
AN OVERVIEW OF EUROPEAN AIR CARGO TRANSPORT: THE KEY DRIVERS AND LIMITATIONS

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Abstract: *The air cargo industry has been recording a rapid growth in last three decades with an average rate of almost 4.9% per year, thus remaining the vital component of overall globe cargo activity. Economic expansion of countries in the Far East and their intensive international trade with other regions (primarily North America, Europe and the Middle East) have boosted the demand for efficient and reliable cargo transport revealing the rising importance of air transport. In this paper, regression analysis is employed to explore the most significant factors (such as GDP, international trade, export-imports of goods, etc) that could have a crucial impact on demand for air cargo transport in the countries of the European Union. Although featured by an evident drop in the volume of air cargo traffic caused by severe economic crisis occurred in 2008, Europe still constitutes an important link in the chain between the East and the West.*

Keywords: *Air cargo, air cargo demand, regression analysis.*

1. INTRODUCTION

Air cargo sector plays a prominent role in the era of rising mobility and trade of goods and services worldwide. The new economy products, consisting of small, light, compact, high value-to-weight parts and assembled components have been shipped internationally by air in a reliable and fast manner (Kasarda and Sullivan, 2006), which places air cargo sector in the first place by value of today's world trade. In its report, Boeing (2014) estimates that air cargo constitutes only a 1% of world trade calculated by tonnage, but about 35% of world trade calculated by the value of goods shipped.

However, several factors have been crucial in catalyzing air cargo's[†] consistent development through the second half of the 20th century. First, according to Air Transport World (2014) the integration of global markets followed by transatlantic and transpacific air shipments of electronics had an enormous impact on rebuilding Europe and developing Japan, South Korea, Taiwan, Hong Kong and Singapore into economic powers in the post-World War II era. Second, an economic giant such as China that has evolved from a centrally planned economy to one with a greater share of free enterprises has become a leading country around the globe by total export volume in the 1990s and early 2000s. In alignment with the profound transformation of economy, which could be characterized as market-oriented, China gradually developed from a low-income country to a higher income level one. These two changes will shape the air cargo industry in the years to come (Hui et al., 2004). The highly populated countries such as India and

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† In this research the terms "air cargo" and "air freight" will be used interchangeably.

Brazil have also adopted more open trading policies which induced substantial demand for air cargo transport.

Certainly, the challenging circumstances (i.e. severe economic crisis) prevailing in the past several years had weakened the entire world economy and trade growth which caused air cargo to stagnate, particularly during the period from mid-2011 to early 2013. Not surprisingly, along with the recovery of world economic activity (primarily in the United States and China) measured by Gross Domestic Product (GDP), IATA (2014) claims that the outlook for air cargo markets has started improving again.

The aim of this paper is to reveal major economic drivers at macro level that could affect the demand for air cargo sector in Europe, having in mind their historically fierce interdependency. A brief overview of key drivers is given in Section 2. Data and methodology used are given in Section 3, followed by subsection which explains the obtained results. Finally, concluding remarks are presented in Section 4.

2. ECONOMIC FACTORS AND THEIR IMPACT ON AIR CARGO DEMAND

Performance for air cargo transport is highly susceptible to the state of global economy and its volatile nature. For example, fuel prices have historically been a persistent problem for air cargo which diverted a large portion of general cargo to less expensive competitor mode of transport during the periods of oil crisis. Furthermore, the global economic downturn drove freight yields down to 22.4% in 2009 (Boeing, 2014). On the other hand, the positive effect of economy on air cargo demand are evident in the countries of the Far East, particularly China which domestic market will be the fastest growing with a 6.7% average annual growth according to Boeing (2014) forecast for the period from 2013 to 2033. The rising economy of China and other countries situated in the Far East with their intense international trading activities will also have a positive stimulus to world air cargo growth in the future. It is worth mentioning that the leading east-west air cargo markets are those between Asia–North America, Europe–Asia and Europe–North America, each of which accounting for 21%, 20% and 8% of total 208 billion revenue tonne-kilometers (RTK) in 2013. Air cargo traffic in a specific country highly relies on the volume of export and import with other countries, as well as on transportation cost, exchange rates and relative prices (Fig. 1). In that sense, air cargo transport constitutes one of the major facilitators to trade activities between countries, mainly the distant ones.



Figure 1. Trading activity between countries pulls the air cargo traffic (Boeing, 2014)

Conversely, the development of air cargo could boost the global economy, as it enables the connectivity of a country to other markets in an efficient and reliable manner. The relation between air cargo demand and economic activity has been very well documented in the literature (Kasarda and Green, 2005; Chang and Chang, 2009) indicating that air cargo volume and GDP per capita are mutually interdependent and causal. Although highly interdependent, air

cargo growth mostly outpaced the GDP growth and trade growth. The evidence for this can be found in the analysis by Kasarda and Green (2005) who used World Bank database for 68 countries and showed that the GDP grew by 72%, trade by 132% and air cargo by 302% in the period between 1980 and 2000. Along with liberalization of markets stipulated through a large number of bilateral agreements between countries, air cargo sector could significantly contribute to inflows of foreign direct investment (FDI) and consequently foster country's economic activity. In the near past, this was the case particularly with Dubai Airport in the United Arab Emirates that use its advantageous geographic position, placed halfway between Europe and Asia, and airport free trade zone to attract companies looking to invest in the Emirates. Nowadays, Dubai Airport is the largest air cargo center in the Middle East and one of the largest reexport hubs in the world.

3. OVERVIEW OF EUROPEAN AIR CARGO SECTOR

About 14.4 million tonnes of air freight (both national and international) were carried through airports within the EU-28 in 2013, marking a slight increase of 0.4 % when compared with 2012 (Eurostat, 2014). However, the share of air freight in the total freight transported by each country within the EU remained sufficiently low ranging between 0.01% for the countries located in the Central and Eastern Europe (Czech Republic, Slovakia, Slovenia, Bulgaria, Croatia and Romania) to almost 1% for Luxembourg. *Cargolux*, one of the major air cargo carriers in the world, has its hub at Luxembourg's Findel Airport which significantly facilitates international trade by air. On the other hand, Germany is a leading country in terms of total volume of freight transported by air accounting for 4.4 million tonnes of freight in 2013, followed by the United Kingdom (2.3 million tonnes) and France (1.8 million tonnes). These three countries together with Italy and the Netherlands have consistently accounted for approximately 70% of all European air trade with North America. Nevertheless, the intra -Europe air cargo market comprises approximately 3% of world's air cargo tonnage, but because the region is geographically compact it comprises only 0.8% of the world's tonne-kilometers (Boeing, 2014).

Europe is still an important partner for the majority of regions in the world. The European Union (EU) remains an important trade partner for Latin America, second only to the United States, and is also the region's leading source of FDI (Boeing, 2014). Furthermore, overall air cargo traffic between the Middle East and Europe has been growing over the last 10 years by an average rate of 5%, accounting for a variety of commodities shipped on both directional flows (such as telecommunication equipment, machinery, and finished goods, perishables and garments). Europe is the primary destination for African air cargo accounting for about 2/3 of the total. African exports are typically counter-seasonal cut flowers and other perishables to Europe, but there is relatively little return cargo (World Bank Group, 2009). Finally, Europe-Asia market comprises approximately 19.6% of the world's air cargo traffic in tonne-kilometers and 10.0% in tonnage (Boeing, 2014) and is expected to have steady growth in the future.

From all the above facts, it is evident that economic activity, followed by industrial activity, play a key role in generating demand for air cargo in any country. European Union countries are very diverse in terms of the level of economic development and broader commercial policy environment which strongly affect their respective international trade, and subsequently the volume of freight carried by air. For example, nominal GDP per capita that can be used as a rough indicator for the relative standard of living among member states, with Luxembourg having the highest (EUR 83,400) and Bulgaria having the lowest (EUR 5,500) in 2013. Between these two extremes, there are a number of variations across EU counties and some of them severely suffered from the European debt crisis that erupted in the wake of the Global financial crisis (Greece, Spain, Ireland, Cyprus and Portugal). On the other hand, Germany, as one of the strongest economy in the world, continues to achieve very positive financial results even in the period of crisis. Having in mind that Germany is the third larger exporter in the world, it is not

surprising that air freight sector recorded an impressive growth rate by 6.5% in the period from 2002 to 2013.

Regression analysis was employed in order to capture the impact of underlying economic factors on the demand for air cargo across the countries of the European Union. The model designed assumes a uni-directional relation between the air freight volume and several economic indicators deemed as crucial drivers.

3.1 Data and methodology

In order to create a robust model for air cargo demand on the European Union level, the importance of several explanatory economic indicators was examined. As it can be found in previous research on this issue, GDP per capita, Foreign Direct Investments and International trade (measured as the sum of import and export) have been selected as key drivers for air cargo demand. The growth rates of those four variables for the period between 2004 and 2013 are shown in Figure 2.

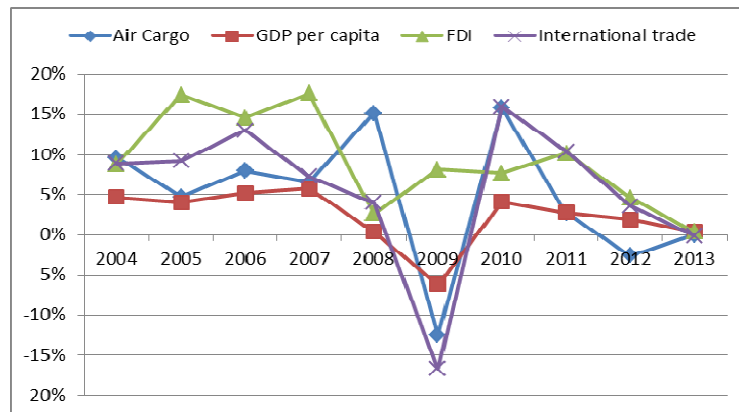


Figure 2. Growth rate for air cargo freight, GDP per capita, FDI and International trade

As it can be observed from Figure 2, growth in International trade has substantially outperformed GDP growth, which is also the case with air cargo growth (except for the last three years when air cargo in Europe has experienced a steady decline).

The cross-panel data was used to explore any differences between variables selected in terms of time period. Three temporal intersection including 2002, 2007 and 2013 were selected primarily to investigate potential changes in correlation between air cargo demand and its explanatory variables across EU member countries. The temporal intersections are in accordance with EU enlargements that have occurred in the last decades. In 2002, the EU consisted of only 15 member states followed by the entrance of former communist countries of the Central and Eastern Europe in 2004, 2007 and 2013. Since no significant changes have been recorded during these three years in terms of correlations between variables, for the sake of simplicity the model will be estimated for 2013 only.

Air freight data of the countries in the European Union originates from EUROSTAT database. Air freight statistics are collected for both freight and mail loaded and unloaded on all commercial flights in schedule and non-schedule service. Air freight data can be divided into national and international level, depending on the scope of research. Annual data are available for the most of EU member states for the period from 2003 onwards, while some countries have provided data ever since 1993. The statistics that are collected are also available for monthly and quarterly periods, but for the purpose of this research only annual data are used.

In addition to air freight data, EUROSTAT provides an abundance of historical data on economic indicators from which four abovementioned have been selected - GDP per capita, Foreign Direct

Investments (net inflows), Exports of goods and services and Imports of goods and services. The variable called International trade is derived as a sum of Exports and Imports of goods and services. All variables have been expressed in the value of current EUR.

3.2 Results

In order to avoid multicollinearity in the regression model, it is necessary to explore the correlation between each pair of variables selected. Multicollinearity is a phenomenon in which two or more explanatory variables in a multiple regression model are highly correlated causing spurious results. Table 1 presents the basic correlation between the volume of freight and mail and three explanatory variables: (1) GDP per capita, (2) International trade and (3) FDI – net inflows. Based on these results, it can be concluded that air cargo volume across EU countries highly correlates with the international trade ($r=0.96$) confirming the previous findings from relevant literature that countries with higher export and import activity are likely to show more needs for air cargo transport. As expected, FDI is seen as a good indicator with correlation coefficient accounting for 0.75. However, the correlation coefficient between FDI and international trade is sufficiently high ($r=0.72$), which is a serious indication to omit one of these two variables from the further regression model. Although GDP per capita is in positive correlation with air cargo volume, this coefficient ($r=0.34$) is still low which disallows this variable to be included into further consideration. This can be explained by the fact that some countries with slightly less GDP per capita (such as Germany, France, the United Kingdom etc.) have higher volume of air freight compared to those countries placed on the top of the list in terms of GDP per capita (such as Scandinavian countries and Luxembourg), but with less volume of air cargo.

Table 1. Correlation between selected variables

	Freight and mail by air	GDP per capita	International trade	FDI, net inflows
Freight and mail by air	1			
GDP per capita	0.34	1		
International trade	0.97	0.28	1	
FDI, net inflows	0.76	0.38	0.72	1

Therefore, the regression model proposed consists of only one variable– International trade. Skewness coefficient for *Air Cargo* volume and International trade (*Int. Trade*) account 2.7 and 2.5 respectively. From the statistical perspective, highly skewed variables have to be transformed into one that is more approximately normal. The convenient method to do so is logarithmic transformation which was carried out in this case. The robust model is presented by the following equation:

$$\log \text{Air Cargo} = -0.92 + 1.14 \log \text{Int. Trade} \quad (1)$$

The accompanying statistics are the following: $R^2=0.75$, $F_{statistics}=82.36$ (with significance of $2.1887E-09$). The interpretation of “log-log” regression model is given as an expected percentage of change in dependent variable when independent variable increases by some percentage. In other words, multiplying International trade by 10 will multiply the expected value of Air Cargo

volume by $10^{1.14}$. Finally, by knowing the international trade of a given country, one can easily predict the volume of freight carried by air in the future.

4. CONCLUSION

The paper provides a robust regression model to estimate air cargo demand across countries in the European Union in 2013. The results reveal that level of international trade remains the most important driver that highly contributes to generation of additional demand for air cargo transport. In other words, as long as the export and import increases, the demand for air cargo will rise. Although minor in terms of freight volume compared to other modes of transport, air cargo sector will present the vital component in the region's overall economic activity in the future. However, the economic growth in the European Union will see several major limitations such as aging populations, uncompetitive labor markets and economic crisis which will certainly have substantial influence on air cargo performance in the long-term periods. Nevertheless, it would be challenging for further researches to investigate reverse relation - the importance of air cargo expansion on economic growth across countries of the European Union.

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