6 (2): 118-125 (2022)

Journal of Aviation

https://dergipark.org.tr/en/pub/jav

e-ISSN 2587-1676

Determinants of Air Cargo Demand in The European Region

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Article Info

Received: January, 05. 2022
Revised: April, 07. 2022
Accepted: May, 27. 2022

Keywords:
Aviation
Aviation management
Air cargo demand estimation
Dynamic panel data analysis
Logistics management

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RESEARCH ARTICLE

https://doi.org/10.30518/jav.1053662

Abstract

Air cargo demand estimation is crucial for every part of the air industry for determining policies, making decisions on investments, pricing, marketing, etc. This study analyses factors affecting the air cargo demand of the European Region (23 countries) where no studies were found by making use of the two-step generalized method of moments (GMM). The effects of Total Airport Investments, Consumer Price Index, GDP Per Capita, Population, Foreign Trade Volume, Industrial Production Index, and Exchange Rate on Air Cargo Demand were examined with the data set covering the years between 2009 and 2018. The findings indicated that previous air cargo demand has explanatory power on current demand, and there was an inverse relationship between the change in the consumer price index and the amount of cargo. In addition, the panel regression estimator indicates a positive relationship between Foreign Trade and Industrial Production Index. The results show that price stability is of great importance not only from a macroeconomic perspective but micro economically also.

It is the revised and edited version of the paper presented in Turkish at the IERFM2021 Congress and published only as an abstract in the proceedings book.

1. Introduction

Air cargo transportation is an integral part of trade, high-tech industries, and general economic development (Lo et al., 2015). Air cargo transportation, which is frequently used for the transportation of high-value (computers, microchips, mobile phones, etc.) and perishable goods (flowers, vegetables, etc.) stands out with its features such as reliability, efficiency, security, and flexibility, particularly in long-distance operations (Lo et al., 2015; Suryani et al., 2012). In recent years, the increase in global trade volume, the development of transportation networks, and the change in modern logistics principles have enhanced the importance of air cargo transportation (Shiao & Hwang, 2013). Besides, as the market grew, the competition between countries, companies, and airports accelerated. Sectoral research shows that the air cargo industry will continue to grow. In this context, determining the factors that may affect air cargo demand is of strategic importance for all parties in the industry. Studies on this subject provide benefits in planning infrastructure and superstructure investments, managing daily operations, reducing costs, increasing competitiveness, determining business strategy development policies, increasing efficiency, and fleet optimization for the shareholders of the industry (Li et al., 2020; Totamane et al., 2014). In addition, the demand for aviation services is an important parameter in terms of energy consumption and greenhouse gas emissions originating from the air cargo sector.

Many methods have been used in studies on this subject, including statistical, econometric, artificial intelligence-based, and hybrid. While there are many studies on air passenger demand forecasting in the literature, there are very few studies on air cargo demand estimation and forecasting. In this context, studies in which air cargo and passenger demand are analyzed together are even fewer (Wadud, 2013). It is seen that the geo-economic characteristics of airports and/or hinterlands of countries are used as explanatory variables in a significant part of the literature discussed in detail in the next section (Hwang & Shiao, 2011; Wang et al., 1981).

Air cargo demand, trade, and Gross Domestic Product (GDP) are directly interrelated factors. As the trade volume and economic activity increase, the demand for cargo increases. In this context, GDP, economic growth, population, unemployment and freight rate are among the most frequently used explanatory variables (Hsu et al., 2009; Magaña et al., 2017). In addition, in many studies, Foreign Direct Investment (FDI) is seen as a competitive factor for the industry of countries and it is stated that there is a positive relationship between air cargo traffic (Kupfer et al., 2017; Suryani et al., 2012). Many criteria and components affect air cargo statistics. According to Boeing (2021) World and regional GDP growth, new commodities, export promotions, new trade relationships, national development programs, open skies and new air services agreements, deregulations, express markets, ‘just in time’ concepts, the proliferation of points served, shipper utilization, airline market and shipper education, airline

market research, and widebody freighters and lower holds positively contributes to air cargo growth. On the other hand, trade quotes and restrictions, currency revaluations, environmental regulations, lack of airport access, air and surface labor stoppages, oil and fuel prices and availability, terrorism and armed conflict, airport curfews, surface competition directional imbalances, and industry imbalances are the constraints.

The pandemic has deeply affected the entire airline industry and has led to a decrease of 26.2% in the air cargo market, which has been on the rise in recent years, although not as dramatic as the number of passengers (IATA, 2020, 2021). Despite this, the sector, which entered 2021 with an increase, has reached the data of the pre-pandemic period. Although there is a pandemic process, forecasts for 2039 show that air cargo traffic will grow by 4% every year, as can be seen in Figure 1 (Boeing, 2021; KPMG, 2021).

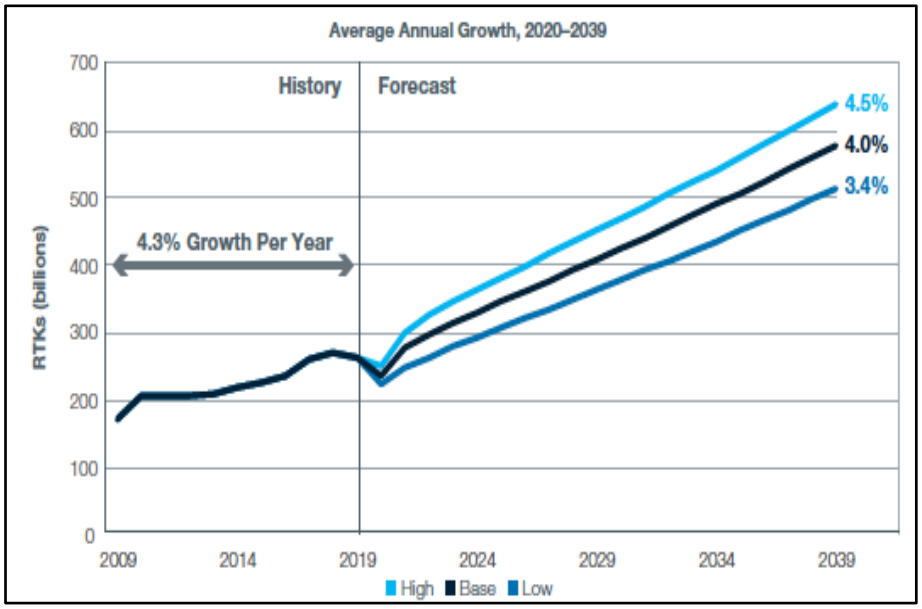

Figure 1. World Air Cargo Traffic Forecast in the Next 20 Years (Source: Boeing, 2021)

When the European region is examined, it is predicted that the air cargo market had a value of 24.68 billion USD in 2018 and this amount will reach 36.15 billion USD in 2027. The European region produced 23.6% of the world's air cargo sector in 2019 and 22.3% in 2020. In this context, the relevant region is very valuable for the sector (ReportLinker, 2019).

It is important to measure the interaction between air cargo demand and macroeconomic variables and to determine the aspects of the relationships. Considering the importance of sector and region, the factors that may play a role in air cargo transportation are discussed with dynamic panel data analysis based on the 2009-2017 period of 23 countries in the European Region. The variables used separately in previous studies were considered together as explanatory variables in the model of this study. Also, to the best knowledge of the authors, no study focused only on air cargo demand in the European region. This study differs from previous studies in applying a comparatively new method, the two-step system GMM, also. In this context, it is thought that the study may provide a modest contribution to the literature. In the next part of the study, it has been attempted to provide a summary of the literature relating to air cargo demand, then the methodology and findings are mentioned in the following section, also the conclusions and recommendations are summarized in the last section.

2. Literature Review

The literature on air cargo demand, which the number of studies is much less than the number of studies related to air passenger demand reveals that many variables affecting passenger demand are also used in air cargo demand analysis. Explanatory factors used in related studies are divided into two groups. The first group consists of external factors that are not under the direct control of the shareholders of the industry, such as the geological, geographical, or economic environment in which the airport is located. These factors include the economic activities and geographical features of the hinterlands surrounding airports and routes. Exogenous factors such as GDP per capita, population, employment rate, and FDI can be given as examples. The second group of factors is the internal factors that include the characteristics of the air transport system under the control of the shareholders. Income and population variables of locations (which are close to airports) are widely used as measures of activity-related factors. These factors are related to service quality and expenses. In particular, the frequency of service, equipment availability, reputation, and transportation costs are such factors (Hwang & Shiao, 2011). Hsu et al. (2009) stated that shippers focus on rates and flight frequency.

The main methods used in the current literature on forecasting the air cargo demand are econometric modeling, exponential smoothing, trend analysis, seasonality indices, time series analysis, etc. (Magaña et al., 2017). Although there are very few studies in which both air cargo and passenger demand are analyzed together for estimating (Chen et al., 2012; Wadud, 2013), more studies are focusing on the price and income elasticities of air cargo demand (Chi & Baek, 2012; Lo et al., 2015; Wadud, 2013). Hwang and Shiao (2011) aimed to determine the variables affecting the cargo demand with the Gravity Model using the data set for Taiwan Taoyuan airport between 2004-2007. Variables analyzed in this study are flight frequency, cost of transportation, GDP per capita,

population, Open Skies agreement (dummy variable-dummy), trade block agreement (TradBloc) (dummy) and colonial links (dummy). The results showed that all dummy variables, population and cost of transportation were the determining variables. Wu and Morrell (2007) used the log-log econometric approach to forecast the air cargo demand in China and used GDP, FDI inflow and trade volume as the variables. Chi and Baek (2012) examined the long-run demand elasticities of US domestic air freight volume using a completely modified ordinary least squares model using the data set from 1996 to 2010. The air cargo demand function consists of GDP, 9/11 terrorist attacks (dummy), air cargo fee, and other modes of transportation. Wadud (2013) analyzed air cargo and passenger demands together using Seemingly Unrelated Regression (SUR) for HSI airport. The author used crude oil prices, national price level and GDP as variables and analyzed the price and income elasticities of those. According to this study, air cargo demand at HSI airport has more price and income elasticity than air passenger demand. Morrell (2012) stated variables such as GDP, foreign trade volume, foreign exchange trade, current rates, interest rates, air freight rates, service quality and competition with other transportation modes as factors affecting air cargo demand. Lo et al. (2015) analyzed the price and revenue elasticities of air cargo demand at Hong Kong airport using the data between 2001-2013. Author used price, jet fuel prices, exchange rate, monthly real GDP, transportation sector price index, hinterland income and internet traffic as variables. The results obtained with OLS, 2SLS and 3SLS methods were compared. The results showed that the increase in internet usage increased the demand for air cargo transportation and price is an important determinant of air cargo demand. Also, it has been revealed that air cargo demand has become more sensitive to changes in both price and revenue after the 2008 global financial crisis. Yao and Yang (2012) analyzed China's air cargo demand by applying the general error correction method based on data from 31 cities for the period 1995-2006. Employment, regional GDP, population, land transportation and trade volume were used as explanatory variables and it was found that these variables were not statistically significant in the short run, but were significant in the long run. Chen et al. (2012) used the Back-Propagation Neural Networks algorithm to adjust the forecast accuracy of air passenger and cargo demand from Japan to Taiwan. Population (of Taiwan), employed population (of Taiwan), a number of listed companies (of Tokyo), GNP (of Taiwan), import price index (of Taiwan), gross import volume (from Japan to Taiwan), economic growth rate (of Taiwan), industrial production volume (of Japanese), per capita income (of Taiwan) and GDP (of Taiwan) were used as variables and it was found that the economic growth rate in Taiwan was the most important factor for air cargo demand forecasting. Hakim & Merkert (2016) analyzed the relationship between air transportation and economic growth through Pedroni/Johansen cointegration, Granger long-run and Wald short-run causality tests by using the data for the past 42 years (1973-2014) in the context of the 8 countries in South Asia. The authors used the following variables in the model: the number of passengers carried and the amount of cargo, GDP per capita, travel per capita and the number of travel per capita weighted by the population of countries. Unlike the past studies, the results of the analysis showed that there was a one-way causality, rather than a two-way one, from the economic growth towards the air operation in the context of South Asia. In addition, the findings confirmed the long-term one-way Granger causality between the GDP and the airline passenger and cargo volumes. Kupfer et al. (2017) determined the amount of air cargo as the dependent variable and the share of the manufacturing sector in the global goods export volume, the air cargo return index, the amount of world cargo export and the oil price index per barrel in US dollars as independent variables. The authors analyzed the relationships between these variables through the error correction model and performed a prospective prediction using the relationship function they obtained. The findings revealed that the exports strongly affected the air cargo demand. Kiraci & Battal (2018) examined the relationships between airline transportation and macroeconomic parameters specifically in Turkey through the VAR analysis by using the data for the years between 1983-2015. The authors included in the model the indicators for the number of passengers (domestic and international lines) and the quantity of cargo (international line) carried through airline transportation. The model was analyzed in three stages. Macroeconomic indicators that are used in the first model investigating the domestic passenger demand are the GDP per capita, CPI and interest rates, whereas the indicators used in the second model as regards the international passenger demand are the GDP, CPI and interest rates. On the other hand, macroeconomic indicators used in the third model that is created for cargo quantity (international line) demand are the GDP, industrial production index, foreign direct investment amount and foreign trade volume. The findings suggest that domestic passenger demand is affected by income per capita and CPI while international passenger demand is affected by the GDP and CPI indicators. The analysis of the third model indicates that international cargo demand is affected by the industrial production index and GDP. Kiraci & Akan (2020) used the Panel causality analysis and bootstrap panel Granger causality analysis methods to investigate the causality relationship between the trade volume and the sea and air transportation for EU-G20 (for 15 countries) and US-G20 (for 16 countries). The study employed the volumes of the sea and air transportation, which were used in total trade and commercial operations destined to G20 countries from the EU between 2002-2016 as well as the volumes of total trade and transportation modes from the USA to G20 countries between 1999-2016. The findings point out the presence of a causality relationship between the relevant parameters. Moreover, it is found that the trade wars between the countries will affect sea and air transportation volumes adversely. On the other hand, Alici & Akar (2020) investigated the relationships between macroeconomic indicators and air cargo demand through the instrument of the p data analysis. This study used the data from the 13 countries with the highest air cargo capacity (e.g. USA, Qatar, Japan, France, Singapore, England, China, South Korea, Canada, India, Turkey, the Netherlands and Germany) for the years between 1980-2018. The GDP ($), export amount ($), import amount ($) and inflation were used as the independent variables in the model while the amount of air cargo transported (tons) was selected as the dependent variable. The findings revealed that air cargo demand had a positive relationship with GDP and a negative relationship with inflation. Furthermore, it is discovered that import and export quantities have no relation to air demand.

The studies mentioned in this section are summarized in Table 1.

Table 1. Studies on Air Cargo Demand Estimation and Forecasting

Study	Location	Method	Variables
(Hwang & Shiao, 2011)	Taiwan Taoyuan	Gravity Model	Flight Frequency, air freight rates, GDP Per Capita, Population, Open Skies Agreement (dummy), Trade Block (dummy) and Colony Links (dummy)
(Wu & Morrell, 2007)	China	Log-Log Model	GDP, foreign direct investment (FDI) inflows and trade volume
(Chi & Baek, 2012)	USA	Completely Modified OLS	GDP, 9/11 terrorist attacks (puppet), air freight rates and other modes of transportation
(Wadud, 2013)	HSI	SUR	Crude oil prices, national price level, GDP and number of airline passengers
(Morrell, 2012)	-	-	GDP, foreign trade volume, foreign exchange trade, current rates, interest rates, air freight rates, service quality and competition with other transportation modes
(Lo et al., 2015)	Hong Kong	OLS 2SLS 3SLS	Price, Jet fuel prices, exchange rate, monthly real GDP, transport sector price index, the revenue of hinterland and internet traffic
(Hakim &Merkert, 2016)	South Asia	Pedroni/Johansen cointegration, Granger long-run and Wald short-run causality tests	GDP per capita, Trips per capita, Trips per capita weighted by country population
(Kupfer et al., 2017)	Worldwide	Error correction model	Airfreight yield, Merchandise exports, % of manufactures in merchandise trade in volume, Crude oil prices
(Kiracı & Battal, 2018)	Turkey	VAR Analysis	GDP, Foreign Trade Volume, Industrial Production Index, Direct Foreign Investment
Kiracı & Akan, 2020)	EU–G20 and USA–G20	Panel causality analysis & Bootstrap panel Granger causality analysis	Trade volume between countries, sea and air transportation volume between countries
Alıcı & Akar, 2020)	13 countries	Panel data analysis	GDP, Import volume, Export volume, Inflation
(Yao & Yang, 2012)	China	General ECM	Employment, regional GDP, population, land transportation and trade volume
(Chen et al., 2012)	Taiwan	BPN	Population (of Taiwan), employed population (of Taiwan), number of listed companies (of Tokyo), GNP (of Taiwan), import price index (of Taiwan), gross import volume (from Japan to Taiwan), economic growth rate (of Taiwan), industrial production volume (of Japanese), per capita income (of Taiwan) and GDP (of Taiwan)

3. Methodology, Data and Variables

3.1. Data and Variables

This study aims to determine the internal and external factors affecting air cargo demand. "Air Cargo Volume" is taken as an indicator of air cargo transportation. "Airport Investments" (as the internal factor) and "Consumer Price Index, Foreign Trade Volume, Industrial Production Index, GDP per Capita, Population, Exchange Rate" are considered external factors. 23 countries in the European region (Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Lithuania, Latvia, Luxembourg, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, and Romania) were analyzed by the data between 2009-2018. Since the value differences between the data are big, their natural logarithms are used. The explanations, units, and data sources of the variables used in the study are presented in Table 2.

Table 2. Variables Used in the Study

Notations	Definitions	Units	Data Source
lfreight	Air Cargo Volume	Ton	Eurostat
lairportinvest	Airport Investments	EUR	OECD
lcpiall	Consumer Price Index		Eurostat
lgdppc	GDP per Capita	USD	World Bank
ltotalpop	Population		OECD
lfortrade	Foreign Trade Volume	USD	World Bank
lindpi	Industrial Prod. Index		OECD, IMF
lfx	Exchange Rate		OECD

The number of air cargo planes, the number of airports, household consumption expenditures, inflation in the transportation sector and foreign direct investments are also considered to be used as variables. However, variables with high correlation and/or variables that make results inconsistent are discarded from the model. The correlation between

inflation in the transportation sector and the consumer price index is 83%; the correlation between household consumption expenditures and airport investments is 81%, and the correlation between household consumption expenditures and foreign trade volume is 91%.

3.2. Methodology

To investigate the effect of independent variables on air cargo demand a dynamic panel data model is employed. We believe that the dynamic panel data model is more realistic than the static panel data model in reflecting the real situation as the dynamic model assumes that the previous value of the dependent variable is effective in explaining the air cargo demand of the following period. Additionally, when historical data is comparatively limited, dynamic panel models become more advantageous. The initial dynamic model is formulated as follows:

$$Iy_{it} = \alpha + \beta\, y_{it-1} + \delta\, x_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

y_{it}	The dependent variable of i at time t.
y_{it-1}	Lagged dependent variable
β	Short-term parameter
δ	Coefficient of independent variables.
x_{it}	Independent variables.
μ_i	Time invariant unit effect
ε_{it}	Error term of i at time t.

The model represented by Equation (1) is estimated with a two-step system Generalized Methods of Moments estimator which is developed by Arellano and Bover (1995) and Blundell and Bond (1998), and implemented by Roodman (2009). The two-step system Generalized Methods of Moments estimator is based on the first differencing and transforming the Equation (1) to the following Equation 2 form. Then, systems of differenced equations and initial equations are solved with a two-step system GMM estimator.

GMM estimator can be used when unit dimension (N) is greater than time dimension (T) in panel data. It controls for endogeneity, omitted variables bias, unobserved panel heterogeneity, and measurement errors. System GMM estimator is consistent and unbiased when instruments are valid, a number of instruments are less than the number of units, Hansen test specifies the overall validity of the instruments used and it should not be below 0.1 and too greater than 0.25 to indicate consistency and overall validity. Differenced error terms should not be second-order serially correlated, AR(2), implying that moment conditions are correctly specified. Two-step system GMM is more efficient and robust to heteroscedasticity and autocorrelation than one-step system GMM (Roodman, 2009).

For illustration, the fixed effect (FE) estimator of panel data regression is applied to the same data. When units in the sample constitute the almost entire population FE model is more appropriate, and when the units in the sample are randomly selected from the population, the RE model is more reasonable (Brooks, 2019). Housman, Chow (F) and/or Breusch-Pagan LM (1980) Tests can also be used to decide the estimator. Since our sample constitutes almost the entire population, and it always gives consistent estimates, the FE estimator is used for illustration purposes in addition to the two-step system GMM. It is applied to the same model represented in equation (1). Our data suffers from consisting comparatively very short time period. Nonstationary is not a concern, in particular when the dynamic model is estimated in small T situations. Also according to Baltagi, cross-sectional dependence is not a problem in micro panels and one does not deal with nonstationarity (Baltagi, 2021).

4. Results and Discussion

Descriptive statistics of internal and external factors were presented in Table 3. According to the statistics it is seen that the highest fluctuation occurred in airport investments and the lowest fluctuation occurred in the consumer price index. This shows that price fluctuations in European countries are low. According to 2017 data, Germany is the country with the highest amount of transportation with 4.8 million tons of cargo. Germany is followed by Turkey with 3.9 million tons and France with 2.4 million tons. Looking at the change in the period between 2009 and 2018, Turkey's increase was 123%, while Germany's increase was 45% and France's was 66%. The highest increase was realized by Norway with 240%, while there was a small decrease in Norway and Greece.

Table 3. Descriptive Statistics

Variable	Average	Std. Dev.	Min	Maks
lfreight	11.98	1.73	8.63	15.39
lairportinvest	17.99	2.05	11.25	21.73
lcpiall	4.58	0.07	4.14	4.94
lgdppc	10.30	0.70	9.01	11.69
ltotalpop	9.13	1.45	5.76	11.33
lfortrade	26.33	1.21	23.18	28.88
lindpi	4.67	0.13	4.47	5.10
lfx	0.84	1.64	-0.34	5.64

Although there is no theoretical assumption or an empirical consensus, we expect airport investment, GDP growth, total population, foreign trade, industrial production and foreign exchange rate to positively affect air-cargo freight. The effect of consumer price may be negative since it represents both price change and macroeconomic instability.

The analyzes of the internal and external variables used in the study are presented in Table 4. Concerning this analysis, the F statistic shows that the model as a whole is significant. The number of instrument variables is lower than the number of units. AR(1) indicates the presence of first-order autocorrelation, while AR(2) shows no second-order autocorrelation. Hansen's statistics of 0.112 show the overall validity of instruments used. For illustration, the model presented in Equation (2) was estimated with Panel Data regression and fixed effect (FE) estimator, and the results are presented in Table 4 in addition to the GMM result. Since the number of airline passengers in the previous period is included in the model, the model calculated with the fixed effect estimator is also dynamic and offers the opportunity to compare with the model calculated with the system GMM estimator. The results obtained with both estimators are statistically significant and confirm each other.

According to the results of the two-step system GMM model, the air cargo volume in the past period has the power to explain the air cargo volume in the following period at a 1% confidence level. A 1% change in air cargo volume in the past period is associated with an increase of 0.753% in the following period. Considering that the changes in the economy did not happen all at once, the result seems reasonable. A relationship was found between consumer inflation and the amount of cargo at a 10% confidence interval. As expected, an inverse relationship was found between the change in the

consumer price index and the change in cargo; a 1% increase in inflation causes a decrease of 1.091% in the amount of cargo at almost the same rate. No statistically significant relationship was found between other variables and the amount of cargo. The results show that price stability is of great importance not only in terms of macroeconomic indicators such as economic growth but also in terms of sectors such as airway transportation. In general, the results are in line with the results of Yao and Yang (2012)'s study, which did not find a statistical relationship between "air cargo demand'' and "employment, regional GDP, population, land transport and trade volume''. The panel regression fixed effect estimator also shows that the amount of cargo in the previous period is an important factor in explaining the amount of cargo in the next period, as in the GMM estimator. However, the past period effect is not as much as the effect on the number of passengers; it is also calculated lower according to the GMM estimator. The 1% increase in the amount of cargo in the previous period is reflected as 0.555% in the next period. According to the FE model, at the 5% confidence interval, a 1% increase in GDP per capita causes a 0.690% decrease in freight transport. Although this situation is statistically significant, it does not seem economically reasonable. In the studies given in Table 1, no statistically significant relationship was found between air cargo demand and GDP per capita. Both Foreign Trade and Industrial Production Index at a 10% confidence level positively affect the cargo amount. The 1% increase in the Foreign Trade or Industrial Production Index affects the freight amount positively by 0.895% and 0343%, respectively. These results seem to be in line with the findings of Yao and Yang (2012) in terms of Trade Volume.

Table 4. Factors Affecting Air Cargo Demand (Dependent variable: Air Freight Amount, lfreight)

	Two-step system GMM		Panel Regression, FE	
	lfreight	p	lfreight	p
L1. lfreight	**0.753**	**0.000**	**0.555**	**0.000**
lairportinvest	0.079	0.422		
lcpiall	**-1.091**	**0.052**	-0.005	0.723
lgdppc	0.322	0.335	**-0.690**	**0.045**
ltotalpop	0.108	0.639	0.056	0.807
lfortrade	0.049	0.722	**0.895**	**0.069**
lindpi	0.925	0.170	**0.343**	**0.082**
lfx	0.001	0.968	0.255	0.282
Cons	-3.333	0.284	0.489	0.041
The number of obs.		207		207
Number of countries		23		23
Number of Inst. Var.		12		
F statistics p		0.000		0.000
R-sq				0.655
AR(1) p		0.041		
AR(2) p		0.296		
Hansen p		0.112		

5. Conclusion

Globalization, trade, digitalization, intense competition, and the increasing importance of effective supply chain management have increased the shipment of high technology products by air. In addition, the fast delivery and quality service advantages it offers, economic growth, open-skies policies, and inventory policies of companies due to 'Just In Time' show that the air cargo transportation market will grow. In this context, estimation and prediction studies to be carried out on the relevant subject have strategic importance and competitive power-enhancing features for all components of the sector. This study aims to analyze the factors affecting air cargo demand. For this purpose, many variables were tested, and the Consumer Price Index, which did not invalidate the model and/or did not have a high correlation with other variables, GDP per Capita, Population, Foreign Trade Volume and Exchange Rate were used as independent variables. In the present study, in which the annual data of 23 countries in the European Region for the period 2009-2018 were used, the system GMM method showed that a 1% change observed in the amount of cargo in the past period is associated with an increase of 0.753% in the next period. Besides, in line with the expectations, an inverse relationship was found between the change in the consumer price index and the amount of air cargo. The results show that price stability is of great importance not only from the macroeconomic point of view, but also from the microeconomic point of view. In addition, the panel regression estimator indicates a positive relationship between Foreign Trade Volume and Industrial Production Index. No previous studies dealing with the 23 countries of the European Region have been found in the literature. Also, the variables used separately in previous studies were considered together as explanatory variables in the model of this study. Also, to the best knowledge of the authors, no study performed the analysis methods used in the present study. In this respect, it is thought that the research will make an original contribution to the literature. However, it would be useful to confirm the results obtained with data covering longer periods. Addressing the effects of the pandemic crisis that has been going on since 2019 stands as a new research area.

Ethical approval

Not applicable.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Cite this article: Alnıpak, S., Kale, S. (2022). Determinants of Air Cargo Demand in The European Region, 6(2), 118-125.