

# EXAMINING THE EFFECT OF TRANSPORT INFRASTRUCTURE ON ATTRACTING FOREIGN DIRECT INVESTMENT

Eyup ATIOĞLU<sup>1</sup>

Osman Nuri ŞAHİN<sup>2</sup>

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**Abstract:** Many factors play a role in determining the level of development in countries, and one of the main factors is FDI. To attract foreign capital to the country, it is necessary to realize the developments desired by the foreign capital and pave the way for investments. The strong transportation infrastructure contributes to the country's development not only in economic terms but also in many social and cultural aspects. With all these contributions, the benefits of transportation infrastructure investments make countries attractive for foreign capital. In this study, the relationship between investments in transportation infrastructure and foreign direct investments (FDI) was examined using the Arellano-Bond difference Generalized Method of Moments (GMM). In addition, inflation, trade openness, and economic growth, among the FDI determinants, were added to the dynamic panel model as explanatory variables. The study's data set covers the period between 2010 and 2017, and the analysis was carried out using data from 30 OECD countries. According to the findings, it has been determined that total transportation infrastructure investment expenditures positively affect foreign direct investments.

**Keywords:** Transportation Infrastructure Expenditures, Foreign Direct Investments, Generalized Method of Moments, Economic Growth, OECD

## ***Doğrudan Yabancı Yatırımların Çekilmesinde Ulaştırma Altyapısının Etkisinin İncelenmesi***

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**Özet:** Ülkelerde gelişmişlik düzeyinin belirlenebilmesinde birçok unsur rol almakta olup bu unsurların başlıcalarından birisi de doğrudan yabancı yatırımlardır. Yabancı sermayenin ülkeye çekilebilmesi için ülke içi yabancı sermayenin arzu ettiği gelişmelerin gerçekleştirilmesi ve yatırımların önünün açılması gerekmektedir. Ulaştırma altyapısının güçlü olması sadece ekonomik açıdan değil sosyal, kültürel birçok açıdan da ülkenin gelişmişliğine katkıda bulunmaktadır. Bu katkıları sayesinde ulaştırma altyapı yatırımlarının faydaları ülkelere yabancı sermaye girişini daha cazip hale getirmektedir. Bu çalışmada ulaştırma altyapısına yapılan yatırımlar ile doğrudan yabancı yatırımlar (DYY) arasındaki ilişki Arellano-Bond fark Genelleştirilmiş Momentler Metodu (GMM) ile incelenmiştir. Ayrıca kurulan dinamik panel modeline DYY belirleyicileri arasında bulunan enflasyon, ticari açıklık ve ekonomik büyüme açıklayıcı değişken olarak eklenmiştir. Çalışmanın veri seti, 2010-2017 arasındaki dönemi kapsamakta olup 30 OECD ülkesine ait veriler kullanılarak analiz gerçekleştirilmiştir. Analiz

### **Research Article**

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<sup>1</sup> Asst. Prof. Dr., Kapadokya University, School of Applied Sciences, Aviation Management Dept., eyup.atioglu@kapadokya.edu.tr, <http://orcid.org/0000-0001-9460-4822>

<sup>2</sup> Asst. Prof. Dr., Alanya Alaaddin Keykubat University, Economics, Administrative and Social Sciences Faculty, Business Adm. Dept., osmannurisahin@yahoo.com, <http://orcid.org/0000-0002-6586-7073>

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sonucunda, toplam ulaştırma altyapı yatırım harcamalarının doğrudan yabancı yatırımları pozitif yönde etkilediği tespit edilmiştir.

**Anahtar Kelimeler:** *Doğrudan Yabancı Yatırımlar, Ulaştırma Altyapı Harcamaları, Genelleştirilmiş Momentler Metodu, Ekonomik Büyüme, OECD*

## 1. INTRODUCTION

As a word meaning, infrastructure means all the installations such as electricity, water, road, and sewerage required by settlements or structures. Infrastructure investments do not directly contribute to the country's economy by producing goods and services but indirectly by facilitating their activities and reducing costs to businesses that produce and trade goods and services. States generally make infrastructure investments in terms of economic and social burdens. The lack or incompleteness of the infrastructure investments required by the companies not only does not contribute to the economy at the desired level but also negatively affects foreign capital. It is accepted that the key to economic development is always infrastructure investments (Crescenzi et al., 2016, p. 555).

Physical facilities such as airports, railways, ports, highways, roads, telecommunication facilities, recycling facilities, water and electricity supply systems are defined as infrastructure (Kodongo and Ojah, 2016). Infrastructure is an important service for both production activities and consumption opportunities and increases the productivity of factors of production as inputs in the production process of enterprises (Ayogu, 2007). Infrastructure investments support the improvement of income levels through production efficiency and sustainable economic growth (Azolibe et al., 2020, p.63; Sanchez-Robles, 1998, p.101). In this context the transportation infrastructure has a key role in facilitating companies to produce products and services, attracting FDI, and providing economic growth. (Yu et. al., 2012; Liu and Zhao, 2005; Ramanathan, 2001].

Transportation, which is of great importance for economic growth, provides the location and time utility of people and goods. There is a direct relationship between the highways, railways, airports, and ports owned by the countries and economic development (Owen, 1987). The key to sustainable economic growth, especially for developing countries, is the provision of accessible and affordable transport infrastructure (Kirkpatrick et al., 2006). Investments in transportation infrastructure are planned to increase economic activity by reducing the costs incurred while transporting people and products from one place to another (Allen and Arkolakis, 2016, p.2). Investments considered as transportation infrastructure investments can be realized in the form of construction of a new transportation system, development, and improvement of existing transportation systems, as well as maintenance and repair (Talley, 1996, p.145). It has been seen that the investments made in this field provide benefits to the countries in many other areas. According to Agbelie (2014), infrastructure expenditures in the field of transportation and logistics cause an increase in personal income and gross domestic product, while helping to decrease the unemployment rate.

The IMF (1993) defines FDI as the international investment made by resident enterprises to engage in long-term activities in other countries. Investments made by foreign capital owners by purchasing a company in a country or providing capital in the establishment of a new company or by including capital in an existing company in capital increase are called FDI (Karluk, 1983, p.14). In its simplest form, the transfer of investable resources to other countries can be defined as foreign investments (DPT, 2000, p.1). The movement of capital from one country to another is defined as foreign investment. This can happen directly or through international money and capital markets (Kurtaran, 2007, p.367).

Foreign direct investments worldwide increased gradually after 1950 and gained momentum with globalization after 1980. With globalization and financial liberalization, capital limits have been lifted, and capital movements have accelerated. Capital moves quickly between countries and moves towards the most suitable environment for itself. Foreign investments are of great importance in the development of countries. Countries also want to benefit from foreign capital in search of foreign resources to obtain the necessary capital. Countries want to make the country attractive for foreign capital to attract foreign capital to their countries and take various steps in this direction. Foreign capital also wants to shift its activities to countries with more advantageous conditions. They want to move from low-income countries to high-income countries. In this way, while foreign investors benefit, countries also gain benefits such as employment, technological innovations, increase in welfare, productivity increase, and economic development, together with the domestic fund source. Effectively directing FDI with good planning can contribute to the national income with positive developments such as production, export, economic development, employment, the balance of payment, and increase in welfare level (Görgün, 2004, p.4).

Diversified and improved infrastructure can attract inward FDI as it provides ease of business. In this context, infrastructure investments have a catalytic effect on economic growth and attract FDI. Investing in infrastructure significantly reduces transportation costs and enables the integration of supply chains into global trade (Rehman et al., 2020).

Transport infrastructure as a prerequisite and foundation for development establishes inseparable links between various growth and development factors through cargo and human movement, enabling rapid and cost-effective integration of local and foreign investment with global trade (Barzelaghi et al., 2012, p.153). This study it is aimed to reveal the relationship between transportation infrastructure investments and inward FDI. In this context, this study contributes to the literature emphasizing the importance and impact of transportation infrastructure in attracting foreign investments.

In the second section of the study, information about the literature is given. The third section contains an empirical analysis consisting of methodology, descriptives, empirical results, and discussion. The results obtained in the study are presented in the fourth section.

## **2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

FDI is a subject that attracts the attention of researchers, and many studies have been conducted investigating the factors affecting FDI. The characteristics of the data sets used in the studies and the econometric methods applied differ.

Khadaroo and Seetanah (2008) concluded that transportation infrastructures are an important determinant of tourism flow to a region by using a panel data set containing two-way tourism flow between 28 countries for the years 1990-2000 in their study on the importance of transportation and logistics infrastructures in determining the tourism attractions of regions. Khadaroo and Seetanah (2010) examined the role of transport infrastructure availability on inward FDI and found that infrastructure expenditures, including transport, contribute to inward FDI, primarily by studying data from Mauritius for the period 1960-2004. Later, 20 African countries were included in the study, and the findings obtained using panel data showed that transport infrastructure positively affects FDI.

Mike and Oransay (2015) concluded that the relationship between infrastructure investments and FDI is positive in their study for the years 1975-2013 using time series methods. Azolibe et al. (2020), in their study, showed that there is a long-term relationship between the variables in the

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model, which is designed as variables, including many infrastructure investments, as well as government expenditures for transportation infrastructure and inward FDI in Nigeria. Pradhan et al. (2013) studied the long-term relationship between transportation infrastructure, FDI, and economic growth in India. An autoregressive distributed lag and vector correction model was applied in the study, and it was determined that there is a cointegration relationship between transportation infrastructure, FDI, and economic growth.

Rahman et al. (2011) examined the effect of infrastructure investments on FDI with time series analysis using data from 1975-2008 in Pakistan. As a result of the study, it has been found that infrastructure has a strong positive effect in attracting FDI in the short and long term. Ahmad et al. (2015) investigated the role of infrastructure in foreign direct investment in Malaysia and analyzed the data for the period 1980-2013 using the time series method. According to the results of the study, it has been concluded that infrastructure has a positive effect on FDI. Bakar et al. (2012) analyzed the 1970-2010 period data in Malaysia using the time series method, studied the relationship between inward FDI and infrastructure, and determined a relationship between the variables.

Barzelaghi et al. (2012) examined the relationship between investments in transportation infrastructure and foreign direct investments in Iran for the 1974-2007 period with a cointegration analysis. In the study findings, it has been reached that the transportation infrastructure does not affect FDI in the short term but has a positive and significant effect in the long term. Gunjimi and Amune (2017) studied the role of infrastructure in FDI in Nigeria using autoregressive distributed lag using data from 1981-2014. While they could not talk about an effect in the short term, they found the existence of a relationship in the long term.

Tufaner and Şirin (2021) analyzed the data for 1997-2016 in 30 OECD countries with the panel data method and found that transportation infrastructure expenditures have a positive relationship with FDI. Zeren and Ergun (2010) analyzed the data for the years 1995-2005 by using dynamic panel data to determine the factors affecting inward FDI for EU countries and revealed that the GDP growth rate, openness rate, and development level positively affect inward FDI. Özcan and Arı (2010) analyzed the data of 27 OECD countries on the determinants of FDI using the dynamic panel data method. They concluded that the level of transportation infrastructure positively affects FDI.

Based on the literature, we have formed our research hypothesis that there is a positive relationship between transportation infrastructure investments and inward FDI.

### **3. EMPIRICAL ANALYSIS**

#### **3.1. Methodology, Descriptives, Empirical Results, and Discussion**

In this study, which aims to reveal the relationship between transportation infrastructure expenditures and FDI, data from 30 OECD countries covering the period between 2010 and 2017 were used while forming our model. The list of countries included in the study is given in the appendix, and since the relevant data of 8 other OECD member countries<sup>3</sup> could not be accessed, they could not be included in the model. In this study, besides total transportation infrastructure investment expenditures (rail, road, waterway, maritime port, airport), which is one of the explanatory variables used by the empirical literature, trade openness, inflation, and economic growth are included in the econometric model as explanatory variables (Asiedu, 2002; Khadaroo and Seetanah, 2010; Cheng and Kwan, 2000; Azolibe et al., 2020, Tufaner and Şirin, 2021, Özcan

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<sup>3</sup> Chile, Colombia, Costa Rica, Ireland, Israel, Netherlands, New Zealand and Portugal

and Ari, 2010). The study's dependent variable was the ratio of foreign direct investments to GDP. Information on the variables used in the study is given in Table 1.

**Table 1.** Variable Information Used in the Study

<b>Variables</b>	<b>Description of Variable</b>	<b>Source of Data</b>
lnRFDI	The ratio of Inward FDI to GDP	OECD database
lnRTRANSPORT	Total Transportation Infrastructure Investment Expenditures	OECD database
lnRGDP_GROWTH	Real GDP Growth	World Bank database
lnINFLATION	Inflation	World Bank database
lnOPENNESS	Trade Openness	Global Economy database

The ratio of inward FDI to GDP and total transportation infrastructure investment expenditures are taken from the OECD database. GDP growth and inflation are taken from the World Bank database. Trade openness of the countries is obtained from the Global Economy database. The total transportation infrastructure investment expenditures and economic growth rates of the countries were converted to real with the GDP deflator obtained from the World Bank database, and the natural logarithms of the series were taken.

Fixed and random effects models frequently used in panel data analysis are static panel data models, but many economic relations have a dynamic structure. Dynamic relationships between economic and financial variables are defined by finding the lagged value of the dependent variable among the explanatory variables (Wang, 2009, p.265). In dynamic panel data analysis, the lagged value of the dependent variable is added to the model as well as the independent variables (Hsiao, 2003, p.69). Since the lagged value of the dependent variable is among the independent variables in dynamic models, least squares estimators give inconsistent and biased results. There is a correlation between the error term and the lagged values (Baltagi, 2005, p.135). In this study, GMM developed by Arellano and Bond (1991) is used to overcome such problems. In this approach, known as difference GMM, lagged values of independent variables are used as instrumental variables to eliminate specific effect components. The econometric representation of the GMM model established in the study is given in the equation below.

$$\ln RFDI_{i,t} = \beta_1 \ln RFDI_{i,t-1} + \beta_2 \ln RTRANSPORT_{i,t} + \beta_3 \ln RGDP\_GROWTH_{i,t} + \beta_4 \ln INFLATION_{i,t} + \beta_5 \ln OPENNESS_{i,t} + u_{i,t} \quad (1)$$

In the equation,  $\beta$  shows the estimated coefficients of the variables, and the error term is expressed as  $u_{i,t}$ .

Some specification tests are required to get accurate results in dynamic panel data analysis. The first test applied in this context is the Wald test. The Wald test is a test that is different from the classical F test to test whether the model estimation is correct and the individual significance of the coefficients determined (İskenderoğlu et al., 2012, p.302).

If the Wald test result is greater than the table value, the null hypothesis that the coefficients are equal to zero is rejected, and the slope parameter is considered statistically significant (Aksaraylı and Saygın, 2011, p.27). Another assumption of the GMM approach is that the instrumental variables in the model are valid. Sargan or Hansen's overidentification test (J statistic) examines whether the instrument variables contain an internality problem. The fact that the instrumental variables do not correlate with the errors in the first difference equation indicates that the instrumental variables are valid.

Hansen J test was used in the study because it is more appropriate to use the Hansen J test in cases where the number of units is more than the time dimension ( $N > T$ ) (Işık et al., 2016, p.17). Hansen J test tests the validity of instrument variables by considering the variable variance problem and produces consistent results in the case of autocorrelation and heteroscedasticity.

One of the most important assumptions of the GMM approach is that there is no second-order autocorrelation between the error terms (İskenderoğlu, 2008). In this context, AR(1) and AR(2) tests examine autocorrelation between error values. In this context, autocorrelation in the AR(1) process is not important. In contrast, the absence of autocorrelation in the AR(2) process is determinative of the validity of the analysis (Tatoğlu, 2012, p.101). Descriptive statistics for the variables are given in Table 2.

**Table 2.** Descriptive Statistics

Variable	Mean	Min	Max	Std. Dev.	Skewness	Kurtosis
lnRFDI	0,5738	-5,4183	4,3647	1,2767	-0,7106	6,3967
lnRTRANSPORT	21,8262	17,4169	25,2798	1,7164	-0,3242	2,5772
lnRGDP_GROWTH	0,7354	-3,7376	2,4159	0,7970	-1,9630	11,0720
lnINFLATION	0,4351	-3,2830	2,4109	0,9774	-1,1566	4,9858
lnOPENNESS	4,4762	3,2778	5,8687	0,5323	0,0875	2,9334

When the descriptive statistics given in Table 2 are examined, it is seen that the lnRFDI, lnRTRANSPORT, lnRGDP\_GROWTH, and lnINFLATION data sets have a right-skewed distribution. In contrast, the lnOPENNESS data set has a left-skewed distribution. In addition, when the kurtosis coefficients of the data sets of all variables are taken into account, it has been determined that the distribution is more sharply peaked. In other words, the distribution of lnRFDI, lnRTRANSPORT, lnRGDP\_GROWTH and lnINFLATION is right-skewed and more sharply peaked, while the distribution of lnOPENNESS is left-skewed and more sharply peaked.

In the study, the factors affecting lnRFDI were tested separately. Thus, the t-1 value of the lnRFDI variable, which is used as an independent variable, total transportation infrastructure investments, real GDP growth, inflation, and trade openness was tested separately. This way, five different models were built on lnRFDI, and analysis was carried out with the GMM. To effectively test the study's hypothesis, total transportation infrastructure investment expenditures (lnRTRANSPORT) are included in each model.

Before the GMM analysis, the model's validity needs to be evaluated. As seen in Table 3, in all models, the Wald test statistic shows that all of the independent variables used in the model are significant in explaining the dependent variable. The Hansen test concluded that the instrumental variables used in all models did not contain an internality problem. In addition, as it is known, the AR(1) autocorrelation test statistic should be negative and significant, while the AR(2) test statistic should be positive and statistically insignificant. Thus, it was observed that there was first-order autocorrelation and no second-order autocorrelation in all models except model 3 at the 5% significance level. In Model 3, it was determined that there was first-order autocorrelation at the 10% significance level.

**Table 3:** Difference GMM Results Using lnRFDI as Dependent Variable

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
lnRFDI(-1)	0,1064 (0,0000)	0,1076 (0,0000)	0,1027 (0,0000)	0,1009 (0,0004)	-0,1114 (0,0000)
lnRTRANSPORT	1,0904 (0,0000)	1,7639 (0,0000)	0,3810 (0,0911)	1,14245 (0,0000)	1,8030 (0,0000)
lnRGDP_GROWTH		0,1915 (0,0122)			-0,1232 (0,0002)
lnINFLATION			0,0472 (0,0504)		0,1947 (0,0000)
lnOPENNESS				-2,0495 (0,0466)	0,7492 (0,1781)
Wald	41,0994 (0,0000)	57,3606 (0,0000)	544,9169 (0,0000)	24,4023 (0,0000)	631,1784 (0,0000)
Hansen J Test	13,5145 (0,8542)	17,0655 (0,6487)	17,1316 (0,5809)	11,1115 (0,9432)	18,8412 (0,3377)
AR(1)	-118,0699 (0,0151)	-70,6478 (0,0042)	-58,9098 (0,0966)	-118,0877 (0,0093)	-78,5908 (0,0000)
AR(2)	12,7898 (0,3446)	2,9341 (0,7891)	-1,3326 (0,9182)	15,0245 (0,2575)	1,3427 (0,9999)

\* Values in parentheses are probability (p) values.

According to the results of the GMM analysis given in Table 3, when the estimation coefficients were examined, it was determined that the lagged value of lnRFDI was positive and statistically significant in all models except Model 5. At the same time, it was negative and statistically significant in Model 5. In all models, except Model 3, lnRTRANSPORT positively affected lnRFDI.

While the lnRGDP\_GROWTH variable affected lnRFDI positively in Model 2, it was found to affect lnRFDI negatively in Model 5. When Model 5 was examined, it was observed that the lnINFLATION variable positively affected lnRFDI. While lnOPENNESS was observed to have a negative effect on lnRFDI in Model 4, a statistically insignificant relationship was found between lnOPENNESS and lnRFDI in Model 5.

As seen in Model 5, considering the coefficients of the variables, lnRTRANSPORT has the most significant positive effect (1,8030) on lnRFDI. It has been determined that, except for the trade openness, the findings obtained in the study were found to be in parallel with the literature (Tufaner and Şirin, 2021; Khadaroo and Seetanah, 2010; Wheeler and Mody, 1992; Loree and Guisinger, 1995; Mike and Oransay, 2015; Morisset, 2001; Azolibe et al., 2020; Asiedu, 2002; Pradhan et al., 2013; Bakar et al., 2012; Rehman et al., 2011; Ahmad et al., 2015). While the trade openness ratio is expected to affect the inward FDI positively, the findings do not match the literature.

According to the findings, the research hypothesis that there is a positive relationship between transportation infrastructure investments and inward foreign direct investments is accepted.

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#### 4. CONCLUSION

Strong infrastructures, which reduce transportation costs, are of great importance for international and multinational companies to make direct investments in a country. The inadequacy of transportation infrastructures in various transportation modes (rail, road, waterway, maritime port, airport) can increase companies' costs and negatively impact direct investment. In this context, investments made by countries to improve the quantity and quality of transportation infrastructure can reduce companies' costs and enable them to gain a competitive advantage in global trade.

This study it is aimed to examine the relationship between transportation infrastructure expenditures and inward FDI by using data from 30 OECD countries. In the analysis process, the application was carried out on five different GMM models where the dependent variable was the Ratio of Inward FDI to GDP (lnRFDI). According to the analysis results, the fact that the lagged value of lnRFDI gives significant and positive results in all models except Model 5 shows that the foreign direct investments attracted in a certain period can be continued for the following periods.

According to the findings obtained in the study in all models, except Model 3, a statistically significant relationship was found between total transportation infrastructure investment expenditures and the ratio of FDI to GDP. Accordingly, total transportation infrastructure investment expenditures positively affect the ratio of FDI to GDP.

Investing in transport infrastructure is an important issue that policymakers should focus on to attract FDI and thus sustainable economic growth. In conclusion, this study suggests that transport infrastructure investments should be considered a catalyst for attracting inward FDI. It should not be forgotten that investments in transportation infrastructure not only reduce transportation costs but also provide integration of supply chains with global trade and a competitive advantage in international trade. Each transport mode positively impacts this competitive advantage to the extent of its convenience.

The prepared data set determined the limitations of the study. In further studies, the relationship between transportation infrastructure investments and FDI can be examined comparatively for developed and developing countries.

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**APPENDIX**

**Appendix 1:** Countries involved in the study

Australia	Finland	Luxembourg
Austria	France	Latvia
Belgium	United Kingdom	Mexico
Canada	Greece	Norway
Switzerland	Hungary	Poland
Czech Republic	Iceland	Slovak Republic
Germany	Italy	Slovenia
Denmark	Japan	Sweden
Spain	Korea	Turkey
Estonia	Lithuania	United States

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## GENİŞLETİLMİŞ ÖZET

### Amaç

Uluslararası ve çok uluslu şirketlerin bir ülkeye doğrudan yatırım yapabilmeleri için ulaşım maliyetlerini düşürme etkisine sahip olan güçlü altyapılar büyük önem taşımaktadır. Ulaşım altyapılarının çeşitli ulaşım yolları (demiryolu, karayolu, su yolu, deniz limanı, havalimanı) açısından yetersiz olması şirketlerin maliyetlerini artırabilmekte ve doğrudan yabancı yatırımları olumsuz etkileyebilmektedir. Bu bağlamda ülkelerin ulaşım altyapısının nicelik ve niteliğini iyileştirmeye yönelik yaptıkları yatırımlar, şirketlerin maliyetlerini düşürebilir ve küresel ticarete rekabet avantajı elde etmelerini sağlayabilir. Bu çalışmada, 30 OECD ülkesinden elde edilen veriler kullanılarak, ulaştırma altyapı harcamaları ile doğrudan yabancı yatırım arasındaki ilişkinin incelenmesi amaçlanmaktadır.

### Yöntem

Çalışmada 2010-2017 dönemini kapsayan ek-1'de verilen 30 OECD ülkesinin verileri kullanılmıştır. 3 numaralı dipnotta verilen 8 OECD üyesi ülkenin ilgili verilerine ulaşamadığı için modele dahil edilememiştir. Bu çalışmada ampirik literatürün kullandığı açıklayıcı değişkenlerden biri olan toplam ulaşım altyapısı yatırım harcamalarının (demiryolu, karayolu, su yolu, deniz limanı, havalimanı) yanı sıra ticari açıklık, enflasyon ve ekonomik büyüme ekonometrik modele açıklayıcı değişkenler (Asiedu, 2002; Khadaroo ve Seetanah, 2010; Cheng ve Kwan, 2000; Azolibe ve diğerleri, 2020, Tufaner ve Şirin, 2021, Özcan ve Arı, 2010) olarak dahil edilmiştir. Araştırmanın bağımlı değişkeni, doğrudan yabancı yatırımların GSYİH'ya oranı olarak belirlenmiştir.

Doğrudan yabancı yatırımların GSYİH ve toplam ulaşım altyapısı yatırım harcamalarına oranı OECD veri tabanından alınmıştır. GSYİH büyümesi ve enflasyon Dünya Bankası veri tabanından alınmıştır. Ülkelerin ticari açıklıkları Global Economy veri tabanından elde edilmiştir. Ülkelerin toplam ulaştırma altyapı yatırım harcamaları ve ekonomik büyüme oranları Dünya Bankası veri tabanından elde edilen GSYİH deflatörü ile reele dönüştürülmüş ve serilerin doğal logaritmaları alınmıştır.

Çalışmada lnRFDI'yi etkileyen faktörler ayrı ayrı test edilmiştir. Böylece bağımsız değişken olarak kullanılan lnRFDI değişkeninin t-1 değeri, toplam ulaştırma altyapısı yatırımları, reel GSYİH büyümesi, enflasyon ve ticarete açıklık ayrı ayrı test edilmiştir. Bu şekilde lnRFDI üzerine 5 farklı model kurulmuş ve GMM ile analizler gerçekleştirilmiştir. Analiz sürecinde uygulama, bağımlı değişkeni DYY'nin GSYİH'ye Oranı (lnRFDI) olmak üzere 5 farklı GMM modeli üzerinde gerçekleştirilmiştir. Çalışmanın hipotezini etkin bir şekilde test etmek için her bir modele toplam ulaştırma altyapı yatırım harcamaları (lnRTRANSPORT) dahil edilmiştir.

### Bulgular

Elde edilen bulgulara göre, ulaştırma altyapı yatırımları ile doğrudan yabancı yatırımlar arasında pozitif bir ilişkinin tespit edilmesi neticesinde araştırmanın hipotezi kabul edilmektedir. Tablo 3'te verilen GMM analizi sonuçlarına göre tahmin katsayıları incelendiğinde lnRFDI gecikmeli değerinin Model 5 dışındaki tüm modellerde pozitif ve istatistiksel olarak anlamlı, Model 5'te ise negatif ve istatistiksel olarak anlamlı olduğu belirlenmiştir. Model 3 hariç tüm modellerde lnRTRANSPORT'un lnRFDI üzerinde olumlu etkisi olduğu tespit edilmiştir. Model 2'de lnRGDP\_GROWTH değişkeni lnRFDI'yi olumlu yönde etkilerken, Model 5'te lnRFDI'yi olumsuz etkilediği tespit edilmiştir. Model 5 incelendiğinde lnENFLASYON değişkeninin lnRFDI üzerinde olumlu etkisi olduğu görülmüştür. Model 4'te lnOPENNESS'in lnRFDI üzerinde olumsuz etkisi

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gözlenirken, Model 5'te lnOPENESS ile lnRFDI arasında istatistiksel olarak anlamsız bir ilişki bulunmuştur. Model 5'te görüldüğü gibi, değişkenlerin katsayıları dikkate alındığında lnRTRANSPORT, lnRFDI üzerinde en büyük olumlu etkiye (1,8030) sahiptir. Çalışmada elde edilen bulguların ticari dışa açıklık dışında literatürle paralellik gösterdiği tespit edilmiştir (Tufaner ve Şirin, 2021; Khadaroo ve Seetanah, 2010; Wheeler ve Mody, 1992; Loree ve Guisinger, 1995; Mike ve Oransay, 2015; Morisset, 2001; Azolibe vd., 2020; Asiedu, 2002; Pradhan vd., 2013; Bakar vd., 2012; Rehman vd., 2011; Ahmad vd., 2015). Ticari açıklık oranının DYY'yi olumlu etkilemesi beklenirken, bulgular literatürle örtüşmemektedir.

Analiz sonuçlarına göre lnRFDI gecikmeli değerinin Model 5 dışındaki tüm modellerde anlamlı ve olumlu sonuçlar vermesi, belirli bir dönemde çekilen doğrudan yabancı yatırımların sonraki dönemlerde de devam ettirilebileceğini göstermektedir.

### **Sonuç**

Ulaştırma altyapısına yatırım, politika yapıcıların doğrudan yabancı yatırımların çekilmesinde ve dolayısıyla sürdürülebilir ekonomik büyüme için odaklanması gereken önemli bir konudur. Sonuç olarak, bu çalışma, ulaştırma altyapısı yatırımlarının, doğrudan yabancı yatırımları çekmek için bir katalizör olarak görülmesi gerektiğini önermektedir. Ulaştırma altyapısına yapılan yatırımların sadece ulaştırma maliyetlerini düşürmekle kalmayıp aynı zamanda tedarik zincirlerinin küresel ticaretle bütünleşmesini sağladığı ve uluslararası ticarete rekabet avantajı sağladığı unutulmamalıdır. Her bir taşıma modu, bu rekabet avantajını elverişli olduğu ölçüde olumlu yönde etkiler.

Çalışmada elde edilen bulgulara göre Model 3 dışındaki tüm modellerde toplam ulaştırma altyapı yatırım harcamaları ile DYY'nin GSYİH'ya oranı arasında istatistiksel olarak anlamlı bir ilişki bulunmuş ve buna bağlı olarak toplam ulaşım altyapı yatırım harcamaları DYY'nin GSYİH'ye oranını olumlu yönde etkilemektedir.