THE RELATIONSHIP BETWEEN DEFENSE EXPENDITURE AND ECONOMIC GROWTH: A PANEL DATA ANALYSIS FOR TURKEY AND SELECTED COUNTRIES

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SAVUNMA HARCAMALARI İLE EKONOMİK BÜYÜME ARASINDAKİ İLİŞKİ: TÜRKİYE VE SEÇİLMİŞ ÜLKELER İÇİN BİR PANEL VERİ ANALİZİ

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Abstract

In this study, the relationships between defense expenditure and economic growth are analyzed by panel data analysis methods by using the data of 1992-2017 periods for 15 countries with the highest defense spending in 2017. The stationarity of the series is examined by LLC and IPS panel unit root tests and the series are determined to be I(1). Cointegration relationships between series are examined by Pedroni panel cointegration test and it is determined that the series are cointegrated. Long and short-term analyzes are performed by PDOLS method, and 1% increase in defense expenditures is estimated to incline the national income by 1.05% in average, and this effect is slightly lower in the short term. Similarly; 1% increase in national income is found to ascend defense expenditure by 0.89% and this effect is also lower in the short term. Error correction mechanism of the models operates. Causality relationships between series is examined by VECM method and it is determined that a causality exists from national income to defense expenditures only in the long term while it exists both in the short term and in the long term from defense expenditure to national income.

Key Words: *Defense Expenditure, Economic Growth, Panel Data Analysis.*

Öz

Bu çalışmada savunma harcamaları ile ekonomik büyüme arasındaki ilişkiler, 2017 yılı itibariyle en fazla savunma harcaması yapan 15 ülkenin, 1992-2017 dönemi verileri kullanılarak, panel veri analizi yöntemleriyle incelenmiştir. Serilerin durağanlığı; LLCve IPS panel birim kök testleriyle incelenmiş ve serilerin I(1) olduklarına karar verilmiştir. Seriler arasındaki eşbütünleşme ilişkileri; Pedroni panel eşbütünleşme testi ile incelenmiş ve serilerin eşbütünleşik oldukları belirlenmiştir. Seriler arasındaki uzun ve kısa dönem analizleri PDOLS yöntemiyle gerçekleştirilmiş ve savunma harcamalarındaki %1'lik artışın, bu ülkelerdeki milli geliri ortalama %1.05 oranında artırdığı, bu etkinin kısa dönemde biraz daha düşük olduğu görülmüştür. Benzer şekilde; milli gelirlerdeki %1'lik artışın da savunma harcamalarını ortalama %0.89 oranında artırdığı ve bu etkinin de kısa dönemde daha düşük olduğu belirlenmiştir. Modellerin hata düzeltme mekanizmaları çalışmaktadır. Seriler arasındaki nedensellik ilişkileri; VECM yöntemiyle incelenmiş ve milli gelirden savunma harcamalarına doğru sadece uzun dönemde, savunma harcamalarından milli gelire doğru ise hem kısa dönemde, hem de uzun dönemde nedensellik ilişkilerinin olduğu tespit edilmiştir.

Anahtar Kelimeler: *Savunma Harcamaları, Ekonomik Büyüme, Panel Veri Analizi.*

Akademik Araştırmalar ve Çalışmalar Dergisi   Journal of Academic Researches and Studies
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1. INTRODUCTION

Defense expenditures are the expenses that are required by a state to protect national sovereignty against internal and external threats. Therefore, military expenditures, which have a large share in public expenditures, are very important for countries since success of a country in economy, politics and so on depends primarily on its ability to maintain its presence, in other words, to ensure its national security.

Due to the regional conflicts of interest of globalized economies, defense expenditures are among the highest expenditure items. In this context, defense expenditures may have an impact on economic growth and other macroeconomic variables. In particular, developing countries can be negatively affected by defense expenditures and thus give deficits in their budgets.

It is a fact that defense expenditures have increased especially since World War II. In the bi-polar world, which was formed during the Cold War period, it is observed that the weight of defense expenditures within the state budgets increased. Defense spending reached its highest level during the cold war era, especially in 1987; then it began to diminish. The defense expenditures, which showed a short-term decrease after the end of the Cold War, changed direction again after 1998 and kept an increasing momentum until today.

The issue on which economists significantly focus about defense expenditures, which have national and international impacts, is the relationship between these expenditures and economic growth. The importance of defense expenditures is better understood in terms of effective resource allocation, which is one of the fundamental problems of the economics. The increase in world defense expenditures bring along the question whether the allocated resources could be transferred to other more efficient areas. As the defense expenditures reached to high amounts, interest in the direction of the effects of this situation on the economy has increased and many studies have been carried out on this subject.

In this study; defense expenditures, the level of defense expenditures and the factors affecting it, the relationship between defense expenditures and economic growth areexamined and analyzed for the case of Turkey.

2. LITERATURE REVIEW

There are many studies on the direction of the effects of defense expenditures on the economy. The majority of the investigations on defense expenditures in national and international studies are related to the relationship between defense expenditures and economic growth. There are two theoretical approaches to the relationship between defense expenditures and economic growth. The first approach is the Keynesian approach, which advocates that defense expenditures positively affect economic growth. The second approach is the Neo-classical approach, which argues that defense expenditures negatively affect economic growth. There are also studies defending that there is no relationship between these two variables.

The first studies to analyze the effects of defense expenditures on economic growth have begun in the 1970s. The first two of these studies belong to Benoit. Benoit (1973, 1978) analyzed the relationship between defense expenditures and economic growth by using data of the 1950-1965 period of 44 developing countries to conclude that defense expenditures increase economic growth (a positive relationship between defense expenditures and economic growth). As a result of Benoit's study, this relationship between defense expenditures and economic growth is called as "the Benoit Hypothesis" in the literature.

Chowdhury (1991) investigated the relationship between defense expenditures and economic growth in fifty-five developing countries. In his study, one-way causality was found from defense expenditures to growth for fifteen countries and from economic growth to defense expenditures in seven countries. In addition, two-way causality between defense expenditures and growth in three countries was determined while no causality relationship was discovered in thirty countries.

Mintz and Stevenson (1995) analyzed the impact of military spending and non-military spending

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

on economic growth by using data from 1950-1985 period for 103 countries. In the analysis, despite the fact that non-military expenditures have a significant and positive effect on economic development in many countries, they have concluded that the impact of military expenditures is insignificant.

Devarajan et al. (1996) studied the relationship between public spending and economic growth in the 1970-1990 period for 43 developing countries. In the study, it is concluded that health, transportation and communication expenditures have a positive and significant effect on economic growth while defense and education expenditures have a negative and significant effect.

Kollias (1997) investigated the relationship between defense expenditures and economic growth using data of the 1954-1993 period for Turkey. In the study, no causality relationship between defense expenditures and economic growth could be identified.

Dunne and Vougas (1999) analyzed the relationship between defense expenditures and economic growth for the South African economy with data covering the years 1964-1996. The study concluded that defense expenditures for the South African economy had a statistically significant and quite negative impact on economic growth.

Kollias and Makrydakis (2000) examined the relationship between defense expenditures and economic growth by using data between 1955 and 1993 for the Greek economy. They did not find any causal relationship between defense expenditures and economic growth.

Dunne et al. (2001) analyzed the impact of military spending in real gross domestic product (real GDP) using the data for Turkey and Greece for the period of 1960-1996 with the help of Granger causality test. The result of analysis revealed that military spending affects the real gross domestic product positively in Greece while its impact is negative in Turkey

Galvin (2003) examined the relationship between defense expenditures and economic growth in sixty-four developing countries using a demand-and-supply model. In the study, it is concluded that defense expenditures had a negative effect on both economic growth and savings-income ratio.

Gökbunar and Yanıkkaya (2004) analyzed the effects of defense expenditures on economic growth and total investments for more than one hundred country of different development structures. In the analysis, they concluded that defense expenditures positively affect the growth in developing countries by increasing investments, whereas in developed countries there is no significant relationship between defense expenditures and growth.

Yildirim et al. (2005) examined the impact of military spending on economic growth in Middle East countries and Turkey using data of the 1989-1999 period. In their study, they determined that military expenditures had a positive effect on economic growth in these countries.

Pieroni (2007) analyzed the relationship between defense expenditures and economic growth for 90 countries. As a result of the analysis, it is concluded that there is a negative correlation between military expenditures and economic growth in countries with high military spending.

Gorkem and Isik (2008) investigated the relationship between defense expenditures and economic growth for Turkey's economy using data of the 1968-2006 period. For the period mentioned in the research, they concluded that no causal relationship between defense expenditure and economic growth in Turkey was found.

Dunne and Tian (2013) analyzed the relationship between defense expenditures and economic growth by using data of the 1988-2010 period for 106 countries. In the study, they concluded that the defense expenditures negatively affect the economic growth both in the short and long term.

Soyyigit Kaya (2013) analyzed the economic impacts of defense expenditures using data from the 1970-2010 period for Turkey's economy. As a result of the analysis, the existence of a causal relationship from employment to defense expenditures and from defense expenditures to economic growth (GNP) was determined.

Durgun and Timur (2017) tried to explain impacts of defense expenditures on economic growth

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

in Turkey's economy by two different views (Military Keynesian and Neo-Classical Approach). In their study, the existence of a long-term causal relationship between economic growth and defense expenditures for Turkey's economy couldn't be determined.

Tuncay (2017) analyzed the relationship between economic growth and defense expenditures for seven countries showing economic and geostrategic similarity to Turkey, which are Tunisia, Greece, Bulgaria, Egypt, Azerbaijan, Iran and Israel, using data from the 1996-2014 period. After the analysis, it was stated that there is a negative correlation between defense spending and growth.

Egri et al. (2017) investigated the relationship between defense expenditures and economic growth with data of 1970-2012 period for Turkey and the selected Middle East countries using panel data analysis method. In the analysis conducted with the last updated data set, they concluded that there was a negative relationship between economic growth and defense expenditures.

Korkmaz and Bilgin (2017) analyzed the relationship between military spending and economic growth for Turkey and the US using 1961-2015 period data. Analysis for the United States identified no significant causal relationship between economic growth and military spending while the authors revealed that there was two-way causality for Turkey.

Ajmair et al. (2018) attempted to identify the relationship between defense expenditures and economic growth by using data covering the period from 1990 to 2015 in Pakistan. In the study, there was no significant relationship between defense expenditures and economic growth in the long term, but a significant and positive relationship between defense expenditures and economic growth existed in the short term.

Analysis of the effects of defense expenditures on economic growth reveals that the effects of defense expenditures differentiate according to the development level of the country and the period examined. As a general assessment of the literature review, there are many studies that show a positive relationship between defense expenditures and economic growth, as well as a number of studies show that defense expenditures have a negative impact on the economy. Even in a part of the studies, there was no significant relationship between defense expenditures and economic growth. The lack of consensus in the literature between defense expenditures and economic growth has led to many empirical studies for many years.

3. THE RELATIONSHIP BETWEEN GDP, LEVEL OF DEVELOPMENT AND DEFENSE EXPENDITURE

Defense expenditures are complementary or intermediate consumer services that are produced to protect other goods and services from external attacks and their demands increase in parallel with economic development (Thompson, 1974: 755). States need defense services for various reasons like their geopolitical positions, their strategic importance and protection of their national interests against domestic and external threats (Kaul, Grunberg and Stern, 1999: 364).

Input costs in the defense area are considered as the opportunity cost of expenditures in the civil sector. In this context, defense expenditures constitute an opportunity cost against productive economy (Deger and Sen, 1995: 294). For this reason, societies must make choices about the allocation of scarce resources between defense services and other goods and services because more defense spending means sacrificing other goods and services, that is, delaying economic growth (Deger and Sen, 1995: 297).

Among the factors that determine the defense expenditures of countries, GNP is a very important phenomenon. The most commonly used criterion for defining the size of defense expenditures is the ratio of defense expenditures to the total GNP, which is called the defense burden. Therefore, it is possible to say that the countries with high income have higher defense expenditures compared to low and middle income countries since the resources to be allocated to the defense is limited to GNP. Low-income countries need to cut back on other social expenditures in order to finance or increase the defense expenditures when it is needed, while high-income countries are more flexible in this regard (Akcair, 2011: 78).

The studies revealed that the level of defense expenditures and the factors affecting these expenditures in developed countries and developing countries vary in structural context. It is determined that the level of defense expenditures is not related to economic factors in the countries established defense industry. However; in developing countries, defense expenditures are directly proportional to income levels. Most of these countries have not established the defense industry and therefore have become dependent on the countries producing weapons in terms of their defense needs (Erbaykal, 2007: 5).

4. DEFENSE EXPENDITURES AROUND THE WORLD

As of 2018, defense expenditures are around 1.81 trillion dollars in the world. With the disintegration of USSR during the post-1989 period, defense expenditures globally reduced until 2001. In 2001, after the terrorist attacks on the twin towers in the US, world defense expenditures increased again. However, in the period after the end of the cold war, share of defense expenditures in GNP of NATO countries declined down to 2.5% on average between 1995 and 2015 (NATO, 2018). The data of the countries with the highest defense expenditures in 2018 are shown in Table 1.

Table 1. World Defence Expenditures (First 15 Countries as of 2018)

	Countries	Defense Expenditures (Billion $)	Share in the World (%)	Defense Expenditure/GDP (%)
1	USA	649.0	35.7	3.2
2	China	250.0	13.7	2
3	Saudi Arabia	67.6	3.7	11.0
4	India	66.5	3.6	2.5
5	France	63.8	3.5	2.3
6	Russia	61.4	3.3	4.3
7	England	50	2.7	1.9
8	Germany	49.5	2.7	1.2
9	Japan	46.6	2.5	0.9
10	South Korea	43.1	2.3	2.6
11	Brazil	27.8	1.5	1.3
12	Italy	27.8	1.5	1.5
13	Australia	26.7	1.4	2.0
14	Canada	21.6	1.2	1.3
15	Turkey	19	1.0	2.5
Total (15 counties)		1470	81	-
World Total		1815	100	2.1

Source: SIPRI (2019)

The total defense expenditures of 15 countries in Table 1 equals to 81% of the total amount of the world defense expenditures. The US is the first in defense spending with 649 billion dollars, while Saudi Arabia ranks first with 11% in terms of defense expenditures to GNP ratio. Turkey, having the share of 1% of the world, ranks 15th with 19 billion dollars in defense spending.

According to the annual report announced by the Stockholm International Peace Research Institute (SIPRI), the upward trend in global defense spending continued, reaching 1 trillion 815 billion dollars in 2018. This amount also corresponds to 2.1% of the GNP of all world countries. According to the report of the Swedish-based institution, Germany ranked 8th in 2018, ranking ninth in the list of countries with the highest military spending in 2017. During this period, Germany allocated a share of 49 billion 500 million dollars for the defense budget. Turkey has maintained its position in the 15th rank. Despite having the same rank, Turkey increased defense expenditures by 24% up to 19 billion dollars and became the country which increased its allocation of the resources most among the others (SIPRI, 2019).

According to SIPRI's 2018 report, the United States was the country that allocated the largest budget to military spending in the world. The annual expenditure of the US reached to $ 649 billion by rising 4%. The United States, which constitutes 36% of the defense spending in the world alone, is followed by China. China's budget for military spending in 2018, which is 250 billion dollars, corresponds to 14% of global expenditures. Despite the upward trend in China's defense spending, the 5% increase in 2018 has been recorded as the lowest rate of increase observed in the country since 1995. Saudi Arabia maintained its third position with $ 67 billion 600 million. India and France follow Saudi Arabia. Russia, which allocated a budget of 61 billion 400 million dollars for military spending in 2018, dropped to the sixth place from the fourth rank. Russia also lost its place in the top five for the first time since 2006. According to the findings of the SIPRI report, 239 dollars per person were spent for armament (SIPRI, 2019).

5. DEVELOPMENT PROCESS OF DEFENSE EXPENDITURES IN TURKEY

Defense expenditures in Turkey, as well as in each country, are due mostly to the state budget. The current defense spending in Turkey is the accumulation of Ministry of National Defense, Gendarmerie General Command and Coast Guard Command expenditure items. In addition, the costs incurred by partnerships such as ASELSAN, HAVELSAN, ROKETSAN, PILSAN, which are resourced by organizations like Defense Industry Support Fund (SSDF) and Turkish Armed Forces Development Foundation (TSKGV), are evaluated within the scope of defense expenditures (Uslu, 2007: 2).

Development of defense expenditures in Turkey are investigated in three periods; in 1924-1994 period, 1994-2000 period and 2001 to today.

5.1. Development of Defense Expenditures in the Period of 1924-1994

Considering defense expenditures by years in Turkey, the share of these expenditures in state budget in the first years of the Republic takes values as high as possible. The fact that The War of Independence has just finished and the state is newly established, and, various problems such as Mosul, the Straits and Western Thrace cannot be solved by the Treaty of Lausanne, the communication with the border neighbors are bad and the events negatively affecting the unity of the country were countlessly high were the main reasons for the importance given to defense budget. The share of defense expenditures, which was realized as 48 million TL in 1924, in the budget was 36% (Akcair, 2011: 93). The Great Depression of 1929 affected Turkey's economy and caused a serious reduction in defense expenditures. In 1929, defense expenditures were reduced to 30.8% in the context of the share of the budget, although it was 78.5 million TL. Until 1934, while the expenditures increased in terms of nominal quantity, it was observed that the share taken from the budget continued to decrease. Between 1935 and 1944, reflections of World War II were seen. Turkey, although not involved in the war, has experienced an increase in defense spending as all economic and social resources have been used in the defense of the country (Akcair, 2011: 93). Between 1945 and 1954, after the World War II, is the period in which the process of NATO alliance was experienced and, in this context, military aids were granted. The development in production of weapons, with the end of the Second World War, has caused increases in defense spending in many countries. However, during this period, the share of Turkey's defense spending in the budget was seen to be reduced. In the following periods, the US and NATO supported aids have continued. After 1970, beginning to allocate large amounts of resources to defense spending, Turkey was the country whose defense spending increased most among NATO countries, especially during the period from 1971 to 1978. The reason for this was the arms embargo implemented on Turkey by the United States during the Cyprus Peace Operation in 1974. Continuing on a regular basis until 1974, the US and NATO-supported aids is interrupted because of Cyprus Peace Operation. That's why the idea of national defense industry in Turkey became widespread (Sezgin, 2003: 77).

Since the early 1980s, "Modernization of the Turkish Armed Forces Program" has been put into effect. The main objective of this program is to update the weapons equipment by establishing the national arms industry. With the help of this program, it was decided to allocate an annual budget of 1

billion dollars to armament during the period of 1985-1995. An important part of the financial sponsorship of the Modernization Program was met from the Defense Industry Support Fund (Senesen, 2002: 13). In this context, with the implementation of Law No. 3238 in 1985, the Turkish Armed Forces Foundation (TSKGV) and the Defense Industry Support Fund (SSDF) allocated a significant amount of resources to the defense expenditures other than the budget. When an assessment is made considering the budget, the decrease in defense expenditures has continued until today. However, considering the non-budgetary sources in a collective manner, especially since the second half of the 1980s, a significant increase in defense spending has been observed (Sezgin, 2003: 78).

As can be seen from Table 2, the share of defense expenditure in GDP and defense expenditures tends to constantly increase in Turkey.

Table 2. Defense expenditures and GDP Shares in Turkey between the years 1988-1994 (%)

Years	Defense Expenditures / GNP (%)	Defense Expenditures (Million/TL)
1988	2.9	3
1989	3.1	7
1990	3.5	13
1991	3.8	23
1992	3.9	42
1993	3.9	77
1994	4.1	156

Source: SIPRI, 2019

In the 1990s along with the end of the Cold War, overall reductions in defense spending of NATO member countries' occur, but as shown in Table 2, a similar case was not seen in Turkey. The main reasons for this case are the tension between Greece and Turkey, the modernization program of the Turkish Armed Forces (TSK) and the problems experienced in relation to internal security. During this period, the share of defense spending in GNP of Britain decreased to 2.4% from 2.6% in 1998, while it fell to 1.9% from 2 % in Italy. However, in Turkey, it was determined to be 4.4% and 5% (Giray, 2003: 192).

5.2. Development of Defense Expenditures in 1995-2000 Period

In the 1990s, reasons like the fight against terrorism, security problems experienced against Greece, security risks in the Middle East after the end of cold war era led Turkey's defense spending to increase steadily. Table 3 shows the increases in defense spending.

Table 3. Defense Spending in Turkey between the years 1995-2000 (Billion TL) and GNP Shares (%)

Years	Defense Expenditures/ GNP (%)	Defense Expenditures (Billion/TL)
1995	3.9	0.3
1996	4.1	0.6
1997	4.1	1.183
1998	3.2	2.289
1999	3.9	4.167
2000	3.7	6.248

Source: SIPRI, 2019

According to the table, while expenditures allocated to defense in Turkey showed a steady increase, defense expenditures to GDP ratio has declined in certain years.

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

5.3. Development of Defense Expenditures from 2001 to Present

In the fall of defense expenditures since 2000, the crisis in November 2000 and February 2001 are responsible. Turkey spent $8.9 billion in 2002 for armament. In 2005, 12.1 billion dollars of defense expenditure was 5% of GNP. Turkey was the country with the highest rate, after Greece, in terms of the defense share in budget among OECD countries (Sezgin, 2018: 17).

Table 4 shows that the defense expenditure/GNP ratio decreased continuously from 2.5% to 1.8% between 2009 and 2015. In 2016, The ratio increased to 2.1% and became 2.5% in 2018.

Table 4. Defense Spending in Turkey between the years 2001-2018 (Billion TL) and GNP Shares (%)

Years	Defense Expenditures / GNP(%)	Defense Expenditures (Billion TL)
2001	3.6	8.84
2002	3.8	13.64
2003	3.3	15.42
2004	2.7	15.56
2005	2.4	16.23
2006	2.4	19.08
2007	2.3	19.95
2008	2.2	22.29
2009	2.5	25.34
2010	2.3	26.96
2011	2.1	28.98
2012	2.1	32.25
2013	2	35.52
2014	1.9	38.89
2015	1.8	43.19
2016	2.1	53.93
2017	2.2	65.56
2018	2.5	96.00

Source: SIPRI, 2019

According to the table, despite the continuous increase in the value of defense expenditures, the share of it in GNP decreased continuously until 2016. While the amount spent on defense in 2001 was 8.84 billion TL, this amount reached up to 96 billion TL in 2018. According to 2018 data reported in 2019 by SIPRI, it is stated that Turkey's defense expenditure, which is the fifteenth highest around the world, is 19 billion dollars. Ratio of defense spending to GNP rose to 2.2% in Turkey in 2018 and the amount spent on defense has increased up to 230 USD per person (SIPRI, 2019).

6. IMPORTANCE OF EXPORTS OF TURKISH DEFENSE INDUSTRY AND ITS OPPORTUNITIES

In order to achieve optimum production capacity in defense industry; it is imperative that the defense products and services produced can be sold not only to the domestic market but also to the foreign markets, that is, it has to have an export potential. TSK's use of domestic products to improve defense power increases the reputation of products in foreign markets; this serves to provide deterrence which is the main objective in meeting the defense and security needs. In this context; export of defense products brings not only economic gains in the international arena, but also the strategic impact and power required to reach politically and militarily in this country or region. While external dependence is prevented by self-sufficient defense industry; with the export of defense products, it is possible to establish dominance over the markets where sales are carried out.

The close interaction of the defense industry with the other civil sectors in the domestic production stages enables the developments in this sector to be reflected on the manufacturing industry and pave

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

the way for the development of industrial branches requiring complex and advanced technology. Large-scale investments encourage new investments and provide opportunities for mobilizing resources in this area. The development of the defense industry, considering the size of the expenditures made in this field, will allow the long-term resources to remain in the country and, as a result, compensate the negativity of the country's balance of payments. The value added it creates, its contribution to employment, its positive impact on capacity utilization and other sectors related to defense and the positive effects on long-term balance of payments once again prove the importance of the defense industry in terms of economy.

Combined with the knowledge gained by the industry, the ability to create original products and projects and the strategic advantage it will acquire on a regional basis, the acquired competitive power and price advantage make the export of the product to other countries easier and more attractive. The fact that the armed forces of Turkey use domestic and original products and their participation in marketing activities through international fairs and various activities plays an important role in the export process. In this context, the long-term dependence of the country's defense industry will be further reduced, and the countries where exports are carried out today will become a potential customer for the future. Table 5 shows Turkey's exports of weapons by years.

Table 5. Performance of the Defense Industry in Turkey

Years	Total Revenue of Defense Industry (Billion $)	Defense Export (Billion $)	Number of Defense Projects
2006	1.855	0.487	115
2007	2.438	0.615	165
2008	3.087	0.784	194
2009	2.900	0.832	241
2010	3.707	0.853	269
2011	4.381	1.100	288
2012	4.756	1.600	310
2013	5.076	1.570	334
2014	5.011	1.855	361
2015	4.908	1.929	416
2016	5.968	1.953	460
2017	6.693	1.824	553
2018	8.761	2.188	622

Source: SASAD, 2018

Defense exports in Turkey were relatively low until the early 2000s. With the advances in the defense industry, arms exports have also increased. Arms exports, which were around 180 million dollars in 2001, pushed the $ 2 billion limit in recent years. The revenue of less than two billion dollars in 2006 was around 7 billion dollars in 2017. While defense exports in 2016 amounted to $1.953 billion, it declined to $1.824 billion in 2017 and reached up to 2.188 billion dollars in 2018. The increasing number of products that can be marketed by the sector indicates that there will be positive developments in exports (SASAD, 2018).

In 2018, 635 million dollars of defense exports were made to the US, 464 million dollars to Europe and 721 million dollars to the Middle East, Asia, Africa and South America. There are also increases in the number of projects related to the defense industry. The number of defense projects, which were 66 in 2002, increased by 9.5 times and reached to 622 in 2018. The external dependency of these projects decreased from 80% to 65% (SASAD, 2018).

7. ECONOMETRIC ANALYSIS

7.1. Data Set

In order to analyze the relationship between defense expenditures and economic growth; military expenditures (Defense Expenditure: ME, Billion Dollar) and Gross Domestic Product (GDP, Billion Dollar) are used for the first 15 countries[1] with the highest military expenditure as of 2017. The data are taken from World Bank (2019a and 2019b). The natural logarithms of the series are included in the analysis. In addition, the 2008 global economic crisis in the analysis period is included in the analysis with the dummy variable.

7.2. Model

The econometric models used in the study are:

$$Model1: LogGDP_{it} = \beta_{0i} + \beta_{1i}LogDE_{it} + \beta_{2i}D2008_t + \varepsilon_{it} \qquad (1)$$

$$Model2: LogDE_{it} = \alpha_{0i} + \alpha_{1i}LogGDP_{it} + \alpha_{2i}D2008_t + \epsilon_{it} \qquad (2)$$

Here, ε_{it} is a series of error terms free of econometric problems. While defense expenditures are expected to improve the national income by increasing the R&D activities in the countries, it is also expected that the amount of resources allocated to defense expenditures will be high with increasing national income. At the end of the analysis; $\beta_1 > 0$ and $\alpha_1 > 0$ are expected. Since the 2008 global economic crisis is expected to have a negative effect on national income and defense expenditures, $\beta_2 < 0$ and $\alpha_2 < 0$ are presumed.

7.3. Panel Unit Root Test

In panel unit root tests, how much the value of the series in the current period is influenced by the value of the previous period is investigated. For this purpose, the following equation is used:

$$y_{it} = \rho_i y_{it-1} + X_{it}\delta_i + \epsilon_{it} \qquad (3)$$

Here, $i = 1,2,...,N$ indicates cross sections (regions for this study), $t = 1,2,...,T$; time dimension X_{it}; exogenous variables like constant and trend, ρ_i; autoregressive unit root parameter and ϵ_{it}; denotes a series of error terms with a white noise process (econometically convenient). In Equation (3) generally occurs autocorrelation, therefore, the model is extended as follows:

$$y_{it} = \rho_i y_{it-1} + \sum_{j=1}^{m_i} \beta_{ij}\Delta Y_{it-j} + X_{it}\delta_i + \epsilon_{it} \qquad (4)$$

One of the unit root tests, Levin, Lin, Chu (2002) (LLC), assumes that the unit root parameter ρ_i is homogeneous in all cross sections forming the panel and null hypothesis of this; $\rho = 1$, for all i. So; y_{it} has a unit root for all cross sections. In the IPS test developed by Im, Pesaran and Shin (2003), it is assumed that the unit root parameter ρ_i could differ between cross sections and null hypothesis is: $\rho_i = 1$ for some i. So; y_{it} has unit root for some cross sections. In this study, the stationarity of the series is tested by LLC and IPS methods and the evidence obtained is presented in Table 6.

Table 6. Results of Panel Unit Root Tests

	LLC	*IPS*
LogGDP	-0.35 (0.36)	0.40 (0.65)
LogDE	-0.02 (0.48)	0.17 (0.56)

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[1] United States, China, Saudi Arabia, Russian Federation, India, France, United Kingdom, Japan, Germany, Korean Rep., Brazil, Italy, Australia, Canada and Turkey.

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

ΔLogGDP	-11.08*** (0.00)	-9.92*** (0.00)
ΔLogDE	-9.82*** (0.00)	-7.29*** (0.00)

Note: The contents in parentheses are the probability values for the respective test statistics. *** indicates that the relevant series is stationary at 1% significance level. Δ shows the first difference of the series.

According to the results in Table 6; both series are stationary in their first difference, not in level values, i.e. I(1). In this case, according to Granger and Newbold (1974), it is possible to encounter spurious regression problems in the analysis which will be conducted by using the level values of these series. In order to avoid this problem, Engle and Granger (1987) stated that cointegration test should be performed firstly and if the series are cointegrated, there will not be spurious regression problem.

7.4. Panel Cointegration Test

In this study, the existence of cointegration relationship between series is examined by Pedroni (2004) panel cointegration test. Pedroni (2004) panel cointegration test is based on the following equation:

$$y_{it} = \alpha_i + \alpha_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \cdots + \beta_{Mi} x_{Mi,t} + \varepsilon_{i,t} \tag{5}$$

Here; $t = 1, \ldots, T; i = 1, \ldots, N; m = 1, \ldots, M$. In this test, y and x are not stationary at the level values and when their difference is taken at the same degree, they must be stationary. Pedroni (2004) test is based on the systematic of Engle and Granger (1987). In other words, while x and y series are not stationary at the level, it is tested whether the series of error terms obtained from the regression of y and x is stationary. If the error term series is stationary, it is decided that the series are cointegrated. For this, the series of error terms is openly indicated according to AR (1);

$$\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + u_{i,t} \tag{6}$$

In this model, since the autocorrelation problem can be encountered, the lagged values of the difference of the dependent variable of the model are added as explanatory variable. Then, the following is obtained;

$$\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + \sum_{j=1}^{p_i} \psi_{ij} \Delta \varepsilon_{i,t-j} + v_{i,t} \tag{7}$$

The null hypothesis of the Pedroni panel cointegration test is "$|\rho_i| = 1$ for all i". In other words, there is no cointegration relationship between the series for all the cross sections forming the panel. Pedroni (2004) developed seven different test statistics in order to test the existence of the cointegration relationship between the series forming the panel. In this study, Pedroni (2004) panel cointegration test is applied and the results are presented in Table 7.

Table 7. Panel Cointegration Test Results

	Model 1		Model 2	
	Test Stats.	**Weighted Test Stats.**	**Test Stats.**	**Weighted Test Stats.**
Panel v-Statistic	1.52 (0.06)	0.71 (0.23)	2.58*** (0.00)	1.68** (0.04)
rhoPanel -Statistic	-2.76*** (0.00)	-1.93** (0.02)	-2.48*** (0.00)	-3.09*** (0.00)
Panel PP-Statistic	-4.20*** (0.00)	-3.79*** (0.00)	-3.69*** (0.00)	-4.33*** (0.00)
Panel ADF-Statistic	-4.55*** (0.00)	-4.34*** (0.00)	-4.08*** (0.00)	-4.50*** (0.00)
rhoGrup -Statistic	-1.05 (0.14)	-	-1.13 (0.12)	-

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

Grup PP-Statistic	-4.17*** (0.00)	-	-3.64*** (0.00)	-
Grup ADF-Statistic	-6.20*** (0.00)	-	-6.12*** (0.00)	-

Note: *** and ** indicates cointegration at 1% and 5% significance levels, respectively. Values in parentheses are the Pedroni (2004) test probability values. Optimum lag lengths are determined according to Akaike Information Criteria.

According to the results in Table 7; both models have a cointegration relationship between series. In this case, spurious regression problem will not be encountered in the analysis with these series and the findings will be reliable.

7.5. Long Run Analysis

In this study, long-term analysis is performed by using PDOLS (Panel Dynamic Ordinary Least Squares) method in the framework of Model 1 and Model 2 by using the level values of the series. While this method estimates the cointegration coefficient, it also avoids endogeneity, autocorrelation and heteroscedasticity problems by including the lags and leads of the independent variable (Camacho-Guti'errez, 2010: 9-10). In this respect, it is an estimator that is resistant to econometric errors. The results obtained in the study are presented in Table 8.

Table 8. Results of Long-Term Analysis

	Variable	*Coefficient*	R^2	$\overline{R}^2$	S.E. of Regression	Long-run Variance	Sum Squared Resid
Model 1	**LogDE**	1.05*** (0.00)	0.98	0.98	0.12	0.03	4.68
	D2008	-0.002 (0.96)					
Model 2	**LogGDP**	0.89*** (0.00)	0.98	0.98	0.11	0.02	4.22
	D2008	0.06 (1.30)					

Note: *** shows the related parameter is statistically significant at 1%. Values in parentheses are t-test probability values. Optimum lag lengths are determined according to Akaike Information Criteria.

According to the results of the analysis for Model 1 in Table 8; 1% increase in defense expenditures increases the average national income in these countries by 1.05%. The fact that this coefficient is greater than 1 also indicates that the defense expenditure has a multiplier effect, that is, it also acts as a stimulus for other sectors. The 2008 Global Economic Crisis affected the national income of the countries in a negative way but statistically insignificant. According to the results of Model 2 analysis; these countries increased their defense spending by 0.89% on average when their national income increased by 1%. The 2008 Global Economic Crisis affected the defense expenditures of the countries positively but not statistically significant.

7.6. Short Run Analysis

Short-term analysis of the series is again carried out by PDOLS method using the first difference of the series and the error correction term (ECT_{t-1}), using the following equations:

$$\Delta LogGDP_{it} = \gamma_{i0} + \gamma_1 \Delta LogDE_{it} + \gamma_2 ECT1_{t-1} + u_{it} \tag{8}$$

$$\Delta LogDE_t = \delta_0 + \delta_1 \Delta LogGDP_t + \delta_2 ECT1_{t-1} + v_t \tag{9}$$

If the coefficient of error correction term is statistically significant as a result of the estimation of this model; it is decided that the error correction mechanism of the model operates (Banerjee, Juan and Mestre, 1996: 8-9). Short-term analysis is performed by PDOLS method and results are presented in Table 9.

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

Table 9. Results of Short-Term Analysis

	Variable	*Coefficient*	R^2	$\bar{R}^2$	**S.E. of Regression**	**Long-run Variance**	**Sum Squared Resid**
Model 1	$\Delta LogDE$	0.95*** (0.00)	0.88	0.82	0.05	0.0006	0.54
	$ECT1_{t-1}$	-0.10** (0.02)					
Model 2	$\Delta LogGDP$	0.73*** (0.00)	0.84	0.77	0.05	0.0006	0.75
	$ECT2_{t-1}$	-0.09*** (0.00)					

Note: *** shows the related parameter is statistically significant at 1%. Values in parentheses are t-test probability values. Optimum lag lengths are determined according to Akaike Information Criteria.

According to the results in Table 9; defense expenditures in these countries affect the national income positively and this effect is statistically significant in the short term, but this effect is lower than in the long term. Similarly, increases in national income incline defense expenditures and this effect is lower than in the long term. In both models, the error correction term is negative and statistically significant, that is, error correction mechanism of the models is functioning. This implies that the short run deviations between the series which move together in the long run would disappear and the series converges again to their long run equilibrium.

7.7. Causality Analysis

As the cointegration relationship is determined between the series, the causality relationships between the series are examined by causality test based on the Vector Error Correction Model (VECM). The null hypothesis of this test is "there is no causality relationship from the first variable to the second variable". The equations used in this test:

$$\Delta LogGDP_{it} = \alpha_0 + \sum_{j=1}^{p} \alpha_{1j}\Delta LogGDP_{it-1} + \sum_{j=1}^{p} \alpha_{2j}\Delta LogDE_{it-1} + \alpha_3 ECT_{t-1} + \vartheta_{it} \qquad (10)$$

$$\Delta LogDE_{it} = \beta_0 + \sum_{j=1}^{p} \beta_{1j}\Delta LogGDP_{it-1} + \sum_{j=1}^{p} \beta_{2j}\Delta LogDE_{it-1} + \beta_3 ECT_{t-1} + \omega_{it} \qquad (11)$$

Table 10 presents the results of the optimum lag length determination required for VECM causality testing.

Table 10. Results of Optimum Delay Length Determination Process

Lag	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	NA	5.38	-4.15	-4.12	-4.14
1	44.85	4.65	-4.30	-4.21*	-4.26*
2	7.23	4.66	-4.29	-4.15	-4.24
3	5.100	4.71	-4.28	-4.09	-4.20
4*	**14.14**	**4.59***	**-4.31***	**-4.06**	**-4.21**
5	7.17	4.60	-4.31	-4.00	-4.18
6	4.89	4.65	-4.30	-3.93	-4.15
7	3.54	4.73e	-4.28	-3.86	-4.11
8	9.68*	4.68	-4.29	-3.82	-4.10

Note: * demonstrates optimum lag lenght selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

From the results of Table 10, lag length of 4 is taken as the optimum lag length according to the FPE and AIC criteria. VECM causality test is performed using this lag length and the results obtained are presented in Table 11.

Table 11. VECM Causality Test Results

Null Hypothesis	Short Run Causality	Long Run Causality
$LogGDP \nrightarrow LogDE$	7.28 (0.12)	-0.10** (0.02)
$LogDE \nrightarrow LogGDP$	9.10* (0.05)	-0.09*** (0.00)

Note: *, ** and *** show the existence of a causal relationship from the first variable to the second variable at the 10%, 5% and 1% significance levels, respectively. $\chi^2_{LM}(4) = 9$ (0.53) and $\chi^2_{Joint} = 320.83(0.47)$.

According to the results in Table 11; there are causality relationships from national income to defense expenditures only in the long term, from defense expenditures to national income both in the short term and in the long term. Results of autocorrelation ($\chi^2_{LM}(4)$) and heteroscedasticity tests (χ^2_{Joint}) conducted for 4 period lagged VECM model reveals that the analysis does not generate autocorrelation and heteroscedasticity problems.

8. RESULTS AND CONCLUSSIONS

Defense expenditures have an important place in the expense bill of all countries. Nowadays, the rapid advancement of innovation has pushed countries to keep a huge amount of their economies to defense services especially in defense systems. New information and techniques obtained via defense research can be used in many other areas, especially in health, which increases R&D and innovation accumulation. This offers the opportunity for the countries to produce and sell high-tech and value added products. Therefore, defense expenditures are driving forces of economic growth especially for the producer countries of these technologies. On the other hand, if the countries does not produce these technologies and only buy and use them, then inefficient allocation of scarce resources will be a problem, which will harm economic growth.

Many events like the tension and war danger between the US and Iran in Middle East, the unending civil war in Syria, the war for land between Palestine and Israel for decades, the unsolved problems in Egypt for nearly 10 years, internal conflicts recently arising in Libya and Tunusia, street protests in Hong Kong and unnecessary nuclear weapon tests of North Korea causes defense expenditures to rise around the world. Thus, frequently analyzing the impacts of defense expenditures on the economies suggesting accurate policies for governments will be benfiacial.

Turkey also allocates a certain share of its GDP for defense and national security services. When compared to developed countries, the ratio is quite high in developing countries such as Turkey. Especially in the mid-2000s, the performance of this sector increased significantly. In parallel with these increases, the incline in the total revenue of defense expenditures is observed. When orders received in the sector are analyzed, it is seen that the orders have decreased in 2017 and the majority of the orders are taken from the domestic market. As a solution to this situation, better determination of foreign market research and market strategies will be important in terms of international competitive advantage in defense industry. On the other hand, it is noteworthy that there has been an increase in the tendency to employ people with academic career in this sector which requires qualified labor force. The part of the budget allocated to defense in Turkey appears to be increased in 2018 compared to the previous year. Shares are transferred to the defense industry through tax regulations. In addition, the increase in the share of defense expenditures in the GNP suggests that defense expenditures positively affect the economy. Turkey, developing the defense industry in order to reduce external dependence on defense, gradually increases the export potential. With its investments and development in the defense industry, Turkey is seen as a candidate country to have an important place in the future. The existence of a same direction relationship between defense expenditures and economic growth is also a reality. Economic size is essential for high defense spending; again, in a parallel manner, a country that has reached a huge

Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

economic size has high defense expenditures.

In this study, the relationships between defense expenditure and economic growth are analyzed by panel data analysis methods by using the data of 1992-2017 period for 15 countries with the highest defense spending in 2017. The stationarity of the series is examined by Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003) panel unit root tests and it is seen that the series are I(1). The existence of cointegration relationships between the series is examined by Pedroni (2004) panel cointegration test and it is determined that the series are cointegrated. Long and short-term analyzes of the series are performed by PDOLS method, and 1% increase in defense expenditures inclines the national income by 1.05% in average, and this effect is slightly lower in the short term. Similarly; 1% increase in national income rises defense expenditure by 0.89% and this effect is found to be lower in the short term. Error correction mechanisms of the models operate. Causality relationships between the series is examined by VECM method and it is determined that there exists a causality relationship from national income to defense expenditures only in the long term and from defense spending to national income both in the short term and in the long term. The results of this paper are consistent with the results of Gökbunar and Yanıkkaya (2004); Yıldırım et al. (2005); Görkem and Işık (2008); Soyyigit Kaya (2013); Durgun and Timur (2017) and Ajmair et al. (2018).

Based on the findings of this paper; it should not be forgotten that defense expenditures should not be seen as a waste and thanks to the investments to be made in this sector, high-tech products with high value added can be produced and sold and in this respect, it can support the production and economic growth in the countries. But the point here is that; defense industry products should not only be imported, but be produced by domestic companies in the domestic market as soon as possible and it is necessary to develop common production models when this is not possible.

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Akademik Araştırmalar ve Çalışmalar Dergisi
Yıl: 2020, 12(22): 86-102

Journal of Academic Researches and Studies
Year: 2020, 12(22): 86-102

Makale Türü: Araştırma Makalesi

Paper Type: Research Paper

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