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The impact of terminal re-organisation on belly-hold freight operation chains at airports

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A B S T R A C T

While it is widely acknowledged that airport re-organisation from destination to dedicated airline group terminals makes passenger travel more seamless, more efficient and also more profitable for both airlines and airports, there is little known about the impacts of such change on freight and in particular belly-hold cargo chains. Our analysis includes data from all airports in Australia but focuses primarily on the proposed re-organisation of Sydney Kingsford Smith airport. This paper reveals a significant relationship between international freight volumes, terminal organisation and freighter operations. However, our interview results only confirm the volume/aircraft type relationship. The paper aims to contribute to the general discussion on the impact of passenger terminal organisation on belly-hold freight operations and more specifically to the consultation process around airport master planning.

1. Introduction

Reliable and cost efficient supply chains are paramount in air passenger and freight operations, as any disruption or delays have the potential to delude the key advantage of aviation that is fast and secure transport. As airlines suffer from structural low profitability, substantial competitive pressures and high volatility (i.e. fuel cost), they rely on working together with airports (e.g., Tang and Wang, 2013) in making the air travel experience more seamless (covering not only security or check-in but also customer experience beyond the terminal building; e.g. Ison et al., 2013). The airports also recognise the benefits of providing passengers with a seamless and relaxed travel experience as this will not only enhance customer satisfaction but will also result in higher non-aeronautical revenues (e.g., Graham, 2009). Particularly at large international hub airports, the importance of commercial (non-aeronautical) revenues has risen substantially over the last decade, with Frankfurt International, Singapore Changi and Incheon airport all featuring a share of non-aeronautical revenues in total revenues of more than 60% (Lufthansa Consulting and Moody Report). Interestingly, the two leading airports when measured in shopping experience (LHR and DXB; the latter with a net retail income of £6.21 per passenger; Davitt, 2013) have both organised their terminals (LHR T5 and DXB T3 respectively) with respect to airline alliances.

However, when airport terminals are organised by airline groups rather than destination (domestic versus international), efficiency and timing issues might arise for freight chains at the airport that are related to international freight carried in the belly-hold of passenger aircraft. As a result of passenger flows and processes for international and domestic flights being optimised by airline group terminal organisation, particularly for international freight additional distances or other constraints, might slow down freight processing (even though or perhaps even as a result of cut off times for freight loading). Such problems are more likely to arise at large international hubs but can materialise at any airport that handles international freight transported in passenger aircraft. In that sense it is interesting to study Sydney Kingsford Smith Airport (SYD) as it is the most important passenger and freight hub in Australia, with a large share of international belly-hold freight operations and most importantly with a management that is keen to change the airport terminal design from destination to airline group terminal organisation. We draw from data of all Australian airports to see whether a relationship between freight volumes, terminal organisation and freighter share in total aircraft movement exists. We also provide qualitative findings from interviews with senior management.

In its essence this paper aims to contribute to the general discussion on the impact of passenger terminal organisation on belly-hold freight operations and more specifically to the consultation process around airport master planning. The remainder of the

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paper is organised as follows: while Section 2 provides some further background discussion Section 3 introduces the methodology. This is followed by a discussion of the results in Section 4 and a summary of our findings as well as key conclusions in Section 5.

2. Setting the scene

The organisation between airlines and airports has changed considerably since deregulation, privatisation and the advent of low cost carriers (e.g., Francis et al., 2003) which has impacted on aviation markets across the world. It is likely that we will see further changes in the physical configuration and management of airports as both airports and airlines need to find ways to improve competitiveness, efficiency and profitability. As the aeronautical part of airport infrastructure is used as an exchange area between aircraft, surface vehicles, cargo and passengers, the airport/airline interface is seen as crucial for airport efficiency (Wells and Young, 2004). We argue that a lot more players (such as ground handlers) and stakeholders (such as local businesses) are relevant to airport master planning as that their objectives and utility functions can differ when it comes to finding an optimal mix between passenger and freight operations. Virgin Australia for example has extensive passenger operations at all Australian airports but has contracted out all freight operations to the Toll group.

Many authors (e.g., Neufville et al., 2013) argue that the design of passenger terminals (with the two options being destination or airline group organisation) is fundamental to both airports' and airlines' success as their configuration considerably impacts upon passenger flows. Kuchinke and Sickmann (2005) for example show that the construction of terminal 2 at Munich airport (dedicated to the Lufthansa group) increased the efficiency of the airport on the passenger side and Socorro and Betancor (2010) show passenger welfare effects in the context of the re-organisation of Madrid airport. Neufville (1995) even argues that there is an optimum or preferred airport terminal configuration, primarily for transferring/connecting flights, but then again only for passenger operations. However, there has been little mention of cargo operations, despite it often playing an interrelated role for combination carriers, as shown in Fig. 1.

Different to the previous literature, the focus of this paper is on the airport traffic flows directly related to air cargo that is carried in the belly hold of passenger aircraft (domestic or international). In this paper we follow the IATA and Ashford et al. (2013) definition of air cargo that includes any property or mail carried on an aircraft other than accompanied passenger baggage. The reason for not including luggage is that passenger baggage operations are entirely separate to air cargo handling, and typically take place within the airport terminal itself (and hence would be similarly to passenger operations optimised by an alliance-based terminal organisation). We account for freighter aircraft (such as the Boeing 747F, which are usually operated by integrators and pure cargo airlines but also by some passenger/mixed airlines) to a lesser extent than belly-hold operation, as the aim of this paper is to show potential impacts of a change in passenger terminal organisation to belly-hold freight chains at the airport. However, freighter operations can impact on these chains too, as some airlines (such as Emirates) use belly-hold freight operations to support/feed large freighter operations and vice versa.

3. Methodology

This paper aims to establish whether a re-configuration of passenger airport terminals from destination to airline group organisation can have impacts on freight, and in particular belly-hold freight chains at the airport. In a first step we analyse all airports in Australia to evaluate whether there is a trend between passenger airport terminal organisation, international freight volumes and aircraft used to carry that freight (pure freighters versus belly-hold passenger aircraft). In a second step we present case study results on Sydney (KSA) airport as it is currently the only airport globally that is proposing (in a consultation process with all stakeholders since early 2012) to change from destination to airline group based terminal organisation.

In terms of the first part of our analysis, we analyse in a pre-step all Australian airports that have at least one passenger by a commercial airline company using traffic and aircraft data of the Australian Bureau of Infrastructure, Transport and Regional Economics (BITRE). We have chosen that sample because of data availability and also because it provides the basis for the second part of our analysis. Out of that panel of 101 Australian airports over the period of 2001–2012, we have selected those which have a least one tonne of international air freight, as the focus of this paper is on freight chains (and particularly on belly-hold freight of connecting flights). By applying that filter we reduce the number of relevant airports to eight, namely Sydney Airport, Melbourne Airport (Tullamarine), Brisbane Airport, Perth Airport, Adelaide Airport, Darwin Airport, Cairns Airport and the Gold Coast Airport.

Our main econometric model is illustrated in Equation (1). By applying a generalised least squares (GLS) random effects regression model to our airport panel data, we aim to show whether annual international freight volumes $FREIGHT_{it}$ (in tonne) and passenger airport terminal organisation $ORGA_{it}$ have an impact on the share y_{it} of pure freighter in total aircraft movements at the relevant airport. Since we also want control for both cross-firm and time errors in our censored panel data set, we use the following random effects regression model:

$$y_{it} = \alpha + \beta_1 FREIGHT_{it} + \beta_2 ORGA_{it} + v_{it} + u_i \qquad (1)$$

The essential assumptions of the random effects model are that the unique/individual (error) effect v_{it} is uncorrelated across

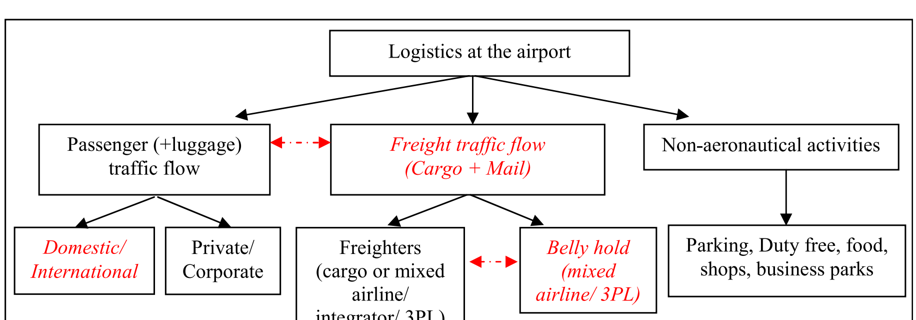

Fig. 1. Different flows at the airport.