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The influence of strategic airline alliances in passenger transportation on carbon intensity

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ABSTRACT

International aviation is growing rapidly and held responsible to contribute to about 2.5% of the global anthropogenic CO_2 emissions. In answer to the increasing public and political awareness of aviation's influence on Climate Change, from 2012 the European Union aims to include air traffic on their territory into the existing EU Emission Trading Scheme. Beside the various measures airlines can take to improve carbon intensity of their activities, joint collaboration in a global strategic alliance offers airlines an opportunity in passenger transportation to cope better with the planned regulation. In this paper we analyze the influence of a strategic alliance membership on determinants of carbon intensity in passenger transportation by using a unique data sample of the years 2004–2008. We find that alliance members on average had a higher utilization rate than non-aligned airlines, but their older average fleet age indicates that they did not take full advantage of the potentials offered through common aircraft investment activities. With regards to the planned Emissions Trading Scheme we show that European carriers on average had a better carbon intensity than Non-European airlines, so that competitive disadvantages for European airlines might be less than expected, if their carbon intensity maintains on this level.

1. Introduction

Expanding growth of international air traffic and an increased awareness of the global Climate Change have focused public and political attention on the environmental consequences of civil aviation. Although the Kyoto Protocol did not agree on CO_2 emissions of international aircraft activities, from 2012 the European Union plans to include all flights on its territory into the existing EU Emissions Trading Scheme (European Commission, 2008; UNFCC, 1998). Over the past few decades the airlines concerned have learned to deal with challenges, whether they were the result of governmental regulations, shifting demands or new business models. The highly competitive environment in which global airlines operate is characterized by a strong volatility of fuel prices and an increasing cost pressure; this has always driven the need to improve the efficiency of their activities. Airlines have responded to these developments with various strategies, one of them being the formation of global strategic alliances.

Strategic airline alliances are long-term collaborative agreements between at least two carriers to cooperate on a substantial level with the declared intention to improve competitiveness and enhance overall performance (Iatrou and Alamdari, 2005; Morrish and Hamilton, 2002). There are several reasons for an airline to join this form of cooperation. Due to the necessity of specific investments and high entry costs in some markets it is often not rational to pursue organic market growth. In addition political restrictions like the limitation of traffic rights to national carriers or infrastructural bottlenecks like the scarcity of airport slots might constrain growth targets (Cento, 2009). By joining a strategic alliance, even airlines with insufficient resources are able to provide comprehensive global coverage.

Some empirical and theoretical investigations revealed that both the carriers and customers can, under certain conditions, benefit from alliances (Gagnepain and Marín, 2010; Oum et al., 2000). The intentions of strategic alliances to increase efficiency and productivity seem to equal the expectations that are raised by the regulators of the planned Emission Trading Scheme. Therefore the following paper analyses whether the membership in a strategic airline alliance improves the load factor of alliance members or stimulates common investment activities and in result has positive effects on the carbon intensity of airlines. With regards to the planned inclusion of the aviation sector to the EU Emission Trading Scheme, this can help the concerned airlines to choose the right strategies and measures to react on this regulation.

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The paper is set out as follows: In Section 2 the environmental impacts of air transportation and the European Union's plans to react on the threat of Climate Change are described. Section 3 discusses the relevance of strategic alliances for passenger and freight transportation in the industry, pointing out relevant areas of collaboration between alliance members and the environmental benefits that might result. An empirical analysis is conducted in Section 4 to identify to what extent strategic alliances can enhance the carbon intensity of airlines and which managerial implications this might have for future decisions. The focus of this analysis is on passenger transportation, since to date most of the strategic alliance activities apply to this business segment. Section 5 concludes the paper.

2. Environmental impacts of aviation

2.1. Climate change and current regulatory activities

The combustion of kerosene in aviation generates greenhouse gases, which are suspected to be the main reason for the anthropogenic Climate Change. Aircraft activities account for 2.5% of the total man-made carbon dioxide (CO_2) emissions, but in addition affect the climate by emitting water vapor (H_2O), nitrogen oxides (NO_x), sulfur oxides (SO_x) and soot (IEA, 2010). The emitted volume of these gases is easy to quantify, while an estimation of their exact impacts on the global climate requires deeper insight into other scientific disciplines. The Radiative Forcing Index (RFI) represents a metric that provides an uplift factor for non-CO_2 emissions and allows to measure the overall perturbations to the energy balance of the Earth's atmosphere system (Sausen et al., 2005). Although the precise effects on the Radiative Forcing level and the complex interactions of the relevant greenhouse gases with the atmosphere are still up for scientific discussion, the International Panel of Climate Change (IPCC) estimated that aviation contributes to approximately 3.5% of the total Radiative Forcing of all anthropogenic activities (IPCC, 2007). These estimates do not include the formation of contrails and cirrus clouds, which are expected to have a much higher influence than the sole emission of greenhouse gases (Lee et al., 2009; Macintosh and Wallace, 2009).

In 2005 the European Union introduced an Emission Trading System (ETS) for CO_2 in order to stabilize the concentration of greenhouse gases to a level that avoids serious damage to the environment (European Commission, 2003). Whereas at the moment only energy and heavy industry sectors are affected by the regulation, commencing in 2012 all aircraft departing and arriving in the European Union will be involved. The cap level for the first trading phase will be limited to 97% of 2004–2006s average emissions. From 2013 this share will be reduced to 95%. 82% of the CO_2-emission allowances will be issued for free by applying a sector-wide benchmark value, while 15% will be auctioned and 3% will be kept as reserve for future market entrants (Anger, 2010; European Commission, 2008; Vespermann and Wald, 2011). Although initially a large portion of permits are distributed at no charge, in the long term the shortage of emission permits and an expected decrease of the free allocation rate will cause additional costs for the airlines in the future. The tradability of permits ensures a high static and dynamic efficiency for the regulatory authority. Airlines will buy permits if the price is lower than their marginal abatement costs or sell otherwise. Consequently emissions are reduced, where it is economically efficient.

Until now the European ETS is the first mandatory trading scheme that aims to include cross-border airline activities. The New Zealand Emission Trading Scheme mainly focuses on liquid fossil fuel suppliers and by now only includes domestic flights. Emissions from international aviation are exempted from the regulation, but airlines are invited to participate voluntarily in trading (New Zealand Ministry of Environment, 2007). In Japan a voluntary emission reduction plan for domestic air transport was initiated in 1997, targeting a 10% increase in carbon intensity until 2010. Yamaguchi found that subsequent to the initiation of the voluntary plan, a significant one-time efficiency gain of 3% was achieved, followed by an annual downsize of CO_2 emissions in the Japanese sector of 1.2% per annum (Yamaguchi, 2010).

2.2. Strategies and measures to improve carbon intensity

Given the conditions of the European scheme, the airlines concerned are expected to react by pursuing at least one of the following strategies:

- As CO_2 emissions rise proportionally with every combusted tonne of kerosene, a *reduction strategy* focuses on a decrease of the fuel consumption through short- or long-term measures.
- Financial instruments allow companies that follow a *trading strategy* to hedge against price fluctuations or to realize benefits by selling unneeded permits.
- In air transportation markets with a rather inelastic demand, airlines that will follow a *compensation strategy* can shift additional costs to the customer through price increases or realize profits by the promotion of carbon offsetting programs (Albers et al., 2009).

Since the last two strategies rather represent a defensive position of companies to evade the regulation, we will focus on the reduction strategy in the following analysis. Although an enhancement of the environmental situation is only achieved by a decrease of the absolute emission level, for the implementation of mitigation measures it is reasonable for the companies to focus on specific emission values in the first instance, especially when there is discrepancy in growth of output (Yamaguchi, 2010). The ASIF approach breaks down the absolute CO_2-emission level into four main drivers (Schipper et al., 2001), each of them providing a starting point for emission reduction measures.

- *Activity* refers to the transport performance offered during a certain period and is, dependent on the objective, measured in terms of traffic [revenue tonne-kilometers (RTK) resp. passenger-kilometers (RPK)] or capacity [available tonne-kilometers (ATK) resp. seat-kilometers (ASK)]. The ratio of the activity in terms of traffic and the activity in terms of capacity is defined as load factor.
- The *structure* of the airlines' business model indicates whether a carrier is operating in the short-, medium- or long-haul flight segment. Every segment requires the use of different aircraft types and determines the distance-related activity via the scheduled route-network.
- *Intensity* defines the specific fuel consumption in kg per revenue tonne- or passenger-kilometers and is mainly influenced by the technical characteristics of certain aircraft types. This relation is also often referred to as fuel intensity.
- Finally, the *fuel type* used represents a fixed emission factor per kg fuel consumed.

According to Hoffmann and Busch (2008) ecointensity considers the amount of an environmental impact in relation to a business metric. The benchmark that is applied for the distribution of free permits in the European Emission Trading Scheme is a carbon intensity value, expressed in kg CO_2 per revenue tonne-kilometer. To consider the characteristics of passenger transportation and standardize conversions to revenue passenger-kilometers (RPK),