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Airline categorisation by applying the business model canvas and clustering algorithms

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ABSTRACT

The phenomenon of increasing airline business model convergence implies attempts for improvement and poses the questions, whether the airline market can be divided into new clusters, in contrast to the established distinction between low-cost and full-service network carriers. The objective of the paper is to determine airline clusters, which go beyond the two well-established low-cost and full-service network carrier models and facilitate a better understanding of the factors distinguishing different business models. The Business Model Canvas approach is applied to a set of 42 currently operating airlines to identify key factors for a subsequent, multi-dimensional two-step cluster analysis. Two of the seven resulting clusters are selected for a more detailed analysis to identify regularities within each clusters' key factor characteristics.

1. Introduction

Business models in the airline industry have seen an increasing convergence, especially between low-cost carriers (LCC) and full-service network carriers (FSNC). According to Belobaba et al. (2009) higher aircraft utilisation rates and lower operating and labor costs of LCC have induced FSNC to adopt some of those business practices and operational procedures, e.g. introducing charges for additional services or decreasing turnaround times through reduced ground services. Some LCC, on the contrary, have been diverging from their initial strategy by introducing a higher service level or integrating other aspects of the FSNC model. Jetblue Airways, for example, operates with a higher seat-pitch and lower seat density than the average LCC, offers leather seats and free inflight entertainment. Additional services are served to attract higher passenger yield segments and, thus, potentially increase revenues (Holloway, 2008).

Daft and Albers (2015) have empirically analysed this phenomenon to raise attention, especially on airline managers' and researchers' side. The objective of this paper is to identify additional airline clusters besides low-cost and full-service network carriers. The analysis in this paper follows a different approach by combining the Business Model Canvas, thus identifying key characteristics of airline business models, and applying a cluster analysis to 42 currently operating low-cost and full-service network carriers. The resulting clusters will further distinguish these two airline types into different subgroups.

In the following, Section 2 gives an overview of the historic development of FSNC and challenges resulting from the market entry of LCC, with Southwest being the first in 1967 (Knorr and Arndt, 2002; Strobach, 2007). Furthermore, a description of factors characterising airline business models is provided, based on different sources: the current classification of airline business models, common performance factors in the airline sector, airline annual reports, and expert interviews. This set of key factors serves as an input for the application of the Business Model Canvas, which provides a well-established structure for describing business models and organising the key factors identified. In Section 3, a two-step cluster analysis is performed using these key factors. Section 4 concludes the paper with a summary of major findings and an outlook of potential future research in this field in Section 4.

2. Historic development of the airline industry

The evolution of the airline industry has been influenced by several political resolutions, ranging from the Chicago Convention in 1944, the deregulation of the U.S. market in 1978 followed by a liberalisation of the European market in the 1990s as well as the EU-US open skies agreement of 2008. The liberalisation and deregulation enabled the entry of other airline business models besides the established FSNC.

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Between 1938 and 1978, the commercial aviation sector consisted of trunk-line carriers as well as new categories like local-service carriers, all-cargo companies, and charter airlines; which were very profitable on the transatlantic market segment (Holloway, 2008). After the deregulation of the airline market LCC, focusing on price leadership, joined the group of well-established carriers. Southwest Airlines was the first low-cost airline in the United States of America and started its operation in 1971, four years after the initial foundation of the airline (Wittmer et al., 2011). Following market liberalisation and deregulation efforts, the airline industry also experienced an increasing trend towards consolidation and market concentration, indicated by a wave of mergers and acquisitions. Besides, airlines entered various forms of cooperation resulting in the convergence of different airline business models as these activities require a certain consolidation of service levels and other operational aspects (Wensveen, 2007). Code-sharing agreements as well as the rise of airline alliances are two examples for this development. The Star Alliance was founded in 1997 as the first global alliance by five airlines from three continents.

Furthermore, the hub-and-spoke system became a well-established operational profile for business models of major carriers. In turn, regional airlines started feeder services into hubs in order to provide sufficient demand for long-haul routes offered by major carriers (Holloway, 2008). Economies of scope, scale, and density were seen as key drivers for airlines to either grow through mergers and acquisitions or via partnerships with other airlines (Wittmer et al., 2011). In order to constrain the merger activities and to prevent a critical level of market concentration, governmental institutions, especially in USA and Europe, established institutional barriers (Holloway, 2008).

Other major external influences on the evolution of airline business models were advances in aircraft technologies and the rise of the internet. The former enabled cost-efficient optimisation of operational processes, e.g. reduction of turnaround times, and the internet facilitated novel distribution channels as well as transparency of ticket fares. Influences from the internet led to an acceleration of adapting business model aspects, especially those which are easy to imitate (Osterwalder, 2004), e.g. online check-in or ticket sales. Airlines became able to implement services related to the internet easily to assimilate their competitors' business portfolio.

Todays' airline business model portfolio can be characterised as very diverse. The low-cost model became a wide-spread alternative to the traditional full-service network model, which is still operated by most of the formerly state-owned carriers, i.e. flag carriers. The low-cost model has also been transferred to long-haul routes with mixed success (Schofield, 2015). Hybrid airline business models evolved from the increasing convergence of FSNC and LCC. One example is Air Berlin, which offers long-haul leisure connections, business-traveler-oriented services, and short-haul low-cost services (Flottau, 2013).

3. Methodological approach for clustering airlines

The following section provides an overview of the methodologies that have been applied to investigate new airline business model clusters using a set of 42 airlines in a two-step cluster analysis. The first step is a relatively coarse heuristically process to form temporary clusters with the possibility to have incorrect or undesirable clusters. This step is required for the assimilation of big data sources. The second step comprises the resulting clusters with a hierarchical cluster algorithm to the predetermined number (Brosius, 2011). This multidimensional cluster algorithm has the advantage of considering several factors in parallel. If the factors provide different units they need to be normalised prior to the cluster analysis (Backhaus et al., 2006; Brosius, 2011; Schendera, 2008). The specific cluster algorithm applied here will be explained in more detail in Section 3.3. The Business Model Canvas has been identified as a feasible and well-established approach to structure and describe operational as well as financial, product, and customer-related aspects of a business model. Therefore, it has been applied to the airline sector in order to investigate if airlines can be categorised in more than only the well-known categories of FSNC and LCC.

The airline data set contains eleven LCC and 31 FSNC which have been selected according to two criteria: the market share of the airline, expressed by the annual available seat kilometers offered by an airline, and data availability required for the cluster analysis. A ranking of global, annual available seat kilometers in 2014 by airline has been performed. The 42 highest ranked airlines have been selected. They cover 60% of the globally offered annual available seat kilometers (Official Airline Guide (OAG), 2014). Furthermore, they were the highest ranked airlines in this list for which the additionally required data from annual reports, financial statements, and websites was available. Airlines, which are members of an airline alliance, have been considered individually for the cluster analysis. Hence, the individual airlines, for example Iberia, were included in the selection. The data availability of each airline was a limiting factor. Airlines without information for all key factors were not included in the cluster analysis. Regional and charter carriers were not considered in the cluster analysis in order to focus on the increasing convergence between LCC and FSNC. Appendix A1 lists the 42 airlines selected for the cluster analysis.

3.1. Business Model Canvas

For the analysis of the convergence of airline business models, a framework based on the Business Model Canvas approach has been developed. The main idea of the Business Model Canvas approach, according to Osterwalder and Pigneur (2010), p. 15, is the implementation of a business model concept that is “simple, relevant, and intuitively understandable, while not oversimplifying the complexities of how enterprises function”. The objective is that everybody has the same understanding and the same basis regarding business models. The Business Model Canvas is a well-established approach for the structuring, visualisation, and assessment of business models (Fielt, 2013).

The Business Model Canvas can be classified as an integral approach to define and describe an enterprise's business model. Other approaches focus on specific aspects within a business model, for example technology (Afuah and Tucci, 2001; Timmers, 1998), organisation of a company (Tikkanen et al., 2005; Zott and Amit, 2006), or its strategy (Chesbrough and Rosenbloom, 2002; Johnson et al., 2008). However, these approaches do not cover all elements that are necessary for the operability of a company. Therefore, integral approaches are preferred to describe business models (Bieger et al., 2002; Bieger and Reinhold, 2011; Osterwalder, 2004; Osterwalder and Pigneur, 2010; Schallmo, 2012; Wirtz, 2011). The Business Model Canvas has been chosen as it combines all considered aspects and appears to provide the most extensive structure of all identified integral approaches (Klemm, 2015). The Business Model Canvas approach is based on nine building blocks. According to Osterwalder and Pigneur (2010), the customer is the most important element of any business model. The customer is represented by the building blocks customers, customer relationship, and channels. The value proposition represents a selected bundle of products and services, which serve customer needs. They are the reason why customers are interested in a firms' portfolio. The revenue streams represent the revenue generated from the customers and are, therefore, an important indicator for a companies' success. The key resources constitute the basis for the value creation. In order to create value for the customer, a company needs to have primary processes that are represented by the building block key activities. An important cornerstone of business models is the presence of key partnerships. The creation of alliances is essential for companies to reduce risk, acquire resources, or enhance their business models. The cost structure reflects all resulting costs that are generated through the other building blocks whereas the revenue considers the overall net sales (Osterwalder and Pigneur, 2010).

Table 1 gives a detailed overview of the Business Model Canvas approach including main questions, which further describe each of the