**	Oil		Gas		Fuels (Exports)**	
			Reserve*	Rate (%)	Reserve*	Rate (%)	%Export	%GDP
1	Turkey	778.38	---	---	---	---	3.28	0.75
2	S. Arabia	786.52	297.67	17.21%	5.89	2.99	78.63	29.44
3	Iran	454.00	155.60	9.00%	31.93	16.22	68.69	14.62
4	UAE	422.22	97.80	5.65%	5.94	3.02	31.34	28.80
5	Egypt	249.71	3.33	0.19%	1.85	0.94	24.57	2.90
6	Israel	370.59	---	---	0.41	0.21	2.26	0.38
7	Iraq	174.90	147.22	8.51%	3.56	1.81	99.99	25.03
8	Algeria	170.16	12.20	0.71%	4.50	2.29	96.11	19.88
9	Qatar	183.33	25.24	1.46%	24.70	12.55	86.13	39.89
10	Kuwait	140.65	101.50	5.87%	1.69	0.86	90.90	46.49
11	Morocco	118.10	---	---	---		1.17	0.29
12	Oman	79.79	5.37	0.31%	0.66	0.34	69.35	36.30
13	Libya	52.61	48.36	2.80%	1.50	0.76	95.40	54.47
14	Bahrain	37.65	---	---	0.18	0.09	48.26	18.39
15	Syria	60.47	2.50	0.14%	0.27	0.14	28.68	9.37
16	Tunisia	39.77	0.43	0.02%	---		5.69	2.22
Middle East (16 Countries)		4,118.84	897.22	51.87%	83.09	42.21	42.88	19.55
Middle East (Others)		124.23	3.16	0.18%	0.27	0.14%	---	---
World Total		75.845	1,729.74	100	196.85	100	5.2	1.43

Note: *Based on 2018 data. Oil reserves data is billion tons and natural gas reserves data is trillion cubic meters. ** Entire 2018 data cannot be obtained for some countries. Therefore, when the table has been established, the year in which all the data for all variables are available for a country have been considered. Accordingly, data for 2016 for Iraq, 2017 for Algeria, 2010 for Syria and 2018 for other countries have been considered in the table.
Source: World Bank,[20] United Nations,[21] Trade Map,[22] BP,[23] Kartal.[24]

One of the most common mathematical techniques utilized in the rating of energy security is the use of energy security indexes, which are created by

[20] World Bank, "World Development Indicators," 2021, accessed June 28, 2021, https://databank.worldbank.org.
[21] United Nations (UN), "Comtrade Database," 2021, accessed June 28, 2021, https://comtrade.un.org.
[22] Trademap, "Trede Map," 2021, accessed June 28, 2021, https://www.trademap.org.
[23] BP, "Statistical Review of World Energy."
[24] Kartal, *Politik Istikrarsizlik ve Enerji Güvenliği Ekseninde Orta Doğu Ekonomileri*, 81.

bringing together statistical data containing different dimensions of energy security.[25] Although it is viewed that the current situation of countries in terms of energy security is evaluated with the assistance of these indexes established in the literature, there are few econometric papers investigating the economic impacts of energy security. In this context, this study aims to contribute to the literature by investigating the relationship between energy security and growth in the Middle East. Moreover, this paper particularly aims to perform the following;

1. To provide a pioneering study on the relationship between energy security and growth given that few studies have empirically examined this relationship.
2. To attract attention to the economic impact of the energy security issue in the context of the key role of energy resources in modern economies.
3. To provide a more holistic analysis in addition to the few available studies by using an index composed of many variables instead of several variables affecting energy security.
4. To demonstrate the significance of energy security in the Middle East, which has the world's most important energy reserves and directly affects the world energy security.
5. To assess whether possessing rich energy resources is sufficient to ensure energy security or not.

2. Literature Review

Although there are many studies examining the definition of energy security, its dimensions and the factors affecting energy security, there are few studies examining the economic effects of energy security (especially the 4A of energy security) with quantitative approaches. This case is also expressed by Le and Nguyen.[26] At this point, it should be stated separately that there are studies that examine the economic effects of energy security by using variables, which do not fully express energy security on its own but are an element of energy security such as fuel supply, natural gas consumption, electricity availability, environmental stress, and oil price

25 Šumskis and Giedraitis, "Economic Implications of Energy Security in the Short Run," 122.

26 Le and Nguyen, "Is Energy Security a Driver for Economic Growth? Evidence from a Global Sample," 438.

shocks. These studies including Balitskiy et al.[27] have established using natural gas consumption as an energy security variable as there is a negative relationship between natural gas consumption and economic growth in the European Union (EU). In the study by Nepal and Paija,[28] which uses the variable of electricity consumption as a variable of energy security for Nepal, it is argued that there is no long-run relationship between electricity consumption and the economic output. Varigonda [29] using fuel supply and electricity supply insecurity as a variable for energy security, argues that if the fuel supply is also unreliable, it could lead to chronic socio-political instability. In the study where energy security is expressed by the China-Pakistan Economic Corridor energy projects by Ahmed et al.,[30] it is argued that there is statistically significant and strong negative correlation between energy security and economic burden and between energy security and project completion delays. In the study by Gasparatos and Gadda,[31] in which the energy imports variable was used as an energy security variable for the example of Japan, it was determined that there is a significant increase in the total amount of consumed energy and an increasing dependence on developing countries for energy imports that threatens long-term economic sustainability. In addition to these studies, the effects of energy prices, supply and demand shocks, which are elements of energy security, are examined in the studies conducted by Alley et al.[32] and Iwayemi and Fowowe[33]

[27] Sergey Balitskiy, Yuriy Bilan, and Wadim Strielkowski, "Energy Security and Economic Growth in the European Union," *Journal of Security and Sustainability Isues* 4, no. 2 (2014): 123-30, https://doi.org/10.9770/jssi.2014.4.2(2).

[28] Rabindra Nepal and Nirash Paija, "Energy Security, Electricity, Population and Economic Growth: The Case of a Developing South Asian Resource-Rich Economy," *Energy Policy* 132 (2019): 771-81, https://doi.org/10.1016/j.enpol.2019.05.054.

[29] Kesava Chandra Varigonda, "An Assessment of the Impact of Energy Insecurity on State Stability in India," *Energy Policy* 62 (2013): 1110-19, https://doi.org/10.1016/j.enpol.2013.06.091.

[30] Salik uddin Ahmed et al., "China Pakistan Economic Corridor and Pakistan's Energy Security: A Meta-Analytic Review," *Energy Policy* 127 (2019): 147-54, https://doi.org/10.1016/j.enpol.2018.12.003.

[31] Alexandros Gasparatos and Tatiana Gadda, "Environmental Support, Energy Security and Economic Growth in Japan," *Energy Policy* 37, no. 10 (2009): 4038-48, https://doi.org/10.1016/j.enpol.2009.05.011.

[32] Ibrahim Alley et al., "Oil Price Shocks and Nigerian Economic Growth," *European Scientific Journal* 10, no. 19 (2014): 375-91.

[33] Akin Iwayemi and Babajide Fowowe, "Impact of Oil Price Shocks on Selected Macroeconomic Variables in Nigeria," *Energy Policy* 39, no. 2 (2011): 603-12, https://doi.org/10.1016/j.enpol.2010.10.033.

for Nigeria; Berument et al.[34] for 16 MENA countries; Cunado and De Gracia[35] for six Asian countries; Bernanke et al.,[36] Doroodian and Boyd,[37] Elder and Serletis,[38] Kilian and Park[39] and Sadorsky[40] for USA; Du at al.,[41] for China; Farzanegan and Markwardt[42] for Iran; Ghalayini[43] G7, OPEC and Russia, China and India; Jiménez-Rodriguez and Sánchez[44] for industrialized countries; Kilian and Hicks[45] and Ono[46] for BRIC countries; Lee et al.;[47] Tang et al.[48] for China; Zhang[49] for Japan.

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34 M Hakan Berument et al., "The Impact of Oil Price Shocks on the Economic Growth of Selected MENA Countries," *The Energy Journal* 31, no. 1 (2016): 149-76.

35 J. Cunado and F. Perez de Gracia, "Oil Prices, Economic Activity and Inflation: Evidence for Some Asian Countries," *Quarterly Review of Economics and Finance* 45, no. 1 (2005): 65-83, https://doi.org/10.1016/j.qref.2004.02.003.

36 Ben S Bernanke et al., "Systematic Monetary Policy and the Effects of Oil Price Shocks," *Brookings Papers on Economic Activity* 1997, no. 1 (1997): 91-157.

37 K. Doroodian and Roy Boyd, "The Linkage between Oil Price Shocks and Economic Growth with Inflation in the Presence of Technological Advances: A CGE Model," *Energy Policy* 31, no. 10 (2003): 989-1006, https://doi.org/10.1016/S0301-4215(02)00141-6.

38 John Elder and Apostolos Serletis, "Oil Price Uncertainty," *Journal of Money, Credit and Banking* 42, no. 6 (2010): 1137-59, https://doi.org/10.1111/j.1538-4616.2010.00323.x.

39 Lutz Kilian and Cheolbeom Park, "The Impact of Oil Price Shocks on the US Stock Market," *International Economic Review* 50, no. 4 (2009): 1267-87, https://doi.org/10.1111/j.1468-2354.2009.00568.x.

40 Perry Sadorsky, "Oil Price Shocks and Stock Market Activity," *Energy Economics* 21, no. 5 (1999): 449-69, https://doi.org/10.1016/S0140-9883(99)00020-1.

41 Limin Du, He Yanan, and Chu Wei, "The Relationship between Oil Price Shocks and China's Macro-Economy: An Empirical Analysis," *Energy Policy* 38, no. 8 (2010): 4142-51, https://doi.org/10.1016/j.enpol.2010.03.042.

42 Mohammad Reza Farzanegan and Gunther Markwardt, "The Effects of Oil Price Shocks on the Iranian Economy," *Energy Economics* 31, no. 1 (2009): 134-51, https://doi.org/10.1016/j.eneco.2008.09.003.

43 Latifa Ghalayini, "The Interaction between Oil Price and Economic Growth," *Middle Eastern Finance and Economics*, no. 13 (2011): 127-41.

44 Rebeca Jiménez-Rodríguez and Marcelo Sánchez, "Oil Price Shocks and Real GDP Growth: Empirical Evidence for Some OECD Countries," *Applied Economics* 37, no. 2 (2005): 201-28, https://doi.org/10.1080/0003684042000281561.

45 Lutz Kilian and Bruce Hicks, "Did Unexpectedly Strong Economic Growth Cause the Oil Price Shock of 2003-2008?," *Journal of Forecasting* 32, no. 5 (2013): 385-94, https://doi.org/10.1002/for.2243.

46 Shigeki Ono, "Oil Price Shocks and Stock Markets in BRICs 1," *The European Journal of Comparative Economics* 8, no. 1 (2011): 29-45.

47 Kiseok Lee, Shawn Ni, and Ronald A Ratti, "Oil Shocks and the Macroeconomy: The Role of Price Variability," *The Energy Journal* 16, no. 4 (1995): 39-56, https://doi.org/10.5547/ISSN0195-6574-EJ-Vol16-No4-2.

48 Weiqi Tang, Libo Wu, and ZhongXiang Zhang, "Oil Price Shocks and Their Short- and Long-Term Effects on the Chinese Economy," *Energy Economics* 32, no. SUPPL. 1 (2010): S3-14, https://doi.org/10.1016/j.eneco.2010.01.002.

49 Dayong Zhang, "Oil Shock and Economic Growth in Japan: A Nonlinear Approach," *Energy Economics* 30, no. 5 (2008): 2374-90, https://doi.org/10.1016/j.eneco.2008.01.006.

One of the few studies that focus on energy security more holistically, taking into account the multidimensionality of energy security expressed as the 4A of energy security, is the study by Kartal.[50] Here, the relations between political instability, energy security and growth were examined by using data obtained from fifteen Middle Eastern countries between the years 1996-2014. As a result of econometric analysis by using first-generation unit root and cointegration tests, the author stated that there are cointegration relationships between the variables. The Fully Modified Ordinary Least Squares (FMOLS) estimator outcomes used for coefficient estimation in this study demonstrate that while 1% increase in energy security risk decreased GDP per capita by 0.41%, 1% increase in political stability increased GDP per capita by 0.25%. In addition, according to the Panel Granger Causality analysis results given in the study, there are a bi-directional association between energy security and GDP per capita and, a one-way causality relationship from energy security to political stability and from GDP per capita to political stability. Fang et al.[51] is investigated China's energy security between 2005 and 2015 by using an index named as China's Sustainable Energy Security (CSES), which taking into account five dimensions of energy security including availability, accessibility, affordability, acceptability, and developability. According to the authors, availability and developability dimensions constitute the most important weight of the index. The availability dimension demonstrates a general downward trend and the developability dimension presents an inverted U-type trend for China. Moreover, authors argued that the lowest point has been 2011 and, China's sustainable energy security had been at risk from 2008 to 2012. Another study, which focuses on energy security, is the study by Le and Nguyen.[52] The authors conducted a panel data analysis

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50 Gökhan Kartal, "Orta Doğu Ülkelerinde Politik Istikrarsızlık, Enerji Güvenliği ve Ekonomik Büyüme Ilişkisi" (PhD diss., Nevşehir Hacı Bektaş Veli University, Institute of Social Sciences Department of Economics, 2018); Gökhan Kartal and Serdar Öztürk, "Politik Istikrarsızlık, Enerji Güvenliği ve Ekonomik Büyüme Ilişkisi: Orta Doğu Ülkeleri Üzerine Ampirik Bir Inceleme," *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi* 8, no. İktisadi ve İdari Bilimler (December 18, 2020): 65-78, https://doi.org/10.18506/anemon.629534.

51 Debin Fang, Shanshan Shi, and Qian Yu, "Evaluation of Sustainable Energy Security and an Empirical Analysis of China," *Sustainability* 10, no. 5 (2018): 1685, https://doi.org/10.3390/su10051685.

52 Le and Nguyen, "Is Energy Security a Driver for Economic Growth? Evidence from a Global Sample."

based on different income levels in subsamples of countries by utilizing Panel-Corrected Standard Errors (PCSE) and Feasible Generalized Least Squares (FGLS) methods. According to the authors, the results demonstrate that energy security increases economic growth for both the entire sample and sub-samples of countries. Moreover, the impact of energy insecurity measured by energy density and carbon density variables on economic growth was negative. In addition, the authors stated that combined topics should be followed at the global level due to the connection among three agendas; energy security, economic development, and climate change mitigation. Finally, in the study by Stavytskyy et al.[53] the New Energy Security Index (NSI) for 29 European countries covering the years 1997-2016, was used, and an empirical analysis was performed by doing so. Among the results of this study, the authors stated that there is a positive relationship between the increases in GDP and NESI, while on the other hand, there is a negative relationship between the increases in GDP and CPI.

3. Data and Methodology

In this paper, the aim is to research the relationship between energy security and growth for 16 countries in the Middle Eastern region. Since data on energy security and economic growth variables are only fully available in all 16 countries between 1980 and 2016, the analysis covers this specific period. Herein, the International Energy Security Risk Index (ESRI) obtained from the Global Energy Institute[54] has been used as the energy security variable.[55]

Energy Security Risk Index values for Middle East Countries are provided in Table 4. According to Energy Security Risk Index values, the Middle East energy security risk average is well above the world energy security risk average. Accordingly, 13 of the 16 Middle East countries examined in

[53] Andriy Stavytskyy et al., "Estimating the Interrelation between Energy Security and Macroeconomic Factors in European Countries," *Journal of International Studies* 11, no. 3 (2018): 217-38, https://doi.org/10.14254/2071-8330.2018/11-3/18.

[54] Global Energy Institute, "Energy Security Risk Index 2018 Edition," accessed July 16, 2020, https://www.globalenergyinstitute.org/energy-security-risk-index.

[55] For details of variables and weights used in this index, which is created by combining data for many dimensions of energy security, see. Global Energy Institute, "International Index of Energy Security Risk 2018 Edition," 2018, 71-75, accessed July 16, 2020, https://www.globalenergyinstitute.org/sites/default/files/2019-10/Final2018Index.pdf.

this study have an energy security risk value above the global average. Only four countries including Turkey, Tunisia, Algeria, and Israel have a risk value below that average. When the table is analyzed, it is observed that the riskiest countries among Middle East countries in energy security are Syria, Libya, and Oman. In addition, these countries are among the most ten risky countries in the world. Despite the fact that they have rich energy resources, Middle Eastern countries are in a negative condition with regard to energy security indicating that energy security requires much more than possessing energy resources.

Table 4. Energy Security Risk Index Values for Middle Eastern Countries

C.N	Country	ESRI	Risk Ranking	
			Middle East	World
1.	Turkey	1,198.49	13	29
2.	Saudi Arabia	1,521.84	7	13
3.	Iran	1,572.57	5	10
4.	UAE	1,539.20	6	12
5.	Egypt	1,515.84	8	14
6.	Israel	1,031.50	16	52
7.	Iraq	1,406.67	11	17
8.	Algeria	1,166.91	15	32
9.	Qatar	1,592.60	4	9
10	Kuwait	1,460.59	10	16
11.	Morocco	1,385.59	12	19
12.	Oman	1,677.31	3	8
13.	Libya	2,159.07	2	3
14.	Bahrain	1,485.70	9	15
15.	Syrian	2,040.51	1	4
16.	Tunisia	1,184.41	14	31
World Average		1,216.24		
Middle East Average		1,459.89		

Note: For Syria, the 2014 risk data and the ranking of the country in that same year have been used. For other countries, the 2016 data was used.

Source: Global Energy Institute[56] and Kartal[57]

56 Global Energy Institute, "Energy Security Risk Index 2018 Edition."

57 Kartal, *Politik Istikrarsizlik ve Enerji Güvenliği Ekseninde Orta Doğu Ekonomileri*, 81.

Nominal GDP data used to represent economic growth was generally used by World Bank data.[58] Due to some events in the region, such as the Arab Spring events, the World Bank data for some of the affected countries was not available for some years, and thus the missing data was completed with the assistance of the UNCTAD database[59] and IMF data.[60] In addition, since the export of energy resources has quite a major position for the economies of the region, the effect of changes in energy security on exports was included in the analysis. While exports data were generally obtained from the World Bank database, the missing data were completed through data from the United Nations[61] and the Trade Map.[62] An econometric analysis was carried out using logarithmic forms of all variables. The abbreviations of the variables that were used in the analysis are illustrated as lngdp (Gross Domestic Product), lnesri (Energy Security Risk Index), and lnx (Export). Hence, the econometric model established is as follows:

$$lngdp = a_0 + a_1 lnesri_{it} + a_2 lnx_{it} + e_{it} \Rightarrow i = 1, 2, ..., 16 \text{ and } t = 1, 2, ...$$

Panel data analysis has recently found a lot of application as an econometric analysis method, which combines cross-sectional data and time series. In this context, the unit root property observed in time series is also valid in panel data. In addition, since the panel data was created by combining multiple country data, cross-sectional dependence has been revealed implying that changes in one country affect other countries as well. Cross-sectional dependence also affects the econometric method, especially unit root and cointegration analyses. In this context, cross-sectional dependence tests should be conducted on the data before performing empirical analysis.[63] In this study, cross-sectional dependence tests were used such as the LM_{BP}

58 World Bank, "World Development Indicators."

59 United Nations, "UNData," accessed December 12, 2020, http://data.un.org.

60 International Monetary Fund, "IMF Data," accessed December 12, 2020, http://data.imf.org/.

61 "UNData"; United Nations (UN), "Comtrade Database."

62 Trademap, "Trede Map."

63 The mathematical representation of the methodologies used in empirical analysis is included in many studies, and the mathematical form of the methodology is easily accessible.

Test by Berusch-Pagan,[64] CD_{LM} Test by Pesaran,[65] CD Test by Pesaran[66] and LM_{adj} by Pesaran, and Ullah and Yamagata.[67] The null hypothesis of these tests is that there is no cross-sectional dependence, while the alternative hypothesis is that there is a cross-sectional dependence.

Furthermore, in order to determine the appropriate cointegration test, it should be examined whether the slope coefficient is homogeneous, that is, whether the slope coefficients of β_i are different from the cross-sections in the cointegration equation. In this study, the slope homogeneity test was carried out with the delta tests ($\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$) proposed by Pesaran and Yamagata[68] for testing slope homogeneity, which is derived from the $\hat{S}$ test of Swamy (1970). While the $\tilde{\Delta}$ test, which is one of the delta tests, is used for large samples, the $\tilde{\Delta}_{adj}$, which is another of the delta tests, is used to test the slope homogeneity of small samples. While the null hypothesis of these tests is that parameters are homogeneous, the alternative hypothesis is that parameters are heterogeneous.

If there is a cross-sectional dependence in the variables, the results of traditional unit root tests (first-generation) may give incorrect results. Therefore, if cross-section dependence is detected, second-generation unit root tests, which consider cross section dependence, should be utilized for unit root analysis. In this study, a unit root analysis was performed by a CIPS test, suggested by Pesaran,[69] which also considers cross-section dependence. While the null hypothesis of the CIPS test is that variables are non-stationary, the alternative hypothesis is that variables are stationary.

In a panel data analysis, whether there is a long-term relationship between variables is determined with the assistance of cointegration tests. Cross-

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64 Trevor S Breusch and Adrian R. Pagan, "The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics," *The Review of Economic Studies* 47, no. 1 (1980): 239-53.

65 M. Hashem Pesaran, "General Diagnostic Tests for Cross Section Dependence in Panels," *CESifo Working Paper, No. 1229*, 2004.

66 Pesaran.

67 M. Hashem Pesaran, Aman Ullah, and Takashi Yamagata, "A Bias-Adjusted LM Test of Error Cross-Section Independence," *The Econometrics Journal* 11, no. 1 (2008): 105-27, https://doi.org/10.1111/j.1368-423X.2007.00227.x.

68 M. Hashem Pesaran and Takashi Yamagata, "Testing Slope Homogeneity in Large Panels," *Journal of Econometrics* 142, no. 1 (2008): 50-93, https://doi.org/10.1016/j.jeconom.2007.05.010.

69 M Hashem Pesaran, "A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence," *Journal of Applied Econometrics* 22, no. 2 (2007): 265-312, https://doi.org/10.1002/jae.951.

section dependence is important in determining the empirical method to be used in cointegration analysis as well as in unit root analysis. In addition, whether the slope coefficient is homogeneous or not is important in determining which cointegration tests should be used. In this study, the cointegration relationship was tested with the Panel ECM Cointegration test developed by Westerlund,[70] which can be used in both heterogeneous panels and cross-section dependence cases. In the Panel ECM Cointegration test, cointegration analysis is performed with the assistance of four test statistics, two of which are group-mean statistics (G_α and G_τ) and two of which are panel statistics (P_τ and P_α). In determining the cointegration relationship, if the panel data is homogeneous, panel statistics should be interpreted. Conversely, if the panel is heterogeneous, group statistics should be interpreted. While the null hypothesis of group-mean statistics is that there is no cointegration for all i (where i denotes cross-sections) , the alternative hypothesis is that there is cointegration for at least one i. While the null hypothesis of panel statistics is that there is no cointegration for cross-section units, the alternative hypothesis is that there is cointegration for all i.

If a cointegration relationship is determined between variables, the coefficient estimation showing the effect of independent variables on the dependent variable in the long-term can be performed. Accordingly, this study applied the Augmented Mean Group (AMG) estimator, which is one of the panel estimators that consider heterogeneity and cross-section dependence. The AMG proposed by Eberhardt and Teal[71] and Eberhardt and Bond[72] is an alternative to the Common Correlated Effects Mean Group Estimator (CCEMG) proposed by Pesaran (2006).

In addition, the causality relationship between variables is also investigated in this study. In this regard, it was used the Granger non-causality test proposed by Dumitrescu and Hurlin,[73] which can be used in both

[70] Joakim Westerlund, "Testing for Error Correction in Panel Data," *Oxford Bulletin of Economics and Statistics* 69, no. 6 (2007): 709-48, https://doi.org/10.1111/j.1468-0084.2007.00477.x.

[71] Markus Eberhardt and Francis Teal, "Productivity Analysis in Global Manufacturing Production," *Economics Series Working Papers*, no. 515 (2010).

[72] Markus Eberhardt and Stephen Bond, "Cross-Section Dependence in Nonstationary Panel Models: A Novel Estimator," *Munich Personal RePEc Archive*, 2009.

[73] Elena-Ivona Dumitrescu and Christophe Hurlin, "Testing for Granger Non-Causality in Heterogeneous Panels," *Economic Modelling* 29, no. 4 (2012): 1450-60, https://doi.org/10.1016/j.econmod.2012.02.014.

heterogeneous panels and cross-sectional dependence cases. Statistics required for causality analysis is based on the individual Wald statistics of Granger non-causality averaged across the cross-section units. If T is greater than N, the asymptotic distribution test results (Z_{NT}) should be interpreted, otherwise the semi-asymptotic distribution test results (Z_N) should be interpreted. Moreover, if there is cross-sectional dependence, Dumitrescu and Hurlin[74] suggest that the bootstrap critical values should be interpreted. While the null hypothesis of the Granger Non-Causality Test is that there is no causality for all individuals on the panel, the alternative hypothesis is that there can be causality for some individuals.

4. Empirical Results

Effects of energy security on economic growth was analyzed by panel data econometrics methods for 16 countries in the Middle East between 1980 and 2016. Because of the fact that panel data econometrics includes both cross-section and time series properties, firstly cross-section dependence, slope homogeneity, and unit root tests must be applied.

The delta tests suggested by Pesaran and Yamagata[75] were used to determine the slope homogeneity for the series. According to the results shown in Table 5, the null hypothesis that the panel is homogeneous has been rejected in both $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ so that the panel was found to be heterogeneous. According to the results of the delta test for the variables, while the null hypothesis claims that parameters are homogeneous, is rejected for lngdp and lnx variables, it is accepted for the lnesri variable.

In this study, LM_{BP}, CD_{LM}, CD and LM_{adj} Tests were used for cross-sectional dependence analysis and their results are provided in Table 5. According to the results of the cross-section dependence tests performed for both the panel as a whole and for each variable, the null hypothesis that there was no cross-section dependence has been rejected, and cross-section dependence was determined. Those results necessitate the use of econometric analysis methods, which consider both the cross-sectional dependence and heterogeneity. In addition, cross-sectional dependence case demonstrates that the countries in the region are affected by the developments in Middle Eastern countries.

74 Dumitrescu and Hurlin.

75 Pesaran and Yamagata, "Testing Slope Homogeneity in Large Panels."

Table 5. Cross-Sectional Dependence and Homogeneous Test Analysis Results

Tests	lngdp		lnesri		lnx		Panel	
	Stat.	p-val.	Stat.	p-val.	Stat.	p-val.	Stat.	p-val.
LM (Breusch, Pagan 1980)	342.959	0.000	170.702	0.002	248.054	0.000	471.333	0.000
CDlm (Pesaran 2004)	14.392	0.000	3.273	0.001	8.266	0.000	22.678	0.000
CD (Pesaran 2004)	-1.624	0.052	-2.910	0.002	-0.465	0.321	8.197	0.000
LMadj (PUY, 2008)	11.423	0.000	6.639	0.000	4.366	0.000	29.327	0.000
Delta	2.804	0.003	0.888	0.187	4.907	0.000	19.951	0.000
Delta Adj	2.925	0.002	0.927	0.177	5.119	0.000	21.092	0.000

Since panel data analysis also includes time series features, it also requires performing unit root tests. Moreover, since cross-sectional dependence was identified, the second-generation unit root tests, which consider the cross-sectional dependence, must be utilized in the unit root analysis. Therefore, the CIPS test proposed by Pesaran,[76] was applied for the unit root test. When the results provided in Table 6 were examined, both in the constant model and in the constant and trend model, the null hypothesis, which expresses the presence of unit root, was accepted. Then, when it analyzed the first differences of the variables, the alternative hypothesis was accepted. Therefore, it was decided that the series are stationary in the first differences; that is, the series are I(1).

Table 6. Unit Root Test Results

Variable	Constant		Constant and Trend	
	level	1st difference	level	1st difference
lngdp	-2.1640	-5.2228*	-2.7350***	-5.1859*
lnesri	-2.1183	-5.4344*	-2.6885	-5.6003*
lnx	-2.1011	-5.1041*	-2.7210	-5.3643*
Critical Values	%1 %5 %10 -2.45 -2.25 -2.14		%1 %5 %10 -2.96 -2.76 -2.66	

Note: ***, **, * indicates statistical significance at 1%, 5% & 10%.

The cointegration analysis was conducted using Panel ECM Cointegration test developed by Westerlund,[77] which can be used in case of both heterogeneous panels and cross-section dependence. If there is cross-

76 Pesaran, "A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence."
77 Westerlund, "Testing for Error Correction in Panel Data."

sectional dependence in data, Westerlund[78] suggests that a bootstrap procedure should be undertaken, which is similar to the method used by Chang (2004). Therefore, when interpreting the panel ECM Cointegration test results (see Table 7), it should be taken into account both the bootstrap p-value (because cross-sectional dependence detected) and group statistics (i.e., G_α and G_τ) (because heterogeneity is detected). In the constant model, the hypothesis excluding cointegration has been rejected for the G_τ statistic at the significance of 10%. In the constant and trend models, the hypothesis expressing no cointegration was rejected for the G_α statistic for a significance at 5% and for the G_τ of 10% significance. Moreover, the cointegration relationship (in both constant and constant-trend model) was confirmed with the results obtained from the Bootstrap Panel LM Cointegration Test (see Table 7). This test proposed by Westerlund and Edgerton[79] provides valid results in case of cross-section dependence by applying bootstrap procedure.

Table 7. Panel ECM Cointegration and Bootstrap Panel LM Tests Results

Tests	Constant			Constant and Trend		
	Stat.	p-value	Bootstrap p-value	Stat.	p-value	Bootstrap p-value
Gt	-3.832	0.000	0.084	-4.271	0.000	0.079
Ga	-3.550	0.000	0.120	-5.093	0.000	0.033
Pt	-6.125	0.000	0.032	-5.905	0.000	0.057
Pa	-7.047	0.000	0.031	-5.181	0.000	0.096
LM	38.879	0.000	0.000	20.494	0.000	0.000

Note: Bootstrap replications 10.000. lag, lead and bandwidth: 4(T/100)2/9 ≈ 3.

After determining the existence of a long-term relationship between variables, a long-term coefficient estimation was made with the Augmented Mean Group Estimator (AMG) proposed by Eberhardt and Bond[80] and Eberhardt and Teal,[81] which assess both heterogeneity and cross-sectional dependence. The estimation results were provided in Table 8. When the coefficients are examined for the entire panel, the 1% increase in energy

[78] Westerlund, 722; Joakim Westerlund, "Panel Cointegration Tests of the Fisher Effect," *Journal of Applied Econometrics* 23, no. 2 (2008): 236, https://doi.org/10.1002/jae.967.

[79] Joakim Westerlund and David L. Edgerton, "A Panel Bootstrap Cointegration Test," *Economics Letters* 97, no. 3 (2007): 185-90, https://doi.org/10.1016/j.econlet.2007.03.003.

[80] Eberhardt and Bond, "Cross-Section Dependence in Nonstationary Panel Models: A Novel Estimator."

[81] Eberhardt and Teal, "Productivity Analysis in Global Manufacturing Production."

security risk reduces the economic growth by approximately 0.66%, while the 1% increase in exports increases economic growth by 0.41%. These results are statistically significant at 1%. According to the results, while the increase in the energy security risk affects the economies of the region negatively, the increase in exports affects the economies of the region positively. Considering the share of oil and natural gas revenues in total exports and in GDP in the economies of the region, it can be expressed that every situation that may adversely affect energy exports can yield significant economic effects. In addition, coefficient estimates for each cross-section analysis were provided in Table 8. The effect of an increase in the energy security risk level on economic growth is negative in 12 of the 16 countries. While the coefficient for Turkey and Iran from the remaining four countries is positive, the results are statistically insignificant. This result, indicating that increasing risk in energy security positively affects economic growth for Iraq and Algeria, is the opposite of expectations. Moreover, it has been determined that the effect of increase in exports on economic growth is positive in all 16 countries of the region, and the result is statistically significant at 1%.

Table 8. Augmented Mean Group Estimators Results

Variable	Coeff.	Z-value	p-value
lnesri	-0.6610118	-3.55	0.000
lnx	0.4148792	8.44	0.000
c	18.29034	11.44	0.000
Wald chi2	83.84		0.0000

Group-specific coefficients

C.N.	Country	lnesri	lnx	c
1.	Turkey	0.057261 [0.16]	0.4469427 [11.07]***	14.35297 [8.26]***
2.	Saudi Arabia	-0.4819925 [-3.39] ***	0.4343814 [16.97] ***	18.05903 [27.16] ***
3.	Iran	0.337456 [0.45]	0.1311781 [0.99]	19.80434 [7.09] ***
4.	United Arab Emirates	-0.711369 [-4.26] ***	0.5104614 [18.97] ***	17.15028 [18.81] ***
5.	Egypt	-1.119138 [-3.28] ***	0.5476937 [11.21] ***	19.82281 [8.39] ***

C.N.	Country	lnesri	lnx	c
6.	Israel	-1.685654 [-10.15] ***	0.5105956 [23.34] ***	24.15068 [19.65] ***
7.	Iraq	2.221681 [3.12] ***	0.2869198 [3.05] ***	1.171365 [0.17]
8.	Algeria	0.7890266 [3.56] ***	0.1166388 [3.24] ***	16.31338 [12.88] ***
9.	Qatar	-0.0631111 [-0.54]	0.6371533 [73.82] ***	8.953987 [11.37] ***
10	Kuwait	-0.4571026 [-2.43] ***	0.5012467 [16.90] ***	15.22515 [19.09] ***
11.	Morocco	-1.009492 [-6.74] ***	0.417566 [14.34] ***	21.41562 [26.95] ***
12.	Oman	-0.6962281 [-6.21] ***	0.6807156 [16.76] ***	12.31641 [38.41] ***
13.	Libya	-0.7403925 [-4.52] ***	0.2424705 [4.29] ***	23.39953 [16.24] ***
14.	Bahrain	-1.018735 [-4.52] ***	0.5881132 [20.26] ***	16.35111 [10.93] ***
15.	Syria	-1.106556 [-3.01] ***	0.1821581 [3.39] ***	27.37404 [10.20] ***
16.	Tunisia	-1.392465 [-10.72] ***	0.3326781 [18.12] ***	25.31219 [25.07] ***

Note: ***, **, * indicates statistical significance at 1%, 5% & 10%.

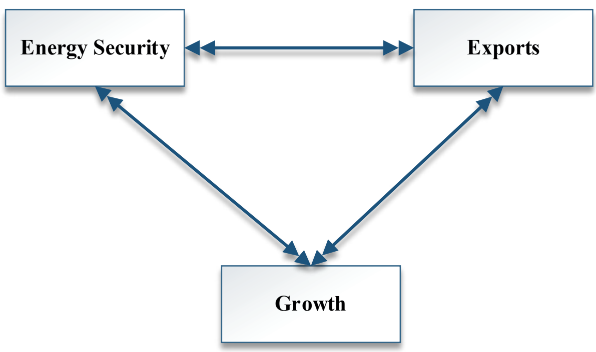
The causal relationship among economic growth, energy security, and exports has been investigated through the assistance of Dumitrescu and Hurlin[82] Panel Causality Test. The data used in the analysis is the T>N and, the existence of cross-section dependence has also been detected. Therefore, the statistical values calculated for Asymptotic Distribution and the bootstrap critical values should be considered. The results provided in Table 9 demonstrate that there is a bi-directional causality relationship between energy security and growth, between energy security and export, and between growth and export. This relationship was schematically summarized in Figure 1.

[82] Dumitrescu and Hurlin, "Testing for Granger Non-Causality in Heterogeneous Panels."

Table 9. Panel Causality Test Results

The Direction of The Causality	Asymptotic Distribution		Bootstrap Critical Values		
	Panel Z_{NT}	p-value	10%	5%	1%
ESRI→GDP	2.843**	0.004	1.700	2.268	3.529
GDP→ESRI	5.212***	0.000	1.669	2.190	3.446
ESRI→EXPORT	2.985**	0.003	1.650	2.156	3.536
EXPORT→ESRI	3.435***	0.001	1.725	2.210	3.167
EXPORT→GDP	11.159***	0.000	1.612	2.133	3.383
GDP→EXPORT	5.384***	0.000	1.827	2.508	3.697

Figure 1. Direction of Causality between Variables



5. Conclusion and Policy Implications

In this paper, the aim is to investigate the relationship between energy security and growth between 1980 and 2016 for 16 countries in the Middle East region. Since in most of the countries in the region the incomes obtained from energy exports have an important place in their respective economies, the exports variable has also been added to the equation. In the empirical application, firstly, the cross-sectional dependence and homogeneity tests were performed. As a result of these tests, it was determined that there was heterogeneity and cross-sectional dependence in the panel data set. Therefore, econometric methods suitable for these cases have been preferred in empirical analysis. Given the cross-sectional dependence in the series, it was determined that the variables were stationary in the first difference by using the CIPS test, which is one of the second-generation unit root tests. Then, it was determined by using the Panel ECM Cointegration Test and the Bootstrap Panel LM Cointegration

Test that there is a cointegration relationship between the variables. After that, long-term coefficients were calculated with the Augmented Mean Group estimator. AMG estimator results demonstrate that a 1% increase in energy security risk reduces economic growth by approximately 0.66%, while a 1% increase in exports increases economic growth by 0.41%. The examination of cross-section coefficients reveals that an increase of 1% in energy security risk level reduces economic growth by more than 1% in 6 countries, including Israel, Tunisia, Egypt, Syria, Bahrain, and Morocco. This result demonstrates that energy security is an important issue, and much more serious for these countries than already thought. On the other hand, an increase of 1% in energy security risk reduces economic growth by less than 1% in six countries, including Libya, the United Arab Emirates, Oman, Saudi Arabia, Kuwait, and Qatar. Contrary to the general expectation, the effect of an increase at the energy security risk level on economic growth is positive for Turkey, Iran, Iraq, and Algeria. However, these results are statistically insignificant for Turkey and Iran. Finally, the causality relationship between variables has been examined through the Dumitrescu and Hurlin (2012) Panel Causality Test. It was determined that there is a bi-directional causality between energy security and growth, between energy security and export, and between growth and export. The results obtained are consistent with the studies of Kartal (2018) and Kartal and Öztürk (2020), which focus on Middle Eastern countries, as well as other empirical studies on other countries and regions. Overall, this study significantly differs from other studies on the Middle East region in terms of considering cross-section dependence in the empirical analysis, focusing on a broader period and a wider range of countries.

The results obtained from the econometric analysis demonstrate that energy security is a vital issue for Middle East economies. Therefore, these results indicate that policies towards energy security in Middle Eastern countries are very important. Accordingly, some policy recommendations on energy security in the Middle East countries can be formulated as follows: First, it is quite important to choose safe trade routes for both energy exporter and importer countries, and therefore, safe routes should be preferred when choosing crossing routes. Incidents related to political instability (war, occupation, riot, etc.), which directly affect the field safety of energy sources and the safety of energy crossing routes, occurring in the Middle East, threaten the energy security of both the countries of the region and the world in general. They threaten the security of oil and gas fields and energy crossing routes in the region as the security weakness caused by activities of various terrorist groups in the region or important regional events like the Arab Uprisings reveal. Therefore, political stability, especially national security, should be ensured in the region. In addition, there is also a great need for patriotic and visionary leaders who defend the rights of their country on the international arena, and meet the demands of the region for more freedom and democracy, while not being under the guidance of external forces. Thus, the instability resulting from external interventions in the countries of the region will be minimized, and the way for the implementation of stronger policies will be opened for both energy security and other areas of economic problem-solving.

Second, the security of the major crossing points in the region as well as the security of the pipelines' crossing routes, which are quite important in oil and natural gas transportation, should be ensured. The creation of alternative crossing routes or "route diversification," may reduce some of the risks in this direction. Furthermore, the elimination of the existing conflict environment in the region and ensuring national security will play an important role in ensuring the security of important crossing points and oil pipelines.

Third, policies should be developed to decrease the share of energy revenues in the region's economies, which are too dependent on income from energy exports. The most important way to reduce this dependence is economic diversification. The most important step in this regard is the use of income from energy revenues as a source of financing for, in particular, advanced technology and other capital-intensive areas. Thus, an important development move can be realized by developing high-value-added industries. This is how high dependence on oil and natural gas revenues can be reduced. In addition, rather than exporting crude oil, exporting it by refining can also increase the revenues to be obtained from selling oil.

Fourth, "country diversification" should be ensured in energy-exporting. Thus, in the event of a potential problem with any country, to which energy resources are exported, the risks that may hinder such exports can be reduced. Likewise, countries that depend on imports in energy such as Turkey, should work on country diversification in energy imports by importing from more countries. Thus, uninterrupted access to energy can be maintained by turning to alternative exporting countries so that recurring problems with some sellers can be better overcome. Thanks to country diversification, energy exporter countries can minimize the risks that can arise from fluctuations in energy revenues, while energy exporter countries may minimize the risks that can arise from energy deprivation.

Fifth, another important issue that has recently gained importance in energy security is the development of appropriate environmental policies. In this context, due to the abundance of energy resources in most places in the region, the use of fossil fuels is considerably higher than renewable energy use. For this reason, the environment has been more damaged than elsewhere. Furthermore, it is important to know that these resources are not unlimited. In this context, energy efficiency policies are also quite important. This is a much more important issue for countries, which depend on imports in energy resources. Because energy imports are an important factor that affects foreign trade negatively for these countries. Ensuring energy efficiency and using renewable energy sources are important for the foreign trade balances of the countries as well as the positive impact on the environment.

Finally, since there are countries with different structures in the region (for example, the high share of energy exports in total exports is an important energy security risk for Saudi Arabia, whereas the high share of energy imports in total imports is an important energy security risk for Turkey), a SWOT analysis should be carried out considering all the elements of energy security. Energy security risk factors should be analyzed individually for each country, and then national energy security policies should be established by determining the most important risk factors for energy security. The selection of the most appropriate policies to be implemented in this direction should be done by comparing the themes constituting the energy security risk elements with the risk conditions of the country in question.

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