INTERNATIONAL JOURNAL OF SOCIAL, HUMANITIES AND ADMINISTRATIVE SCIENCES
Open Access Refereed E-Journal & Refereed & Indexed
JOSHAS Journal (e-ISSN:2630-6417)

**MARCH 2021 / Vol:7, Issue:37 / pp.257-265**
Arrival Date **:** 25.01.2021
Published Date **:** 19.03.2021
Doi Number **:** http://dx.doi.org/10.31589/JOSHAS.549
Cite As **:** Demirci Celikkol, C. & Keskin, G. (2021). "Logistics Performance Index And Gdp – Relationship Of Turkey's Logistics Performance Through Neighbours", Journal Of Social, Humanities and Administrative Sciences, 7(37):257-265.

Research Article

# LOGISTICS PERFORMANCE INDEX AND GDP – RELATIONSHIP OF TURKEY'S LOGISTICS PERFORMANCE THROUGH NEIGHBOURS

## Lojistik Performans Endeksi Ve Gsyih - Türkiye'nin Lojistik Performansı Ve Komşu Ülkelerinin Lojistik Performansı Arasındaki İlişki

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**ABSTRACT**

The increasingly competitive environment in trade has made it necessary to improve logistics performance. Logistics sector is considered as one of the most important elements of developed economies since improving logistics performance depends on providing suitable infrastructure conditions. In this context, the logistics sector has an important role in social and economic development due to its benefit in providing a competitive advantage in trade. Many studies in the literature have researched the relationship between the logistics industry and the welfare of a country. In this study, Turkey and its neighbor's logistics performance and GDP per capita score are analyzed by regression analysis. For this purpose, Logistics Performance Index (LPI) and GDP per capita in belonging to 2007, 2010, 2012, 2014, 2016, 2018 data as published by the World Bank have been analyzed. Analyzing the relationship LPI scores of Turkey and its neighbors is also the objective of this study. As a result of the analysis made, there is a significant correlation between the scores of LPI and GDP per capita for Turkey and its neighboring countries. There is no significant relationship between Turkey's LPI scores and its neighboring countries' LPI scores.

**Keywords:** LPI, GDP, Logistics

**ÖZET**

Ticarette giderek artan rekabet ortamı, lojistik performansın iyileştirilmesini zorunlu kılmaktadır. Lojistik sektörü, lojistik performansının iyileştirilmesi uygun altyapı koşullarının sağlanmasına bağlı olması nedeniyle gelişmiş ekonomilerin en önemli unsurlarından biri olarak kabul edilmektedir. Bu bağlamda lojistik sektörü, ticarette rekabet avantajı sağladığı için sosyal ve ekonomik kalkınmada önemli bir role sahiptir.

Literatürde birçok çalışma lojistik sektörü ile bir ülkenin refah düzeyi arasındaki ilişkiyi araştırmıştır. Bu çalışmada, Türkiye ve komşu ülkelerinin lojistik performansı ve kişi başı GSYİH puanı regresyon analizi ile karşılaştırılmıştır. Bu amaçla Dünya Bankası tarafından yayınlanan 2007, 2010, 2012, 2014, 2016, 2018 verilerine ait Lojistik Performans Endeksi (LPI) ve kişi başı GSYİH analiz edilmiştir. Türkiye ve komşularının LPI skorlarının arasındaki ilişkinin incelenmesi de bu çalışmanın amaçlarındandır. Yapılan analiz sonucunda Türkiye ve komşu ülkeler için LPI skoru ve kişi başı GSYİH puanları arasında anlamlı bir korelasyon bulunmaktadır. Türkiye'nin LPI skoru ile komşu ülkelerin LPI skorları arasında anlamlı bir ilişki bulunamamıştır.

**Anahtar Kelimeler:** LPE, GSYİH, Lojistik

## 1. INTRODUCTION

Logistics is a service that enable trading goods from one place to another. Due to this function, it forces countries and companies to make continuous improvement in logistics sector. Logistics is a network that should be exist throughout the country is directly related to the development levels of the countries (Çelebi, 2010; Jhawar et al. 2014; Gunasekaran, 2003; Shang & Marlow, 2005).

As the world gets close together, the economic factors changing and world is becoming an open market (Jhawar, 2014) . It becomes necessary for every company to response quickly to consumer demands, reduce lead times, maintain quality at the right cost, and be flexible to achieve the competitive advantage. LPI scores show the countries in which operate with conscious qualitative assessments of other countries in which they are trading. Therefore, LPI also shows the commercial ability of a country. Because it gives an opinion about whether the goods can be delivered at the right time, which is one of the most important elements of the supply chain. 160 countries assessed by the logistics performance index ranking in 2018; Turkey was ranked 47th

(World Bank, 2018). According to the previous LPI scores, Turkey was ranked 34th in 2016 and 30th in 2014. So, Turkey has not steady improvement in logistics performance and its ranking mostly decreased in 2018.

The researches have shown that different levels of income countries can have different levels of logistics performance (Arvis et al, 2010). The income alone cannot explain logistics performance and logistics performance cannot explain income level. However, in a study conducted for EU countries, a strong relationship was found between GDP per capita and LPI scores. Accordingly, it has been observed that countries with lows GDP scores have low LPI scores (Bîzoi et al, 2015). The reason of that a country is more suitable for trade if it has competitive logistics performance. If the logistics costs in a country are high, economic growth slows down (Chamber of Shipping, 2017:10). It is known that trade activities of countries with developed logistics infrastructure are more effective and efficient (Ministry of Development, 2013:122). Economic growth relies on the trade, exports, imports, manufacturing, primary and secondary industries and etc. and the recovery in economy leads to an increase in GDP (Jhawar, 2014).

Turkey has potential to combined transportation due to its geographic situation, so, it become more important that develop appropriate macroeconomic foundation and trade policy, reduce formalities associated with freight traffic and speed up customs clearance procedures (Turkish Combined Transport Strategy Plan: Executive report, 2013). The most important point is delivery of goods on time; serious delays cause increase in the cost because of legal administrative, customs or technical barriers. Researches have shown that increasing port throughput by every percentage of 10 could lead to an increase in the regions' GDP by percentage of 6 to 20. Therefore, it influences the neighboring regions in the range of percentage of 5 to 18 (Bottasso et al, 2014).

In the literature, the relationship between a country's LPI and GDP, as well as its transportation relations with its neighbors, is also effective on LPI scores. Turkey's customs categories in LPI score also received the lowest score. In this study, linear regression is used to analyze the LPI and GDP of Turkey's neighbors and also the relationship between Turkey's LPI score and its neighboring countries' LPI scores is analyzed.

## 2. CONCEPTUAL FRAMEWORK

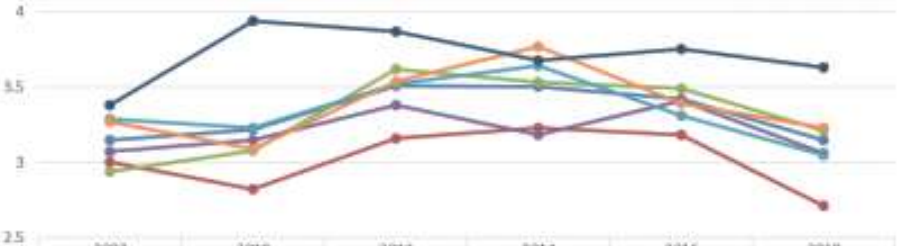
Since the year of 2007, the World Bank lists the logistics performance indexes of the countries by a worldwide survey aimed to forwarders and express carriers. The logistics performance indexes of the countries are published by the World Bank every two years. Logistics performance index (LPI) consists of 6 dimensions and each countries scores are calculated for each dimension. The 6 dimensions of LPI as follow (Uca et al., 2019);

- ✓ Efficiency of the customs clearance process such as speed, simplicity, predictability of formalities at customs and customs control points
- ✓ Quality of transportation and commercial infrastructure such as ports, information technologies, tracking and etc.
- ✓ Ease of shipments and competitive pricing
- ✓ Quality and adequacy of logistics services of customs and carrier partners
- ✓ Traceability of shipments
- ✓ The frequency with which the shipment is delivered to the recipient in the planned time.

The scores give a feedback to countries to identify the strenghts and weakness of its logistics services and their partners to improve logistics performance (D'aleo, 2015; Arvis et al., 2007).

The changes over time in Turkey' LPI scores are shown in the Fig.1 below.

Logistics Performance Index: Turkey




| | 2007 | 2010 | 2012 | 2014 | 2016 | 2018 |
|---|---|---|---|---|---|---|
| LPI | 3.15 | 3.22 | 3.51 | 3.5 | 3.42 | 3.15 |
| Customs | 3 | 2.82 | 3.16 | 3.23 | 3.18 | 2.71 |
| Infrastructure | 2.94 | 3.08 | 3.62 | 3.53 | 3.49 | 3.21 |
| International Shipments | 3.07 | 3.15 | 3.38 | 3.38 | 3.41 | 3.06 |
| Logistics quality and competence | 3.29 | 3.23 | 3.52 | 3.64 | 3.31 | 3.05 |
| Tracking and tracing | 3.27 | 3.09 | 3.54 | 3.77 | 3.39 | 3.23 |
| Timeliness | 3.38 | 3.94 | 3.87 | 3.68 | 3.75 | 3.63 |

Fig.1: Turkey's LPI scores 2007-2018
Source: https://lpi.worldbank.org/

LPI score of Turkey decreased in 2018; as shown in the fig.1, there has been a decline in all areas from 2016 to 2018. When we compare 6 dimensions, the customs score is most decreased area.

The economic success of a country depends on its international competitiveness level. As mentioned on the World Economic Forum's annual Global Competitiveness Report, competitiveness is the set of institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, labor market efficiency, goods market efficiency, financial market development, technological readiness, market size and innovation (World Economic Forum). All these factors reinforce each other, and a weakness in one area can resulted a negative impact in others.

GDP Per Capita (current US$) - Turkey 2007-20018

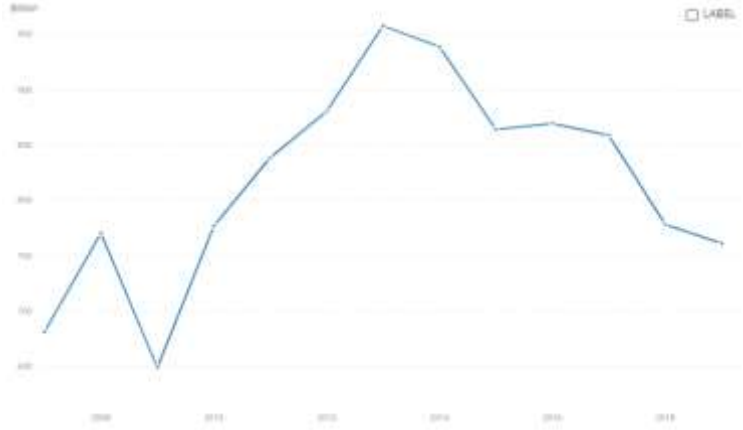


Fig.2: Turkey's GDP per capita 2007-2018
Source: https://data.worldbank.org/indicator

As shown in Fig.2, Turkey's post-2012 period has decline in GDP per capita. Similar to the LPI score, the values that increased until 2010 started to decline in 2012.

A research made by Gani (2017) showed that logistics performance in low and middle income countries are at a lower than in high income countries. When we examine Turkey's neighbors, majority of them are low income countries. Inadequate infrastructure, inefficient customs procedures, a physical inspection of goods and lack of adequate and consistent transport strategies by government authorities make unable to compete globally (Bugarčić et al., 2020).

Turkey's neighbors were investigated according to their export and import volumes to understand the commercial activities. When we look at the commercial situation of Greece; Greece's exports in 2019 were 38 billion dollars and imports were worth 62 billion dollars. The trade deficit is worth $ 24 billion. Greece ranks 3rd in Turkey's exports. Greece's imports in Turkey rank 12th. Turkey's exports to Greece reached 2.1 billion

dollars in 2019 increased by 1.3% compared to last year. Imports, on the other hand, decreased by 33% compared to the previous year and fell to 1.3 billion dollars.

The trade volume between Turkey and Armenia is low. According to TUIK data, the foreign trade volume between the two countries was 2.7 million dollars in 2019. The trade volume between the two countries reached its highest level in the last 5 years with the data in 2017.

The trade volume between Turkey and Bulgaria presents a balanced structure. Turkey is Bulgaria's third-largest trading partner. In the first quarter of 2019, Bulgaria's exports to third countries increased by 13.4% compared to the same period of the previous year and reached 2216 million euros. In the first quarter of 2019, Bulgaria's total exports increased by 8.9% on an annual basis and reached 7128 million euros.

Among the countries that Turkey exported to Iran ranks 25th. It ranks 18th among countries in Turkey's imports of Iran. According to statistics released by TUIK, trade volume between Turkey and Iran has been a 39% decrease compared with the same period of the previous year in the first 10 months of this year. Turkey's imports from Iran for $ 3.09 billion with a 50.28% decrease compared to the same period last year; Turkey's exports to Iran stood at 1.91 billion dollars, it has down by a percentage of 5.

Iraq has an oil-based economic structure. Iraq private sector organizations are lagging behind in terms of finance and business experience. In the service sector, the weight of the private sector is felt. Iraq imports consumption, intermediate, and investment goods to a large extent. According to the data from 2020, the trade volume between Turkey and Iraq has exceeded $20 billion. Turkey, China, and Iran, Iraq stand out as his most imports from the country. Iraq exports of Turkish brand image in the market are higher than the producer countries are competing in Turkey (ADASO, 2020).

Georgia ranks 117th in the world with exports of 3.7 billion dollars in 2019. The main countries that Georgia exports to are Azerbaijan (13.2%), Russia (13.2%) and Armenia (10.9%). Turkey ranks 7th in the country's exports with a share of 5.4%. In 2019, 9 billion dollars of imports ranks 103rd in the world. Georgia's main imports from countries which are located in Turkey rank first with 17.8%.

When analyzing the trade relationship between Turkey and Syria, it can be said that the trade affects political relations. In 2019, the volume of the trade between two countries has decreased to 1 billion 310 million dollars.

As in the literature, the relationship between logistics performance and economic development has been based on many reasons. Firstly, investment in transport infrastructure is considered to be a prerequisite of economic development. Because it creates new markets for goods by linking depressed industrial regions and other rural areas to the more competitive regions to increase overall economic activity (Banister & Berechman, 2001). So, there may be a positive relationship between logistics infrastructure and GDP. Secondly, transit time causes additional costs, so, reducing the transit time gives a more efficient logistics system which also helps reach a wider trade area (Gunasekera, Anderson & Lakshmanan, 2008; Lean, Huang & Hong, 2014). Thirdly, the quality of infrastructure for all modes of transportation affects the degree of foreign direct investments which is one of the engines of growth (Hong, 2007). As a result, when these three conditions are met, the country becomes suitable for logistics and thus transportation costs are reduced. An economic geography study by Krugman (1991) argues that transportation costs determine the location of production and the extent to which they are geographically concentrated.

When the scores by country are analyzed over the years, although Sweden, Norway and Luxembourg are countries that do not have heavy logistics traffic, LPI scores are considered to be countries with logistics excellence in the world. While landlocked countries seem disadvantaged, the most important reason why Luxembourg's LPI score is at the top can be shown by the strong logistics infrastructure of its neighbors. Except for the factors affecting the LPI score, a country's proximity to other countries, its performance and logistical relations are considered remarkable (Bizoi & Sipos, 2014).

As the logistics sector has developed, transportation modes have also changed. In addition to the basic types of transport, integrated transport types have also been expanded. With the integrated transportation system, businesses can realize the masses of significant sizes in an easier time and at a more affordable cost, and business processes in this system have a more effective and more controllable structure (Loebbecke and Powell, 1998). All modes can be used in intermodal transportation, which is an indicator of the development levels of countries, but road and rail vehicles are commonly used due to their ease of transfer. Using different modes, it is aimed to deliver the products as soon as possible, the most important factors are customs processes

and infrastructure investments that facilitate the use of different modes. As transportation technologies improve and transportation infrastrucutres develop, and consequently the relative reduction in transport costs, facilitates such connections (Torre, 2008).

## 3. RESEARCH MODEL

Main question of this research is the relationship between Turkey's LPI and GDP, as well as its transportation relations with its neighbors, is also effective on LPI scores or not. If exist a mediator effect of LPI and GDP of neighbors, it is discussed that Turkey's potential in terms of integrated logistics.

According to aim of the research, the listed hypotheses are tested;

$H_1$: LPIs of neighbors have a significant impact on Turkey's LPI score

$H_2$: There is a relationship between border countries' LPI scores and GDP scores

The article consists of the following parts, methodology where the regression model is discussed, emprical findings and conclusions.

## 4. DATA AND METHODOLOGY

In this section, the relationship between the logistics performance and GDP based on border countries of Turkey are analyzed. The database used includes LPI data calculated for the years 2007, 2010, 2012, 2014, 2016 and 2018 and GDP per capita data for the same years.

The World Bank calculates the LPI of countries by a country's logistics efficiency in terms of customs operations, infrastructure, international shipments, logistics competence, tracking, timelines. The World Bank collects by the data of LPI by making surveys to institutions from the academic and international field, private companies and individuals acting in logistics. The LPI scores are obtained in the end by averaging and aggregating all scores from the determined six areas (World Bank, 2020).

Overall LPI scores of Turkey and Neighboring Countries of Turkey

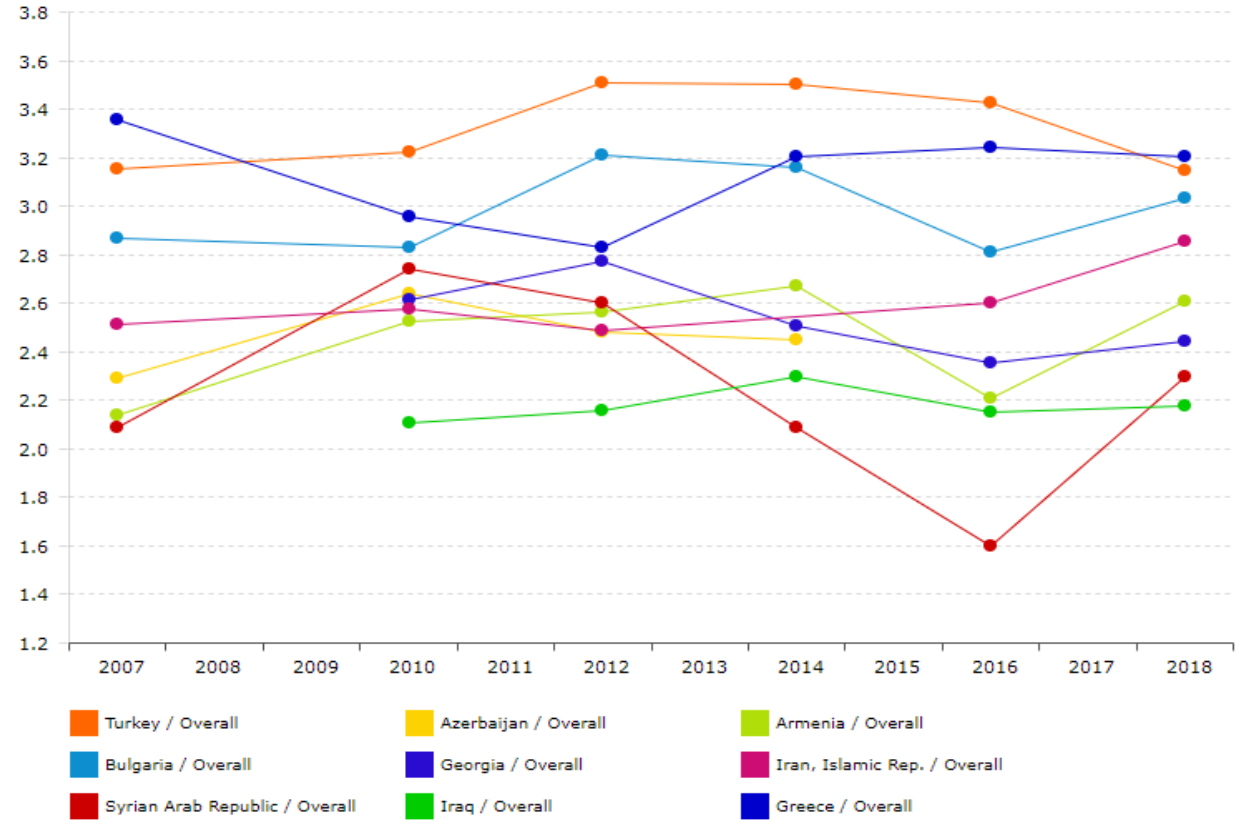



Fig.3 Overall LPI scores of Turkey and neighboring countries
Source: https://lpi.worldbank.org/

Five countries of Turkey's neighbors have a coast to the sea; Greece, Bulgaria, Georgia, Syria, and Azerbaijan. The presence of a country's seacoast positively affects the LPI score. Logistics performance increases as it provides a variety of transport modes. The logistics expenses of landlocked countries are higher than the others. If the economy of the country is not strong enough and cannot invest in transportation corridors, the expenses become even higher.

When we analyze the Fig.3, Turkey's score as seen in the figure is higher than its all border countries except Greece. As Turkey's score began to falls, Greece's scores began to rise since the year 2012.

The acceleration of Bulgaria is similar to Turkey; the score of Bulgaria was increasing until 2012 and it started to decrease after 2012. However, Bulgaria's score is started to rise in a contrast with Turkey in 2018.

The country with the closest score after European countries is Iran. Iran has not experienced much decrease in its score and has been on the rise since 2016.

The score for Azerbaijan, one of the coastal countries, was determined until 2014. It seems that there has been a decrease in the score of Azerbaijan since 2010.

There seems to be a decline in the score of Armenia after 2014. Unlike Turkey's score, Armenia's score has increased rapidly after 2016.

The greatest dramatic increases and decreases were observed in the Syrian's score. The Syrian civil war began on 15 March 2011, the LPI score of the country has dramatically decreased until 2016. It seems clearly that the political situation of the country affects the LPI score.

The score of Iraq has been determined since 2010 and continues in its average course. in 2018 among Turkey's neighbors seem to think that the country with the logistics performance.

In general, it is seen that the performances of the European member countries Greece and Bulgaria have better scores. However, it is observed that not the high performance of Turkey's neighbors. This may result in disadvantages for Turkey.

If the overall score of LPI is low, the country has lack of proper infrastructure due to the problems connected with capacities starting from the lack of containerization and the poor development of cargo handling facilities and ending with non-developed railway rolling stocks or ships and barges (Sharapiyeva et al, 2019). The lack of infrastructure in land-covered countries results in not acting as logistics corridors. Border countries that do not act as a corridor may create a disadvantage in integrated transport.

As a result of this analysis made in the same time period; neighboring countries have not significant effect on Turkey's LPI scores. Because scores of neighboring countries did not decrease or increase over the same periods with Turkey's score. So, $H_1$ has been rejected.

In order to examine the relationship between logistics performance and GDP per capita, the LPI scores and GDP per capita values of these countries were examined. GDP per capita is also calculated by the World Bank in every year. The formula of the GDP per capita is given below;

*GDP per capita = GDP / mid-year population*

According to the previous researches, low-income countries face a series of barriers such as human, technology, finance, and also the quality of the infrastructure and these barriers affect the performance negatively (Arvis, Mustra, Ojala, Shepherd, Saslavsky, 2010; Bizoi & Sipos, 2014). So, countries with different income levels also have different levels of development. However, the income is not enough to explain all the development levels of a country; the policy has also an important effect on performance. This research aimed to understand the correlation between logistics performance and GDP per capita in neighboring countries of Turkey. The relationship of the LPI and GDP per capita for the years of 2007, 2010, 2012, 2014, 2016 and 2018 is analyzed.

Table 1 . The relationship between LPI and GDP per capita in Turkey and its border countries

| Model Summary | | | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | ,615[a] | ,379 | ,362 | ,33983 |

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2,675 | 1 | 2,675 | 23,162 | ,000[b] |
| | Residual | 4,388 | 38 | ,115 | | |
| | Total | 7,063 | 39 | | | |
| a. Dependent Variable: LPI | | | | | | |
| b. Predictors: (Constant), GDP | | | | | | |

| Model | | Standardized Coefficients | t | Sig. | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|
| | | Beta | | | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | | 26,912 | ,000 | | | | | |
| | GDP | ,615 | 4,813 | ,000 | ,615 | ,615 | ,615 | 1,000 | 1,000 |

GDP per capita values have not been known since 2007 due to the civil war in Syria. Therefore it was not included in the analysis; Turkey and the analysis was carried out for 6 with its neighboring countries. According to the results, there is quite a strong relationship between LPI and GDP per capita in Turkey and its border countries. The correlation coefficient value is high, which indicates that GDP significantly has effect on LPI.

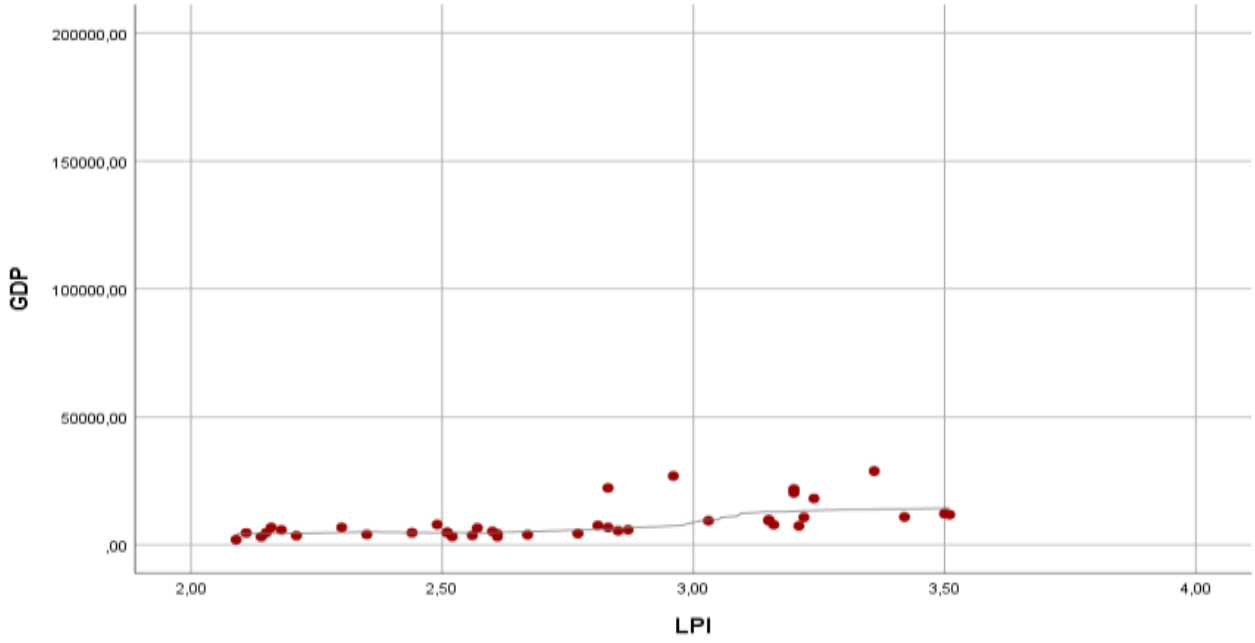



Fig.4 Correlation between GDP per capita and LPI

Fig.4 shows that the GDP per capita and LPI scores based on data for Turkey and its all neighboring countries Based on these findings, it can be said that there is a relationship between GDP per capita and LPI scores for these countries. So, H2 has been approved.

## 5. CONCLUSION

As a result, there is a relationship between GDP per capita values and LPI scores of the countries included in this study. This situation shows that; The more developed the economic levels of the countries, the better their performance in the field of logistics. The logistics service is strengthened by components such as infrastructure, technology, and ports that require investment. The ability to make such investments is also related to the economic situation of the country. Located between neighboring Turkey and the economic and logistical

aspects of the performance of countries that are members of the European Union is higher than in other neighboring countries.

The high logistics performance of neighboring countries are important in terms of the efficient transportation of products sent through these countries and for the sustainability of trade. The increasing competition in trade forces countries to improve in service. Such improvements are directly related to the economic situation.

On the other hand, there is no significant relationship between the neighboring countries of Turkey's LPI score with LPI score. The absence of such a relationship in a competitive environment shows that Turkey can increase performance by improving its logistics infrastructure.

The lowest score is in the customs area of logistics performance in Turkey. Scores received in the customs area of Turkey work together with customs in digitization can be increased.

## 6. DISCUSSION

According to the results, one of the hypotheses is accepted and two of them rejected. Therefore, the relation between LPI score and GDP per capita is statistically significant for targeted countries. This confirms that economic growth has a positive effect on wealth and also logistics performance has a positive effect on economic growth through a competitive edge on trade.

According to another result of this study; The neighbors of Turkey have not a direct effect on Turkey's logistics performance. When the LPI scores of all countries were examined, it was observed that they did not experience fluctuations in the same periods. It is concluded that the country can increase its performance by strengthening its own resources, infrastructure, and technology.

Turkey's customs procedures can affect the sustainability of trade negatively. Turkey's customs procedures are more efficient by using the process of digitization will increase the efficiency of customs processes acronym.

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WB, World Bank, https://lpi.worldbank.org/

WEF, World Economic Forum, https://www.weforum.org/