

## AIR CARGO FLOW ANALYSIS IN THE EUROPEAN UNION

Danica Babić<sup>a\*</sup>, Jovana Kuljanin<sup>a</sup>, Milica Kalić<sup>a</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia

**Abstract:** *Although the demand for air cargo services in the world has been showing signs of accelerated growth since 2010, the level of cargo traffic in the European Union is still below its pre-crisis 2007 level (measured in freight tones-kilometres). Notwithstanding, air cargo volume in the European Union accounts for up to 20% of the total air cargo worldwide. In this paper the authors examine air cargo network and air cargo flows on schedule routes in the European Union in 2013. Air cargo flows include flows within the European Union as well as flows from the European Union to other regions in the world. Additionally, main European Union cargo airports are identified and cargo movements between them are analyzed.*

**Keywords:** *Air cargo, flows, cargo airports.*

### 1. INTRODUCTION

The importance of air cargo to the economy and consumers could be perceived through the fact that air cargo represents less than 1% of the weight of all international cargo, while at the same time this segment represents around 35% of the total worldwide shipment value (Boeing, 2014). The air transport mode found its role on the market to ship goods between countries quickly and efficiently compared to other modes of transport, especially on the longer routes where savings in time is most noticeable. This advantage makes air transport more suitable for transport of goods which are either time-sensitive or high-value. But unfavourable economical developments in recent years have had a direct impact on people's willingness to spend and, thus, on world trade growth. A significant, negative impact of the economic crisis is noticeable on the European market because, as a mature market, it has a great number of consumers for high value products (which tend to use air freight). Thus, it has had important consequences on air freight.

Development of the airline industry was the subject of many research papers. The focus of these research papers was mainly on the passenger side of the airline industry, putting the cargo sector development aside. Only a few of the research papers deals with air cargo, Zhang (2003), Hui et al. (2004) and Hwang (2011), which focusing on the Eastern and Southern Asia markets.

In 2013, cargo airlines in the European Union (EU) took some cyclical upturn and improved profitability, after years of stagnation (IATA, 2014). But the negative effects of global economic recession that began in 2007/2008 were so strong on air cargo demand that, in terms of freight tonne-kilometres (FTKs), the traffic levels were still below the pre-crisis 2007 level (AEA, 2013). Additionally, high fuel prices and increased competition from other modes of transport and non-EU airlines still make the European market a challenging environment. However, the EU air

\* d.babic@sf.bg.ac.rs

cargo industry is one of the most competitive in the world. Air freight accounts for a significant share of EU cargo in terms of FTKs. Almost 20% of world air cargo FTKs are transported through the EU (World Bank, 2015). Measured in tonnes of goods, the share of EU member countries accounts for up to 30% in the total world air cargo transport (in 2013, airlines transported 49.8 million tonnes of goods) (IATA, 2014).

In spite of the slow recovery and low growth rates (IATA, 2014), air cargo is still very important in facilitating trade and economic activity of EU member countries and development of efficient and sustainable transport network should not be neglected. Analyzing transport flows within the network is very important for understanding air cargo movements and developing future strategies for airlines, airports and policy makers. This paper presents statistical data on air cargo handled at airports in the European Union (EU) in 2013. The main objective of this paper is to contribute to a better understanding of air cargo network flows in the EU. It, also, examines air cargo movements focusing on countries with the highest air cargo volumes within the EU and individual results for their main airports, as well as the strongest air cargo flows between EU members and regions in other parts of the world. The remainder of the paper is organized as follows. Section 2 consists of three parts that describe air cargo flows in EU on domestic, international and intercontinental level. This section investigates distribution of air cargo volume from EU by regions and countries and provides a review and outlook for the expected developments of main air cargo flows. Finally, Section 3 contains concluding remarks.

## 2. AIR CARGO FLOWS

This paper represents the review and analysis in air cargo transport in the EU by countries and airports with emphasis on main cargo flows inside and outside this region. The research is based on data collected from the Eurostat database (statistical data related to carriage of goods by air) in the period from January to March 2015. Eurostat database contains all air cargo movements in the 28 EU member countries. The total volume, measured in weight of air cargo, transported through EU member countries amounted to 14.6 million tonnes in 2013. According to this result, air cargo volume remained more or less stable from 2012 to 2013, with a 0.04 % decrease in the total gross weight of goods. The total air cargo volume based on geography allocation is distributed as follows:

- 72.64% of the total air cargo volume is traded between EU member countries and the countries outside the EU,
- 23.64% of the total air cargo volume is traded between EU member countries,
- 3.72% of the total air cargo volume represents national cargo trade.

Germany alone had nearly 4.5 million tonnes in 2013, that is 30% of the EU air cargo transport. Germany was followed by the United Kingdom (UK), France and the Netherland, with shares of 16%, 12% and 11% of the EU total, respectively. High concentration of air cargo transport in the EU is also noticeable through the fact that five member countries account for more than 75% of the total air cargo volume (Table 1). Frankfurt Main Airport is the largest airport due to the cargo tonnes moved by both belly and dedicated freighters, followed by Amsterdam's Schiphol, London's Heathrow and Paris' Charles de Gaulle that recorded more than 1 million tonnes in 2013 (Table 1). Besides Frankfurt Main Airport, there are two more airports in Germany (Leipzig and Koln) that belong to top ten EU airports in terms of tonnage throughput in 2013. Altogether those three German airports account for 25% of total air cargo tonnes in the EU. The 10 largest airports accounted for about 72% of the total tonnage of air cargo handled in the EU countries in 2013. This result indicates that air cargo in the EU is concentrated into several key airports that are close to regional centres of production and consumption.

## 2.1 Domestic and International Air Cargo Flows

The total air cargo that is transported within the EU comprises approximately 3.0% of the world's air cargo tonnage, but only 0.8% of the world's tonne-kilometres (Boeing, 2014). The routes inside the EU are primary short haul, mostly between 900 and 1,200 kilometers, which favors other modes of transport due to lower costs.

Table 1. EU member countries and airports by air cargo volume, 2013, (Source: Eurostat database, 2015)

Country	2013 (t)	%	Airport	2013 (t)	%
Germany	4,421,995	30.11	Frankfurt/Main	2,160,824	14.71
United Kingdom	2,362,259	16.08	Amsterdam/Schiphol	1,565,755	10.66
France	1,775,342	12.09	London/Heathrow	1,512,246	10.30
Netherlands	1,619,819	11.03	Paris/Charles de Gaulle	1,491,287	10.15
Belgium	1,004,808	6.84	Leipzig/Halle	895,270	6.10
Italy	814,024	5.54	Köln/Bonn	766,131	5.22
Luxembourg	673,445	4.59	Luxembourg/Luxembourg	673,445	4.59
Spain	580,492	3.95	Liege/Liege	560,470	3.82
Austria	221,518	1.51	Milano/Malpensa	430,342	2.93
Finland	192,421	1.31	Brussels	400,282	2.73
Other	1,020,882	6.95	Other	4,230,983	28.81
Total freight	14,687,005	100	Total	14,687,005	100

Air cargo flows in the EU can be observed in respect to domestic and international transport, separately. Freight on domestic flights account for only 4% of all EU air freight (545,988 tonnes in 2013) since narrow-bodied aircraft with minimal belly capacity are used for these flights and road and rail transport within the EU are more cost effective. A small proportion of cargo that is transported by air in domestic markets of EU countries can also be observed through its small share in the total air cargo transported within the EU borders, that is 16%. The countries with highest domestic air cargo volumes are France (156,238 t), Germany (119,485 t) and the United Kingdom (116,933 t), while main airports with domestic cargo are East Midlands (73,146 t), Charles de Gaulle (67,069 t) and Leipzig's Halle (60,985 t).

Air cargo transport within the EU achieved a very slow growth since 2011 (2% annually), after having recovered from the economic crisis in 2008. Primary routes for air freight inside the EU are the routes from Germany to the United Kingdom, France, Italy and Spain where the total tonnage by route was more than 100,000 t in 2013 (Table 2). The highest total cargo tones flown on routes within the EU were between Germany and the United Kingdom in 2013 (224,815 t). The routes within EU with lower tonnage i.e. between 50,000 t and 100,000 t were: Germany-Belgium (62,554 t), the United Kingdom-France (59,590 t), Germany-Sweden (59,567 t) and the United Kingdom-Belgium (57,692 t).

Table 2. Air cargo flows within EU member countries, 2013, (Source: Eurostat database, 2015)

Air cargo flow	Total air cargo (t)	Air cargo flow	Total air cargo (t)	Air cargo flow	Total air cargo (t)
UK-Germany	224,815	Austria-Germany	38,755	Germany-Hungary	22,528
France-Germany	177,192	UK-Ireland	38,429	Spain-Netherl.	21,829
Italy-Germany	134,524	Germany-Netherl.	36,210	Sweden-Belgium	20,143
Spain-Germany	100,244	Spain-France	32,033	Portugal-Germany	17,479
Belgium-Germany	62,554	UK-Italy	31,432	UK-Netherland	16,841
UK-France	59,590	France-Belgium	30,050	Sweden-Finland	15,743
Sweden-Germany	59,567	Denmark-Germany	29,074	Hungary-Luxemb.	15,335
UK-Belgium	57,692	UK-Spain	24,339	Ireland-Germany	13,526
Poland-Germany	47,276	Spain-Belgium	24,206	Spain-Portugal	12,860
Italy-Belgium	44,752	Greece-Germany	23,760	Germany-Slovakia	12,468
Italy-Luxemb.	43,393	UK-Luxemb.	23,347	Denmark-Netherl.	12,266
Italy-France	41,647	Germany-Finland	22,856	Denmark-France	10,503

## 2.2 Intercontinental Air Cargo Flows

In terms of weight, EU member countries exported (52%) more air freight than they imported (48%). In absolute numbers, they exported 5,559,173 tonnes and imported 5,109,115 tonnes. Primary routes for air freight in and out of the EU are the transatlantic routes to and from the United States of America (USA) for both imports and exports, and also routes to and from major Asian regions (Eastern Asia and Near and Middle East Asia) (Figure 1a).

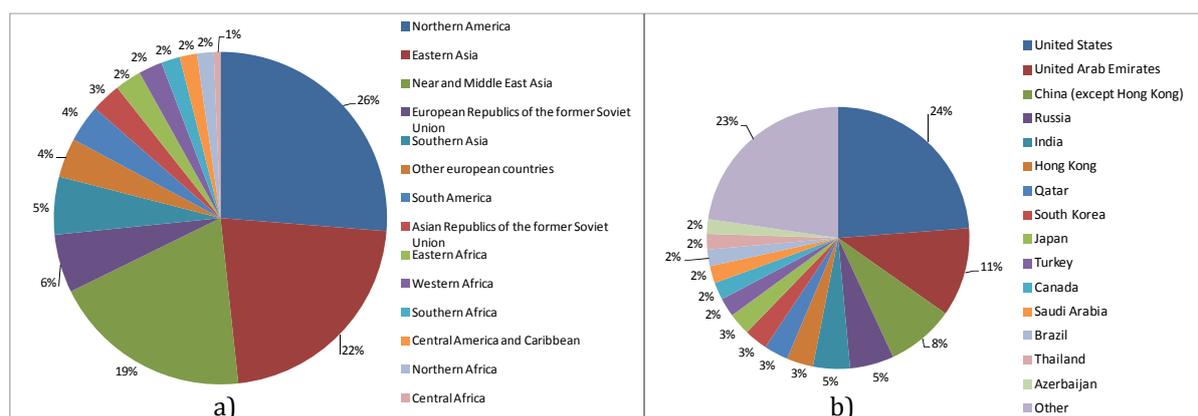


Figure 1. Total freight in 2013 by international routes between EU member countries and: a) partner world regions; b) partner world countries, (Source: Eurostat database, 2015)

After a period of declining demand (2008-2010), the EU-North America flow started to recover in 2011, but in 2012 air trade fell by 5.47% and 3.34% in 2013. The total air cargo trade between the EU and North America accounted for 2.76 million tonnes in 2013 and this volume was still below its peak of 3.3 million tonnes in 2007. However, the EU-North America flow is still the strongest air cargo flow within the regions and accounts for approximately 6.6% of

world air cargo tonnage and 8.4% of the world's tonne-kilometres (Boeing, 2014). Air cargo flows to Asian regions were more stable in the recent years. After a slight decrease in 2009, air cargo trade between the EU and the Eastern Asia, as well as between the EU and the Near and Middle East Asia, increased continuously with an average growth rates of 5.16% and 5.69%, respectively. Countries with highest air cargo trade with the EU are the United States, the United Arab Emirates, China and Russia that together account for almost 50% of the total world air cargo trade (Figure 1b). The United States had 90% share of North America's air cargo exports from the EU and 91% share of air cargo imports from this region into the EU during 2013. The total air cargo trade on the EU-to-US direction fell by 6% in 2012 and 3.25% in 2013. Analysing on a country level, the major air cargo trade routes are between the USA and Germany, the USA and the United Kingdom, Germany and the United Arab Emirates, Germany and Russia (Table 3). All these main routes between EU member countries and countries outside the EU are more or less two-way balanced (cargo volume that is exported is close to cargo volume that is imported) except the routes Germany-India and the United Kingdom-India where the import was more than 50% higher than export and the route Germany-South Korea where export was more than 70% higher than import. Air cargo volume on all main routes from Germany to other countries outside the EU decreased in 2012, except on the route between Germany and Hong Kong, where air cargo volume increased by 12%.

Table 3. Main air cargo flows between EU member countries and other countries in the world, 2013, (Source: Eurostat database, 2015)

Countries	Total (t)	Import (t)	Export (t)
Germany-USA	726,274	309,275	416,999
United Kingdom-USA	675,571	330,884	344,687
France-USA	280,756	118,544	162,212
Netherland-USA	275,553	149,152	126,401
Luxemburg-USA	162,657	76,126	86,531
Belgium-USA	144,867	84,258	60,609
Germany-United Arab Emirates	357,526	189,479	168,047
United Kingdom-United Arab Emirates	230,235	118,961	111,274
Netherland-United Arab Emirates	134,056	68,241	65,815
Germany-Russia	324,729	177,119	147,610
Germany-China (except Hong Kong)	290,017	123,569	166,448
Netherland-China (except Hong Kong)	259,922	136,113	123,809
France-China (except Hong Kong)	108,580	47,388	61,192
Germany-India	232,573	140,076	92,497
United Kingdom-India	126,510	77,137	49,373
Germany-Hong Kong	112,118	59,037	53,081
Germany-South Korea	110,802	40,699	70,103
Germany-Turkey	106,678	54,199	52,479

In 2013, flows from Germany to China and India recovered and recorded a growth of 12.74% and 4.75%, respectively. Air cargo trade between Germany and Hong Kong stayed stable in 2013 with a growth of 13.53%. The strongest air cargo flow on the intercontinental level is still between Germany and the USA, despite the repeated decline in volume tonnes recorded in 2012 and 2013 (5% and 6%, respectively).

### 3. CONCLUSION

The recovery of air cargo transport in EU has been very slow after a strong impact of the economic crisis in 2008. Unlike passenger airlines, airlines in air cargo transport are faced with additional problems such as low load factor that is below 50% and low yields, both caused by overcapacity in the air freight business. However, recent forecast given by reputable institutions and companies (IATA, Boeing, AEA, Airbus, etc.) are suggesting stronger performance of air cargo in the years to come (worldwide air freight volumes will expand at an annual rate of 5.2% through 2030). Carriers in all other regions already improved their transport and financial results, which is also expected for carriers in the EU despite the challenges they are faced with (the ongoing sanctions against Russia, the Eurozone economy recession etc.). The possible means, but not least, by which EU cargo airlines can improve their performances are increased connectivity and efficiency through their networks (e.i. where possible introducing connecting flights to cover airports where demand is insufficient to justify non-stop flight and better matching capacity with demand using new freighters). Moreover, results presented in this paper show that they should focus on the routes that have more even two-way balance and to become more competitive on the domestic and intra-EU routes. Significant growth of air cargo demand is expected on the routes between the EU and Asia (5.3% annually, Boeing 2014) indicating that this region will still be the key driver for shaping the pattern of EU airline networks in the future.

### ACKNOWLEDGMENT

This research has been supported by the Ministry of Science and Technological Development, Republic of Serbia, as part of the project TR36033 (2011-2015).

### REFERENCES

- [1] AEA, (2013). Traffic Growth - Will the Infrastructure Cope?, Association Of European Airlines. <http://www.aea.be/news-media-room-media-centre.html>, (December, 2013).
- [2] Boeing, (2014). World Air Cargo Forecast 2014–2015. [www.boeing.com/](http://www.boeing.com/), (January, 2015).
- [3] Eurostat. <http://ec.europa.eu/eurostat/data/database>, (January-March, 2015).
- [4] Hui, G.W.L., Hui, Y.V., Zhang, A., (2004). Analyzing China's air cargo flows and data. *Journal of Air Transport Management*, 10 (2), 125-135.
- [5] Hwang, C. C., Shiao, G. C., (2011). Analyzing air cargo flows of international routes: an empirical study of Taiwan Taoyuan International Airport. *Journal of Transport Geography*, 19, 738–744.
- [6] IATA, (2014). Annual Review 2014, International Air Transport Association, [www.iata.org/.../iata-annual-review-2014-en.pdf](http://www.iata.org/.../iata-annual-review-2014-en.pdf), (January, 2015).
- [7] World Bank, (2015). <http://data.worldbank.org/>, (March, 2015).
- [8] Zhang, A., (2003). Analysis of an international air-cargo hub: the case of Hong Kong. *Journal of Air Transport Management*, 9, 123–138.