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The underlying drivers and future development of air cargo

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ABSTRACT

Air cargo plays a crucial role in the air transport chain and in the globalized economy. As for other modes of transport, the demand for air cargo is a derived demand. Previous studies showed that the main determinants of air cargo demand are merchandise trade and the share of manufactures in merchandise trade. This paper aims to fill a gap in the existing literature by additionally taking the influence of air freight yields and oil prices into account when modelling the global air cargo development. Furthermore, it provides an insight into the future development of air cargo. Forecasts until 2023 are made based on a number of scenarios for the main determinants of air cargo demand. Moreover, an insight is provided into the current air cargo market, including traffic levels and different types of actors and traffic flows. The results are useful not only for academics but also for industry stakeholders for which air cargo is an important contributor to profit and/or cash levels.

1. Introduction

During the past three decades amongst others due to globalization, air cargo has gained importance for airlines, forwarders, shippers, airports and the economy in general. However, since 2008, the global air cargo industry is experiencing a severe slowdown. Several air cargo carriers disappeared from the market while others reduced capacity to adjust to decreasing demand. In addition, many shippers and forwarders switched to cheaper ways of transport. Modal shift from air to sea and from air to surface transport is considered as one of the reasons for the underperforming air cargo business. From 2001 to 2012 maritime container traffic has outgrown air cargo: container traffic has grown by 8.3%, while air cargo has grown by only 3.7% on a yearly basis (Boeing, 2012). However, according to Seabury (2014), the higher growth of air cargo compared to ocean freight is not completely due to a modal shift from air to sea. Between 2000 and 2013, the demand for products that have a higher propensity to be shipped by ocean freight (e.g. raw materials) was higher than the demand for products that are important for air cargo (e.g. high tech, fashion). Despite the on-going difficulties being faced by air cargo carriers, the air cargo industry has slightly begun to rebound since the second half of 2014, partly stimulated by the substantial decrease in oil prices. However, 2015 again showed stagnating traffic levels (IATA, 2015).

As for other modes of transport, the demand for air cargo is dependent on economic activity. It was shown in Kupfer et al. (2011) that especially the evolution of world merchandise trade and more particularly, the trade in high-value goods, is an important determinant of the demand for air freight services. An extension of the model also showed that the problems in the air freight business during the economic crisis of 2008/2009 were a pure consequence of the economic situation. The air freight sector was not hit significantly harder during the recent crisis than maybe other sectors but merely followed the trend of the underlying variables (Kupfer et al., 2014). After understanding the main underlying variables of air freight demand, it is worthwhile to forecast the future demand of air cargo. More specifically, this paper aims at forecasting air cargo traffic up to 2023 based on a number of different scenarios.

In contrast to air passenger demand, academic studies focusing on air cargo demand and forecasting are limited. Zhang and Zhang (2002a, 2002b) for example looked at various issues related to air cargo liberalization, such as differences in routing needs and air traffic rights required by passenger carriers and all-cargo carriers. Jiang et al. (2003) analysed future air cargo demand in China and developed a forecast for China's air cargo demand through 2020. They also discussed the implications of the predicted demand on infrastructure, especially major hubs and emerging airports. A frequently cited study is this of Kasarda and Green (2005). In this

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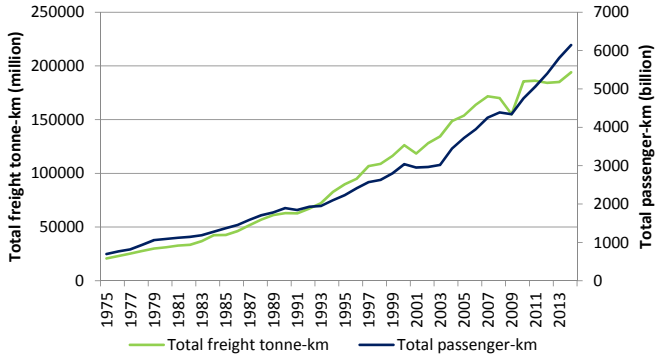

Fig. 1. Evolution of worldwide air freight and passenger traffic, 1975–2014.
Source: ICAO, 1985–1998, 2008–2015.

study, the authors examined the relationship of air cargo to trade and GDP in order to quantify the role that air cargo plays in economic development. Moreover, Morrell (2011) identified a number of key variables impacting future air cargo development, such as GDP, international trade, oil prices, exchange rates, interest rates and globalisation. He also looked at various air cargo forecasting approaches. Suryani et al. (2012) developed a system dynamics simulation model to forecast air cargo demand and to determine terminal capacity required at Taiwan Taoyuan International Airport. They found that GDP and FDI are important drivers of air cargo demand. Lo et al. (2015) on the other hand focus on estimating the price and income elasticities of air cargo demand at Hong Kong International Airport and examine how they may be impacted by the 2008 financial crisis. They also provide an overview of academic studies which estimate the price and/or income elasticities of air cargo demand. However, earlier studies mainly do not forecast global air cargo demand based on a number of scenarios for the main determinants of air cargo demand, including oil prices and air freight yields next to merchandise trade and the share of manufactures in merchandise trade.

The remainder of this paper is structured as follows. Section 2 focuses on the air cargo environment, including the traffic evolution, the different market actors and segments. In Section 3, the relationship between air cargo demand and its underlying variables is investigated by means of an error correction model. Section 4 deals with forecasts of future air cargo demand based on different scenarios. Section 5 contains the main conclusions and suggestions for future research.

2. The air cargo environment

Increasing globalization has led to a strong growth of international freight transport over the past decades. Also the demand for air freight, which is like other transport modes a derived demand, increased strongly during this period. Fig. 1 shows the development of air freight and passenger traffic between 1975 and 2014. It can be observed that air freight traffic in freight tonne-km has experienced a much steeper growth after 1991 than passenger transport. Air cargo on the other hand is more volatile than passenger transport with the sharp declines in 2001 and 2009 as the best evidence of this. The reason for the higher volatility of air freight relative to passenger traffic might be found in the fact that air transport is mostly used for intercontinental transport. While for air cargo, other transport modes such as maritime or rail transport can be a good substitutes, passengers often have no real alternative to air transport. This is also why passenger transport resumed its growth in the years after 2009. In air freight traffic, even though a strong recovery could be noted in 2010, partly due to the revival of the economy, this growth stagnated after 2010 and even decreased again. In 2014, air freight traffic increased modestly by 4.8% compared to 2013. However, air cargo stagnated again in 2015 with an average freight load factor[1] falling to 44%, a level not seen since 2009 (IATA, 2015).

Fig. 2 depicts the evolution of air freight tonnes carried and revenue tonne-kilometers performed between 1975 and 2014 as index of 1975. It becomes clear that the distance between the indices increased over time. This means that freight tonne-km increased more than tonnes, which indicates increasing distance of air cargo transport. The reason behind this development can be found in increased globalization which led to more international, long-haul transport.

When analyzing air cargo demand, one needs to take into account that the air cargo industry is a heterogeneous industry with various types of players and traffic flows. Regarding the types of players, a distinction should be made between integrated and non-integrated air cargo carriers. Fig. 3 distinguishes these two types of business models for air cargo delivery: the non-integrated and the integrated model. Most players in the air cargo industry are non-integrated service providers. These are forwarders and combination carriers or all-cargo carriers cooperating to provide air cargo delivery. In the integrated business model one actor, the integrator, controls the whole air cargo transport chain from sender to receiver. The integrator owns all assets of production from shipper to consignee, including physical assets such as trucks and aircraft.

Only four companies worldwide are considered as integrators (FedEx, UPS, DHL and TNT). The largest (FedEx) and third largest (UPS) cargo airlines worldwide in terms of total scheduled freight tonne-kilometers (FTKs) are integrators. In terms of domestic scheduled FTKs, FedEx and UPS are the numbers one and two respectively. In 2014, FedEx and UPS together represented a market share of 15% in the top-50 IATA cargo airlines based on total scheduled (FTKs). This shows the dominance of the integrated all-cargo carriers, which are performing better than the non-integrated all-cargo carriers in the current air cargo market. Kupfer et al. (2014) showed that all-cargo carriers are more heavily impacted by the economic crisis than integrators and combination carriers. The top-50 in 2014 consisted of 41 combi carriers, 5 non-integrated all-cargo carriers (Cargolux, Polar Air Cargo, Nippon Cargo Airlines, AeroLogic and ABX Air) and 4 integrated carriers (FedEx, UPS, TNT Airways and DHL Air[2]).

Another distinction that should be made based on the type of traffic flows is between all-cargo traffic (traffic generated by freighters) and combi traffic (traffic generated by combi or passenger aircraft). Freighters are used in markets with much cargo demand and relatively little passenger demand (e.g. Merkert and Ploix, 2014) and for cargo that due to its dimensions or hazardous characteristics is not suitable to be transported in passenger aircraft. All-cargo traffic is more vulnerable to economic downturns than combi traffic. The reason is that airlines in times of decreasing demand often switch from transporting cargo in all-cargo aircraft to the belly space capacity. Actually, only between 5% and 15% of air cargo shipped globally is bound to be transported with all-cargo aircraft due to their dimensions or hazardous characteristics (Boos, 2015). Freighter operators have to deal with imbalances between some incoming and outgoing cargo flows (due to trade imbalances), leading to small load factors. A potential solution is

[1] The average freight load factor reflects the average load factor of the total freight capacity (full freighters and belly capacity).

[2] DHL Air is a cargo airline based in the UK that operates on behalf of the integrator DHL.