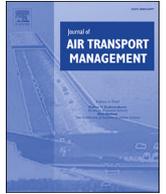




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Editorial

Making or breaking - Key success factors in the air cargo market

A B S T R A C T

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This introductory paper considers a number of major evolutions in the air freight market. In the first instance, it describes the heterogeneous environment in which air cargo services are performed. Subsequently, it looks at some of the most notable developments in air freight. Lastly, it deals with the market structure and with possible future strategies.

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1. Introduction

Air freight and associated logistics operations are like a real-time laboratory of transport economics in action, an environment where technological and business model developments unfold not only constantly but also with increasing speed. This involves a wide range of industrial and economic tools, including frequent market entries, as well as exits through mergers, takeovers and bankruptcies. At the same time, airports and carriers are increasingly confronted with ecological and capacity restrictions, such as bans on night flights at certain airports. What is more, commercial viability of air cargo airlines is suffering albeit a substantial fall in yields, ever increasing pressure from freight forwarders and integrators and competitive pressure from ocean shipping and road haulage. Yet, despite such developments, airports and regions continue to lock horns in competition for airlines, freight flows and associated handling activities. This is because of the substantial economic impact that air cargo brings and also because while air cargo airlines have usually poor profit margins some other parts of the air cargo supply chain are indeed highly profitably or an important contribution to revenues (e.g. in combination carriers). Air freight and the logistics it involves therefore constitute a highly dynamic sector that is drawing growing attention from politicians and policymakers, as well as academics.

Some major developments at both the supply and the demand side of the market have meant that the economic significance of air freight has grown considerably in recent decades, as is reflected in changed attitudes on the part of suppliers (Zhang and Zhang, 2002). Whereas air freight used to be considered as secondary to passenger transport (and hence treated as a by-product that would have to cover an over proportionally high proportion of the shared cost such as fuel cost and could at best achieve break even only), a number of airlines are now dedicated entirely to providing full freighter services. At the same time some passenger airlines with dedicated cargo operations recently divested from their full freighter fleet due to the strong fluctuations in the air cargo market

and the ample belly capacity of new long haul passenger aircraft (e.g. Merkert and Ploix, 2014). In those cases intermediaries with a full freighter fleet are now hired to provide supplemental cargo capacity if necessary.

This introductory paper considers a number of major evolutions in the air freight market. In the first instance, it describes the heterogeneous environment in which air cargo services are performed. Subsequently, it looks at some of the most notable developments in air freight. Lastly, it deals with the market structure and with possible future strategies.

2. The complex and heterogeneous nature of air freight

Air freight is a heterogeneous product. This is due in part to the wide range of cargo transported and the divergent handling requirements of these divergent goods (e.g. perishables). A distinction can be made between traditional air freight carried by full freighters or in the bellies of passenger aircraft on the one hand and express cargo on the other. However, any strict division into two such submarkets would be somewhat contrived, as there is abundant interaction between the players involved in each. At some airports, integrators are among the main customers of traditional airlines and vice versa (Kupfer et al., 2010).

This degree of heterogeneity in air freight translates into a wide range of market players. Fig. 1 provides an overview of the various actors besides the airport authority or operator who are actively involved in air freight operations at airports. Airlines and airports obviously constitute the core of such operations. Airlines are attracted to air cargo because it constitutes a growth market with great potential, which ties in with those airlines' concern with profit maximisation. It offers an attractive yield, enables carriers to attain higher capacity utilisation on traditional passenger aircraft, and provides a means of achieving economies of scale and scope. Airports are similarly attracted to freight operations for reasons of diversification, profit maximisation and improved capacity utilisation. Equally crucial, however, are the owners and/or

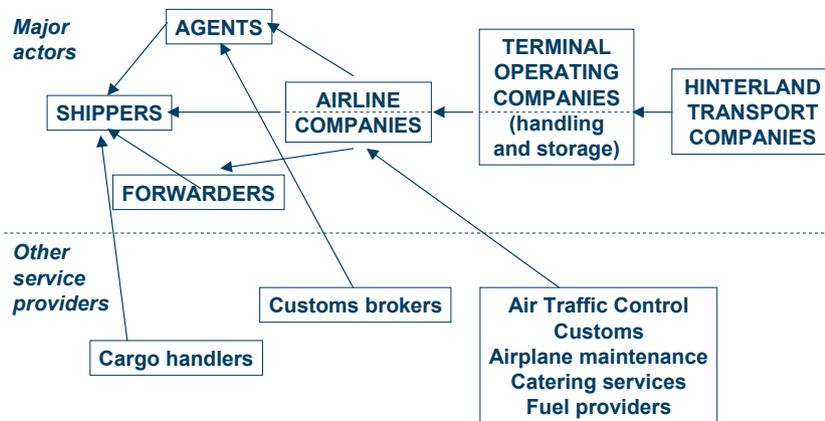


Fig. 1. Air freight actors at an airport. Source: Based on Meersman et al. (2011).

shippers of freight, be it in conjunction with forwarders or not. They are surrounded by a vast network of players each of whom deals with an integral aspect of air logistics, including agents, handling companies, customs, maintenance and fuel suppliers.

This characteristic heterogeneity also comes into play in the choice of an airline and/or airport. A first important question to arise is who leads the decision-making process, particularly in the choice between air freight or an alternative transport mode. Is it the owner of the goods, the consignor or the shipping agent/forwarder? What determines the choice for a particular airline or mode? And why does an airline choose particular airports (e.g. in multi-airport systems such as London or New York)? What shape does the total logistics chain assume, and which part of this chain may be seen to constitute air freight logistics? These are all important questions meriting further academic research.

3. Global trends in international air freight

For a growing number of network carriers, which used to focus primarily on passenger transport, air freight is no longer a by-product, but has become a crucial element in the competitive struggle with other airlines and operators in alternative transport modes. The degree of success of a given route, or even of the global network, is now co-determined by the air freight component.

The constant growth of air cargo is due to a number of developments at both the demand and the supply side of the (liberalised)¹ international air freight market, including growing global trade, technological progress and specialisation, smaller freight volumes combined with a rising average value of freight, downward pressure on air freight rates, and changing production processes (Kupfer et al., 2011). Despite its modest share in global trade in terms of tonnage and tonne-kilometres (less than 1%), air freight accounts for 35% global trade value (Shepherd et al., 2016). However, it is hard to predict whether value will continue to rise, as downward pressure on air freight rates may make it viable also to transport low-value freight by air.

Moreover, the observed growth pattern is not identical for all airlines. European airlines have performed noticeably less well than their U.S. and, even more so, their Asian and Middle-Eastern counterparts. Asian airlines saw a threefold increase over a twenty-year period. This evolution has coincided with a growth

¹ For example, the increasing number of open skies agreements allows for sixth and seventh freedom rights of full freighter operations. For example, this enables FedEx to operate a cargo hub at DXB.

in market share of all-cargo flights as compared to combination flights, which is attributable to a variety of factors. First, on certain routes and for specific types of freight, the free cargo capacity in passenger aircraft (available at marginal cost) has become insufficient to meet rising demand for air freight. Moreover, some air transport routes (e.g. Asia – Western Europe) are characterised by a strong imbalance between inbound and outbound flows. Unlike in the bi-directional passenger transport, in freight transport an outward flight is not necessarily followed by a backhaul flight. This gives rise to combination and hence capacity issues for combi flights. Furthermore, passenger and freight flows are not necessarily matched. Finally, certain types of freight are subject to strict safety/security regulations, so that they can no longer be combined with passenger flights.

The air freight market is experiencing momentous developments that may impact strongly on future trends. First and foremost, in terms of the creation of alliances, there is a noticeable difference with the passenger market, where almost all major players now operate within global networks. This is far less the case in air freight. In fact, there is just one large global freight alliance, namely SkyTeam Cargo (formed around Air France Cargo-KLM Cargo, Alitalia Cargo, Korean Air Cargo). What appears to be working much better in the air freight sector are bilateral alliances such as the one between Lufthansa and Singapore Airlines or joint ventures such as the one between Cathay Pacific and Air China.

Another important phenomenon, certainly within Europe but also most other parts of the world including Australia, is the frequent feeding of freight towards large intercontinental hubs (Frankfurt, Schiphol, Paris CDG). Such operations are not necessarily performed by air. In fact, in Europe, they mostly involve trucking under an air waybill. As a consequence, the hinterlands of the various European freight hubs tend to largely overlap.

Some freight operators, known as full-freighter airlines, are not involved in passenger transport at all. These are usually smaller niche players, who do not need to adapt their cargo services network to the requirements of passenger transport. Hence they are able to deploy aircraft to destinations and at times that suit air freight demand. Nevertheless, such airlines are, more so than combi carriers, confronted with the (harsh) realities of geographical imbalances in freight flows. When full-freight operators are unable to respond creatively to acute shortages in air freight on certain routes – e.g. in consequence of operating triangular freight routes or diversification strategies – they are compelled, as it were, to charge lower rates or to fly empty to the airport of loading. Sometimes a sea-air concept is applied, whereby the combination on longer distances and in certain corridors of a maritime and air leg

contributes to a better capacity use of freight aircraft. Further, airlines providing regular freight services may deploy additional capacity in the sometimes unpredictable air freight market by wet-leasing of all-cargo planes (cf. ACMI contracts which include the aircraft, crew, maintenance and insurance but excludes fuel cost) from specialised companies.

As for the airports, some (particularly some of the smaller ones) specialise in freight. Competition between such airports tends to be fierce, as distances between national and regional airports can be small, and given that few (cargo) airports have a unique catchment area, combined with the strong negotiating position of airlines and the footloose nature of air freight. The latter is due to relatively easy access to price information, a comparatively high price elasticity and low costs associated with switching airports. Especially the European regional airports (Köln/Bonn, Liège, Leipzig, East Midlands) that are frequently flown to by integrators (UPS, FedEx/TNT, DHL) have experienced strong growth. But so too have regional freight hubs aiming primarily at the segment of traditional full-freighters (e.g. Hahn).

4. The market structure

An analysis of the market structure may, in the first instance, be limited to the two most important market players: the airlines and the airports. Additionally, one might explore existing ties with other suppliers. And third, one may wish to consider the extent of cooperation between the various players. Airports compete with each other in the same 'catchment area'. If airports located in one another's proximity are operated by different owners, there is no mutual interest and hence no agreement will be reached regarding the bundling or spreading of freight. If there is common ownership, such agreements are more likely.

Air freight has not followed the trend observed in the passenger market, whereby most carriers (apart from Emirates and Etihad although both have strong codeshare partners too) are now part of one of three large strategic alliances (STAR, SkyTeam, Oneworld). At the same time, the consolidation trend among suppliers of freight is continuing unabated. With a view to achieving potential benefits of scale, freight forwarders and shippers like to see air freight grouped in a single hub if at all possible. This allows them to transport and consolidate freight in the largest possible quantities as well as variance in terms of volume/weight/value add on opportunities and in the most efficient way, either as belly freight or in full-freighter aircraft. This marks a break with the past, when air freight was synonymous with relatively small volumes and a comparatively high cost.

This consolidation trend also results in constant shifts in the value chain: integrators engaging in forwarding; forwarding agents operating aircraft for their own account; airlines/agencies bypassing the forwarding agents by striking direct structural deals with major shippers etc. An even more outspoken example provides Amazon. As a big parcels shipper this web shop has integrated its distribution by air for the US domestic market. Amazon has started to lease its own fleet of forty aircraft under the name Prime Air.

Equally important insofar as market structure is concerned is the presence or lack of such at a given airport of an integrator and/or a so-called home carrier already handling large tonnages of air freight. Such airports not only receive tonnages from the airline concerned, they also tend to attract additional air freight because of their wide range of origin-destination routes served. Particularly at airports with a resident air freight carrier, there is usually a presence of a handful of still globally operating freight forwarders. They are able to offer the networks of such freight carriers

door-to-door transport services at a global scale to complement the services of such transport companies. Increasing spatial concentration of global general cargo services is therefore likely. A further reinforcing mechanism results from the interaction between the location of logistics distribution centres of multinationals in the neighbourhood of these larger cargo airports. This results in increased air cargo demand which benefits from the strong international accessibility by air.

Despite some strong fluctuations in air freight, it seems quite likely that this market will continue to grow. So too will any derived activities, such as goods handling, storage and delivery at destination. It seems even more likely that the significant volatility that has come to characterise the air freight market will persist in the future.

The question arises which strategic developments are likely to unfold. There is no such thing as a single, unique, air freight model. The market is markedly heterogeneous, with multifarious players, many of whom act in accordance with their own business models. One possible scenario is that of the business model of the average airline that will be adapted to new collaborations. Other market players may also be involved in such an evolution.

Airline companies typically encounter many opportunities for collaboration, both with other airlines and with freight handlers or even airport operators and authorities. Hence another scenario may see far-reaching concentration in the air freight market, resulting in a limited number of large companies or alliances. But a degree of concentration may also be discerned among freight handlers, leading to a limited number of large handlers operating at different airports. Even the role of government should not be ignored, as its influence may range from active participation in the capital of an airline or airport operator to intergovernmental collaboration in the field.

Operators in any sector of industry are constantly on the lookout for new niche markets. This also holds for air freight. Moreover, as previously mentioned, and unlike in passenger transport where there is usually an outward and a return trip, air freight is typically transported in a single direction, from the production to the distribution or consumption centre. This causes imbalances in freight flows. Whichever airline is able to neutralise such imbalances most successfully will be rewarded with a better capacity use and hence a higher profit margin, so that they will ultimately emerge as the winners of the competitive game that characterises the air freight market.

Since a major part of air cargo will continue to be accommodated by passenger airlines developments, this segment of the air transport market will also substantially affect air cargo transport. For example, new protectionist symptoms parallel to further liberalization of air transport markets (see the EU/US-Gulf dispute) are also relevant for air cargo developments. And how will new aircraft technology influence airline networks of combination carriers? The rapid renewal and expansion of existing passenger fleets will affect the belly cargo capacity as well as the opportunities for cargo conversions. The future of the A380 is not sure, but how does this aircraft type affect air cargo markets? Airport congestion and slot scarcity will rapidly increase in the next decade. Do long haul passenger flights get priority in slot allocation, will slots be traded and result in the crowding out of full freighter operations? What effect will 3D printing have on the demand for air freight? Will digitalisation make air freight more cost efficient? How will combination carriers use state-of-the-art revenue management systems to improve the yields of both passenger, cargo and other ancillary revenue streams?

These are just a few questions that will further echo in the air cargo world in the near future.

5. Contributions to this air freight issue

This special issue on air cargo deals in greater detail with some of the aforementioned aspects. The aim is to act as a laboratory for the air cargo industry, both at the management and the research side. A careful selection of papers allowed us to tackle new air cargo topics. The result is a diversified high quality special issue. In what follows we present for each paper the motivation to include the paper, the method applied, the key findings and the contribution to the management practice in the air cargo business.

Starting point is to understand the main underlying variables of air freight demand and to get an idea about the future demand of air cargo. The error correction model proposed by Kupfer et al. reveals a strong influence of merchandise trade on air freight transport. In the long run an elasticity between air freight and merchandise trade of 0.62 has been calculated, in the short run this elasticity has been revealed to be higher at 0.82. Furthermore, the share of manufactures in merchandise trade, the price of oil and the air freight yield are variables that influence air freight development. A structural change due to for example 9/11 or the economic downturn after 2008 could not be proved. Based on the model estimated, scenarios are developed with regard to the development of air freight in the future.

Yuen et al. start from the question whether developing air cargo airports in the hinterland could be the way of the future. They develop an analytical model to examine the social benefits of introducing hinterland airports and to analyse the competition and collaboration between the gateway and hinterland airports. A numerical analysis is conducted using real-life data from the Pearl River Delta region in China, where the Hong Kong airport serves as a gateway airport and the Shenzhen airport serves as a hinterland airport. From their analytical results, the authors find that an increase in the charges of an airport decreases its air cargo output but increases the output of the other airport. An increase in gateway airport charges, imposed on either passengers or cargo, decreases passenger output. If coordination between gateway and hinterland airports leads to improved connections between the two regions, the social welfare is also improved.

The contribution of Chao and Li deals with the effects of cargo types and load efficiency on airline cargo revenues. Air cargo revenue management is affected by numerous factors. Air cargo companies base their cargo charges on whichever is the greater of gross weight or volumetric weight. The authors develop a cargo consolidation model based on air cargo characteristics, and investigate the effect of cargo density, the Density Ratio of Heavy cargo to Light cargo, and the percentage of small cargo on the chargeable weights and revenues of airlines. Out of their empirical work they show that a higher DRHL indicates greater chargeable weight, and that as the DRHL climbs to a certain level, the extent of chargeable cargo weights tends to stabilize gradually. The closer the cargo density approaches the most suitable loading density for a flight, the greater the chargeable weight is. In terms of airfreight rates, it is clear that multiple factors and limits should be considered because air cargo handling and freight charging are complex.

Budd and Ison explore the role of dedicated freighter aircraft in the provision of global airfreight services. Empirical evidence of recent airline behavior has shown that many passenger-cargo airlines are redeploying, reducing or entirely eliminating their fleet to concentrate on belly hold freight that can be carried at marginal cost. In addition, the dedicated freighter is affected by all factors that influence demand for all types of airfreight, i.e. global economic vitality, oil price volatility, security concerns, trade protection measures and the introduction of new environmental safeguards. The authors state that in order to remain competitive, freighter operators will need to be innovative in their approach,

add value to existing products and ensure that they offer a service that is not only tailored to the needs of their customers but that is responsive to their changing requirements.

The contribution of Alexander and Merkert evaluates some of the issues regarding the domestic air freight markets in Australia by examining the time and cost of services provided by air and road transport modes. The gravity models used identify regional economic factors (unemployment, employment within logistics and transport sectors, retail service levels) that may indicate the strength (or weakness) of attraction for any domestic air freight route. Most importantly, despite less growth of air cargo in Australia compared to other regions such as the US, their modelling confirmed that some Australian domestic air corridors pose competitive advantages for air freight over any other mode of transport, which is promising for future business development.

The overselling/overbooking from airlines and intermediaries make the revenue management complex for the air cargo industry. Lin et al. address an air cargo space buy-back problem accounting for demand uncertainties. The buy-back occurs between the order release and order execution period. A buy-back model is proposed which takes advantage of Hellerman's capacity option model and Black-Scholes' pricing model. An experiment demonstrates that the proposed buy-back model yields more profits for asset provider and intermediary. That means that implementing a buy-back policy can improve revenue for the air cargo industry.

Walcott and Fan look at the air freight connections within China, a major rapidly developing trade centre. The theoretical framework used includes global production networks strategically coupled by transport logistics linked to aerotropolis type development. As in China many second tier nodal city sites share an airfreight network, showing the importance of intermediacy. Coordinating functions strategically couple transportation modes across a wide variety of distances among suppliers and markets in global production networks. Chinese hub cities more closely correspond to major manufacturing and population centres and central policy directives for development dispersion.

Due to the shortage of cargo aircraft Chinese express companies have to provide transportation services with a hybrid method that consist of rented bellies and self-owned cargo aircraft. Yu et al. design the structure of the mixed air cargo transport network, in which the bellies of passenger aircraft and cargo aircrafts are jointly used. They optimize the operation plans for transporting cargo between O-D pairs based on the mixed network. Based on the calculated results, they further analyze the paths of cargos and discuss the transshipments at some airports.

Bonekamp and Burghouwt present an air transport connectivity model for air freight. Connectivity is defined as all possible direct and indirect connections to or from an airport operated by wide-body aircraft, weighted for the quality of the connections in terms of transshipment and in-flight times. Using this model, the networks of seven European airports are analyzed. In general, there is a relatively high spatial concentration of the supply of freighter services at European airports. Since there are many airports sharing the same catchment area, potential competition for air freight is fierce.

The aim of the study of Rezaei et al. is to identify the optimal strategy for planning freight for transport from outstation to a hub. A multi-criteria decision-making problem is formulated and solved to determine the optimal freight bundling configuration for transport. As such the methodology allows to test various alternatives for optimizing an export air freight chain, which includes three bundling freight options: all freight for the same flight, freight for different flights, and loose freight in trucks. The goal for a carrier is to find the best freight bundling configuration alternative. The case study shows that there are different optimal freight bundling configurations for different outstations and that trucking costs

and freight handling tariffs are among the key factors in deciding which configuration is optimal.

Niine et al. comment upon air cargo enablers and constraints in Estonia, a rather peripheral country in the European Union. In the Baltic Sea area, the role of Estonian air cargo is mostly to serve spoke connections to nearby cargo hubs in Scandinavia and mainland Europe. The authors approach that situation through intertwined viewpoints of general development outlooks and volume projections, location quality evaluation and innovation factors inside the organizations of air cargo service. The problem is rather complex and needs an extensive and multidisciplinary approach. If the right mix of macro aspects and entrepreneurship environment is present, the cargo volumes served can easily return and there is long growth room.

The work of Amorim da Cunha et al. deals with how to keep cargo security costs down. The current aviation security framework imposes strict rules in all domains which can produce inefficiencies and raise costs. This is especially the case in small and medium airports. A case study presents a qualitative risk assessment and cost efficiency analysis of cargo security screening, considering six airports of different size and located in different regions. The results make evident the advantages of a risk based approach to define appropriate security procedures. However, it is not clear at all that a risk based approach will lower costs.

Within the air transport literature up to now publications on air freight are rather limited. The traditional literature has been concentrated around passenger transport. With this special issue we aim to change this situation. Air freight is more than a 'by-product' of passenger transport. The topics dealt with in this issue are new and they open new research horizons. What is more, each paper ends with a clear description of needs for further research. Our intention is that this special issue will contribute to a boom in air cargo research.

6. Conclusions

The air freight market has experienced rapid growth in recent years. This is undoubtedly due to strong growth of the integrators (door to door supply chains) but also to the fact that some of the established combination network carriers no longer regard freight as a by-product, but rather as an opportunity for achieving profit maximisation. This rapid growth has in turn inspired some airlines

to make cargo their core business, with varying success due to the volatility, competitive pressures (e.g. from government owned airlines) and poor commercial viability of some sectors in that market.

More often than not, a sector experiencing such momentous growth requires scientific support in order to fully understand ongoing changes to the structure and functioning of the market, and to be able to respond timely and adequately to such evolutions. With this special issue, the Journal of Air Transport Management hopes to provide such support.

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