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AIR CARGO TRANSPORTATION IN POLAND – TREND ANALYSIS AND FORECAST

Abstract

Air freight transportation is the fastest developing branch of shipping services in Poland and Europe likewise. As the economy develops, demand for air freight is on the rise. Because of infrastructure insufficiencies, Polish airports rely on air cargo road feeder services (RFS). The aim of this paper is to analyze air freight transportation in Poland and to forecast air cargo traffic for the Chopin Airport in Warsaw for the years 2018 and 2019 using trend models. The data published by the Polish Civil Aviation Authority for the 2013–2017 period were applied. The analysis shows that the transport accessibility of the Warsaw Airport significantly affects its overall passenger and cargo traffic. As the forecast suggests, the volume of cargo shipped by air through the Warsaw Airport will assume an upward trend.

Keywords: forecast, air cargo, RFS, air freight shipping

JEL: C100, C530, L930

Introduction

Referring to on Boeing's analysis, the value of air freight in the world is almost USD 84 billion, representing a 14.30% share of the entire air transport market. In Europe, the concept of the so-called "golden triangle of cargo" constructed at the tops of Frankfurt – Amsterdam – Paris airports, where almost 60% of the total European air cargo is generated. There is also a "cargo diamond", including London in this construction, whose potential is almost 80% of the European market (Kuczek, 2018).

As in other European Union countries, also in Poland, air transport is a branch of transport that is growing fastest. This is due to economic growth, and thus

the growing demand for cargo transport. According to Boeing's forecasts, in the next 20 years, air cargo operators will need over 2,600 freighters to handle air freight transport, which grow on average by 4.20% per year (Sniedziwski, 2018).

Research shows that the value of cargo transport is strictly correlated with GDP and GDP per capita (Kasarda, Sullivan, 2005) (the correlation coefficient in Poland in 2013–2017 is 0.9898 and 0.9296, respectively).

Due to the fact that deregulation took place on the air transport market, the basic principles of the operation of air carriers changed. Deregulation forced changes in the management of marketing skills, strategic planning, cost control and competition with other companies. Carriers and airports became profitable entities (Wensveen, 2007) and each seemingly insignificant decision may have specific financial consequences (Cheng-Jui, 2002). For the above reasons, the aim of the study is to analyze cargo transport in air transport in Poland, as well as the forecasted size for Warsaw Chopin Airport for 2018 and 2019 using trend models. For this purpose, data published by the Civil Aviation Office for the years 2013–2017 were used.

1. Theory and methodology

In Poland, cargo is still a small percentage of total air transport. This is due to the following reasons:

- lack of developed infrastructure to service cargo,
- lack of far-reaching planning,
- high prices for ground cargo services,
- high prices for renting warehouse and office space,
- complicated customs and tax procedures.

In addition to the above, it should be noted that the Polish national carrier PLL LOT does not have a fleet, which is intended for exclusive cargo service. The transport of cargo is carried out with the use of passenger aircraft and only a part of them makes it possible to transport more cargo – the possibility of loading cargo in containers. Other transports are carried out in bulk, with a limited payload and this is associated with the extension of service time (System transportowy Polski, 2015). Similar restrictions apply to other and low-cost air carriers.

Moreover, it should be highlighted that airports servicing large transport aircraft should have runways of appropriate length, as well as (Jóźwiak, 2011):

- optimal location (convenient access to the airport, proximity to the seaport and railway infrastructure, access to specialist equipment necessary for loading and unloading heavy and oversized shipments),
- facilitating customs clearance in transit of goods within the European Union,
- attractive rates of airport charges,
- good cooperation with the airport management and a commercial agent, including substantiveness and flexibility during the negotiations,
- the ability to handle aircraft and perform air operations around the clock.

On the freight transport market in the air, there is a distinction between the following service models (Bujak, Filarska-Durak, 2010):

- transport of small passenger planes,

- regular or charter passenger transport flights in trunks,
- small cargo aircraft transport (regular and charter flights – delivery companies),
- regular transport of large cargo airplanes.

Therefore, airports decide on a slightly different form of air freight service, which from the point of view of the airport is easier to organize, cheaper and pays off at a lower level of traffic – RFS (Road Feeder Service). “The goods are transported via hubs. At the request of the airlines, the goods are transported by lorries from the so-called “off-line-airports” to major air cargo ports (...) and is further transported using air transport. This system also works in the opposite direction, i.e. the goods are delivered to the transshipment port by means of air transport, and then they are transported by trucks to “off-line” airports” (Rześny-Cieplińska, Wach-Kłoskowska, 2016). Due to the fact that this type of transport does not generate revenues from airport charges or air traffic in general, they are not included in the statistics of airports and the Civil Aviation Office.

One of the reasons for launching road transport in air cargo traffic is the limited catchment area for a given airport. The airport communication zone is measured by the time of reaching the airport or the distance within a radius of the airport (Rześny-Cieplińska, Wach-Kłoskowska, 2016) (Figure 1). “According to the European Union standards, it is assumed that the limit time of arrival determining the airport’s transport accessibility is 90 minutes. In Polish conditions, this time is extended to 120 minutes” (Śmieszek, Migala-Warchoł, Mentel, 2014).

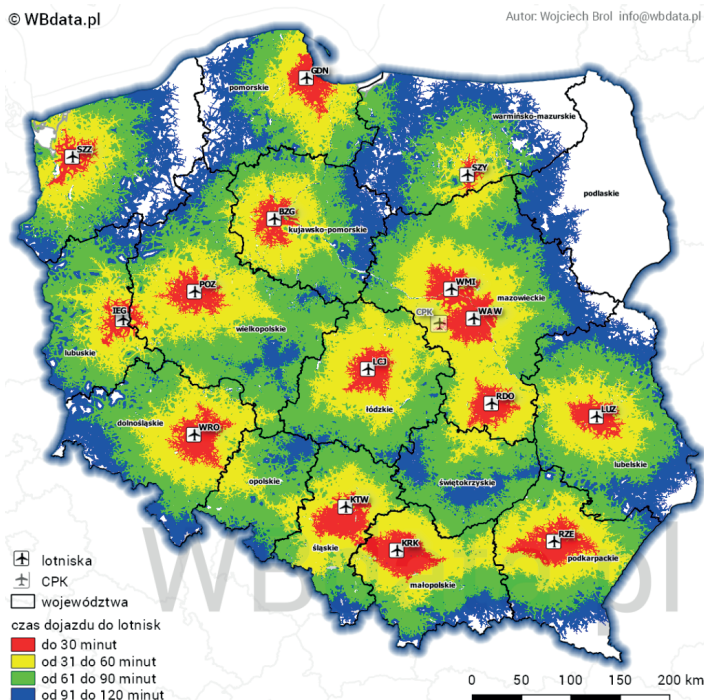


Figure 1. Accessibility of Polish airports in 2018

Source: (Brol, 2018)

The evolution of the quantity of cargo handled in air transport in Poland is illustrated by the dynamics of changes presented in Figure 2 with the use of chain indexes.

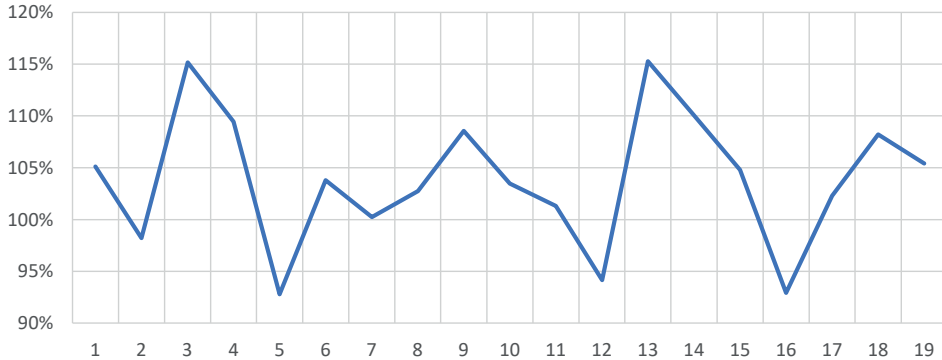


Figure 2. Dynamics of changes in the volume of cargo on board handled (in kilograms) in Poland in individual quarters in 2013–2017 – chain indexes

Source: (own study based on data from the Civil Aviation Authority, www.ulc.gov.pl)

The largest increases in the volume of cargo served in air transport were recorded in the second quarter of 2016 – 15.29%, in the fourth quarter of 2013 – 15.16% and in the third quarter of 2016 – 10.04%. The largest decreases in cargo volumes were observed in the second quarter of 2014, the first quarter of 2017 and the first quarter of 2016. They were respectively: 7.21%, 7.10% and 5.85% (Figure 2).

In Poland, the number of air cargo handled from year to year increased on average by 14.48%.

Cargo transport performed by Polish carriers includes Europe, North Atlantic, North America, South and Central America, Africa as well as Middle East and Asia (Table 1). Among the aircraft used are: Boeing (B787, B737, B737-800), Embraer (ERJ190, ERJ170), Bombardier (DHC-8), Airbus (A320, A321), Cessna (C-172, C-182, C-T206H), Beechcraft (BE-58, BE9L), Piper (PA-34, PA28), SAAB 340A (Swedish, twin-engine turboprop aircraft) and ATR72 (Italian-French turboprop aircraft).

Table 1. List of holders of Air Operator Certificate (AOC) as at 2018.10.05

	Name of the carrier	Areas of air transport	Types of aircraft
1	PLL LOT S.A.	EUR, AFI, MID/ASIA, World Wide	B787, B737, ERJ190, ERJ170, DHC-8
2	Enter Air Sp. z o. o.	EP, EUR, AFI, MID/ASIA, NAT, NAM, CAR, SAM	B737-800
3	SprintAir S.A.	EUR, AFI, MID/ASIA	SAAB 340A, ATR72
4	Travel Service Polska Sp. z o.o.	EUR, AFI, MID/ASIA, NAT, NAM, CAR, SAM	B737-800
5	Sky Taxi Sp. z o.o.	EP, EUR, AFI, MID/ASIA, NAM, CAR, SAM	SAAB 340A
6	Small Planet Airlines Sp. z o. o.	EUR, AFI, MID/ASIA, NAT	A320, A321

	Name of the carrier	Areas of air transport	Types of aircraft
7	IBEX UL Sp. z o.o.	EP, EUR	BE-58, PA-34, C-172, C-182, C-T206H
8	SprintAir Cargo Sp. z o.o.	EUR, AFI, MID/ASIA	SAAB 340A
9	„Royal-Star” Sp. z o.o.	EUR	PA28, PA34, BE9L

Where: EP – Poland, EUR – Europe, NAT – North Atlantic, NAM – North America, CAR – Central America, SAM – South America, AFI – Africa, MID / ASIA – Middle East and Asia.

Source: (Civil Aviation Authority, www.ulc.gov.pl)

The largest share in the volume of cargo transport in the analyzed period is held by Warsaw Chopin Airport (PL), then PL Katowice Pyrzowice and PL Lech Walesa Airport in Gdańsk (Figure 3).

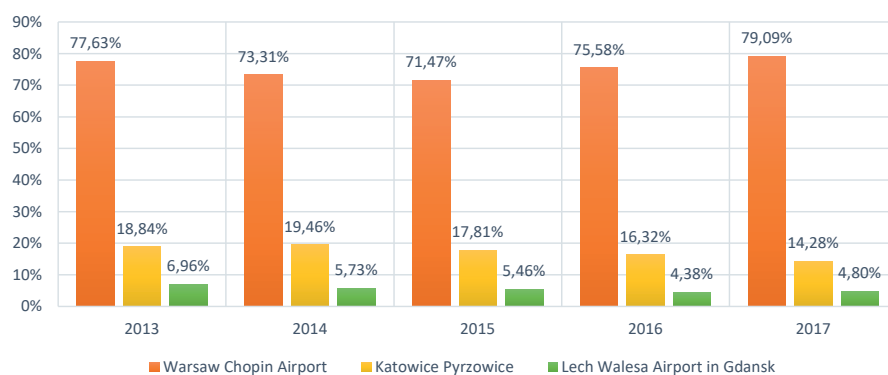


Figure 3. Participation in the volume of cargo on board (in kilograms) served at Polish airports in domestic and international traffic in 2013–2017

Source: (own study based on data from the Civil Aviation Authority, www.ulc.gov.pl)

Figure 3 does not include the following airports, due to the lack of cargo transport:

- Warsaw-Modlin,
 - Radom-Sadków,
 - Łódź-Lublinek,
 - Olsztyn Masuria,
 - Zielona Góra-Babimost,
- and airports, in which these transportations are residual:
- Rzeszów-Jasionka (2013 – 0.30%, 2014 – 1.10%, 2015 – 4.74%, 2016 – 0.77%, 2017 – 0.37%),
 - Poznań-Ławica (2013 – 0.27%, 2014 – 0.20%, 2015 – 0.32%, 2016 – 0.22%, 2017 – 0.44%),
 - Wrocław-Starachowice (2013 – 0.15%, 2014 – 0.16%, 2015 – 0.11%, 2016 – 2.43%, 2017 – 0.88%),
 - Szczecin-Goleniów (2013 – 0.07%, 2014 – 0.03%, 2015 – 0.07%, 2016 – 0.29%, 2017 – 0.12%),
 - Bydgoszcz-Szwederowo (2013 – 0.003%, 2014 – 0.002%, 2015 – 0.01%, 2016 – 0.00%, 2017 – 0.02%),

- Lublin Airport (2013 – 0.02%, 2014 – 0.001%, 2015 – 0.02%, 2016 – 0.001%, 2017 – 0.00001%),
- Kraków-Balice (2013 – 0.75%, 2014 – 0.00%, 2015 – 0.00%, 2016 – 0.004%, 2017 – 0.0001%).

2. Results

The Chopin Airport in Warsaw generates over 70% of cargo transport in Poland. Since 2015, this share has been growing steadily and reached the level of almost 80% in 2017. Due to this, it is worth paying attention to the development of this size in Chopin's Airport in Warsaw (Figure 4).

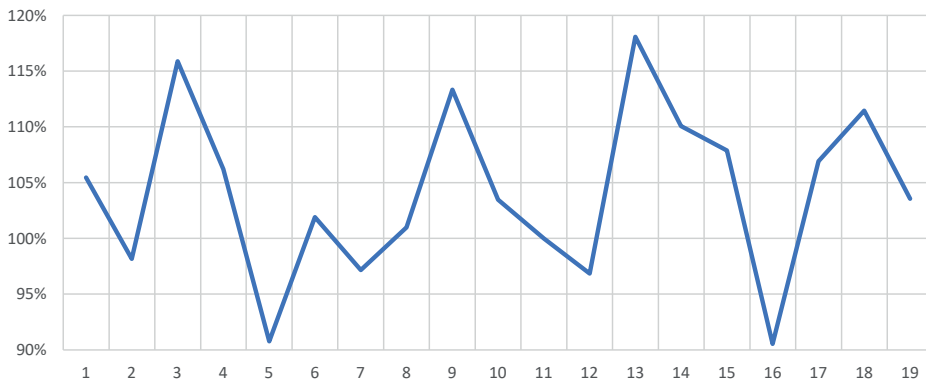


Figure 4. Dynamics of changes in the volume of cargo on board handled (in kilograms) in Warsaw Chopin Airport in individual quarters in 2013–2017 – chain indexes

Source: (own study based on data from the Civil Aviation Authority, www.ulc.gov.pl)

The largest increases in the volume of transported cargo were recorded in the second quarter of 2016 – 18.08%, in the fourth quarter of 2013 – 15.90%, in the second quarter of 2015 – 13.34% and in the third quarter of 2016 – 10.08%. The largest decreases in the analyzed values were recorded in the first quarter of 2017 – 9.45%, in the second quarter of 2014 – 9.21% and in the fourth quarter of 2014 – 2.83%. In the analyzed airport from year to year, the number of air cargo handled increased on average by 15.02%.

Based on graphic analysis in quarterly terms, it was found that there is a growing development tendency and random variations in the time series. It can also be assumed that in the analyzed period the variable shaped as an exponential function. The estimation of the model parameters was estimated using the least squares method and it took the form: $y_t = 10597348,1493e^{0,0359t}$, where $R^2 = 0,8988$ (coefficient of determination), $V_s = 7,15\%$ (coefficient of random variation). Model verification allows to assume that it is well suited to empirical data. Taking into account all the above aspects, a forecast was prepared of the volume of cargo handled in Warsaw Chopin Airport for particular quarters of 2018 and 2019.

Table 2. Values of forecasts for particular quarters 2018–2019 with specified forecast errors

Period	Forecast	Average error of prediction ex ante	Relative forecast error ex ante	Absolute error forecast ex post	Relative error of ex post forecast
I quarter 2018	22,522,252	1,247,313	5.54%	-2,576	-11.46%
II quarter 2018	23,345,489	1,264,170	5.42%	-454,613	-1.99%
III quarter 2018	24,198,818	1,282,306	5.30%	-	-
IV quarter 2018	25,083,338	1,301,668	5.19%	-	-
I quarter 2019	26,000,189	1,322,203	5.09%	-	-
II quarter 2019	26,950,552	1,343,856	4.99%	-	-
III quarter 2019	27,935,654	1,366,575	4.89%	-	-
IV quarter 2019	28,956,763	1,390,307	4.80%	-	-

Source: (own study based on Civil Aviation Authority data, www.ulc.gov.pl)

The absolute and relative values of the ex post forecast error¹ presented in table 2 were determined based on real data and indicate deviations of the forecasted values from actual values, whereas the average prediction error and the relative ex ante forecast error² indicate how much the average observed values of the explained variable in forecasted period will deviate from the forecast value.

The analysis of the time series on an annual basis shows that also in this case the variable shaped as an exponential function assuming the form: $y_t = 40494700,5339e^{0,1419t}$, where $R^2 = 0,9729$ and $V_\zeta = 3,62\%$. Model verification allows to assume that it is well suited to empirical data and can be used to make forecasts (Table 3).

Table 3. Forecast values for 2018–2019 with specified forecast errors

Period	Forecast	Average error of prediction ex ante	Relative forecast error ex ante
2018	94,876,032	2,545,606	2.68%
2019	109,340,964	2,646,795	2.42%

Source: (own study based on Civil Aviation Authority data, www.ulc.gov.pl)

As can be seen in Figure 5, the values of forecasts obtained for quarterly data and annual data are similar. It can therefore be assumed that in subsequent periods the volume of cargo handled in air transport by Warsaw Chopin Airport will show a growing tendency.

¹ Full methodology in publication: (Barczak, Nurzyńska, Król, 2017, p. 55; Cieslak, 1997, p. 53).

² Full methodology in publication: (Barczak, 2015, pp. 26–35).

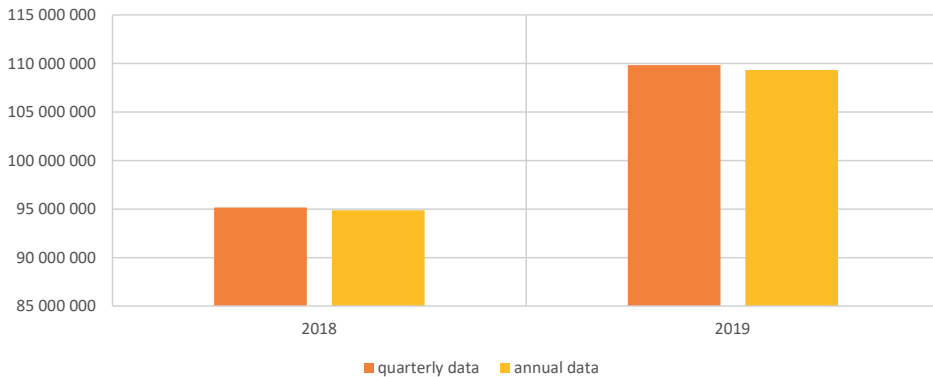


Figure 5. Comparison of forecast values for quarterly and annual data
 Source: (own study based on Civil Aviation Authority data, www.ulc.gov.pl)

The obtained error values indicate that the forecasts can be considered acceptable. They can be used in the planning of airport activities in the field of cargo transport.

Conclusions

The most important advantages of air transport include a short transport time at long distances, as well as a relatively high level of security. Undoubted disadvantage of this branch is the high cost and lower economic availability for this type of transport. It should also be noted that “the development of the fleet, navigational and terrestrial infrastructure, technical and technological base, operation, distribution and promotion process require significant expenditure, without which it is impossible to develop cargo transport and increase attractiveness and expand the market offer. Only a few entities of the air transport sector are able to find the necessary resources to carry out activities characterized by the highest quality level” (Stajniak, 2012).

With the current volume of cargo traffic, establishing permanent connections that are dedicated to the carriage of cargo is not beneficial. Therefore, most airlines use car transport. This is due to the fact that they can handle loads of much larger dimensions than most aircraft that perform scheduled flights to and from Poland. Cargo carried on RFS trucks is cleared at a specified airport in Poland and after reaching the hub it is placed in the cargo space of the aircraft.

The analysis shows that the transport availability of Warsaw Chopin Airport largely determines the number of passenger and cargo transport. Air cargo transport is largely influenced by the availability of road and rail infrastructure. Warsaw is a city located on the communication route between Berlin and Moscow, which connects Western and Eastern Europe. The airport is located 1.4 km from the S79 expressway, 5 kilometers from the Warsaw Southern Bypass (S2), and 16 kilometers

from the A2 motorway. The airport also includes a railway siding, whose manager and owner is the State Enterprise “Porty Lotnicze” (Statut sieci kolejowej..., 2017).

As the forecasts show, the volume of cargo carried by air transport at Warsaw Chopin Airport will show an increasing tendency. A similar trend may be maintained throughout the country. Consequently, as mentioned before, proper marketing management as well as strategic planning and cost control skills by airport management are necessary.

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