

Chapter 1

Introduction

“If the facts don’t fit the theory, change the facts.”

Albert Einstein

1.1 The ‘Old Industry’

From the mid-1990s to the beginning of the new millennium, the aviation industry faced one of the biggest booms in its history. Worldwide increases in GDP, riding on the wave of the new economy, and a greater demand for travel resulting from globalization stimulated the airlines to healthy growth of around 4–6 percent per year. However, this tendency was not continued in subsequent years. At the beginning of 2000, the economic slowdown brought an end to the growth phase, and the terrorist attacks of 11 September 2001 and the SARS virus in 2003 exacerbated the situation. In 2004, the airline industry probably faced the most difficult period of its existence.

The uncertainty about the future was clearly expressed in the official press releases of KLM President and CEO Leo van Wijk after the 11 September terrorist attack (Wijk 2001):

... many passengers are cancelling their reservations and we can expect diminishing load factors as a result. Demand is diminishing on various intercontinental routes and I do not expect this to change in the near future... (www.klm.com).

Similarly, on 19 September 2001, Lufthansa CEO Jurgen Weber officially announced (Weber 2001):

... there is uncertainty about the length and effect of the crisis and the future developments in the aviation industry (www.lufthansa.com).

There has always been a fundamentally precarious balance within the industry between profit generation and loss. One of the biggest exceptions to this rule occurred during the 1990s, when the global economic upturn boosted travel demand.

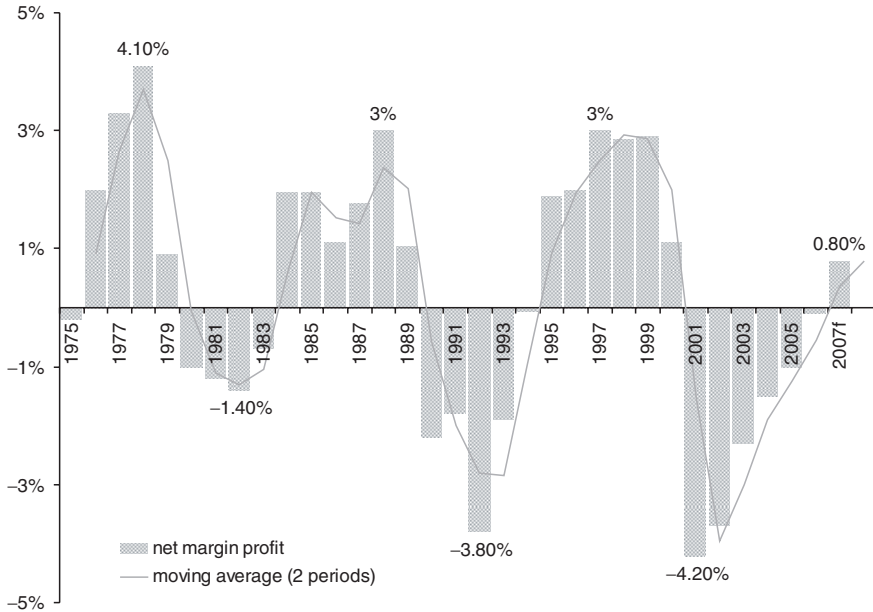


Fig. 1.1 Net margin profits of the world-wide airline industry (Source: ICAO and IATA forecasts 2006–2007)

Furthermore, the major airlines gained from the new economy in terms of computer technology progress, which enables new business processes such as ‘network management’ or ‘yield management’, e-commerce and e-services to be supported.¹ Quantitative analyses permitted the improvement of demand forecasting and the optimization of seats supplied in the network (Fig. 1.1).

Nevertheless, during these years, a group of airlines, known as low-cost carriers, were able to generate profits and positive growth by generating a cost advantage, no frills, and a point-to-point network business model, in contrast to the traditional hub-and-spoke national flag carriers. Nowadays, the low-cost business model is quite popular and is advocated as an alternative, or sometimes as a complement, for the traditional airline business model, which, on the contrary, aims to cover all market segments and city-pairs, and these airlines are therefore now named ‘full-service carriers’.

The market deregulation in the United States in 1978 mainly affected the network strategy of carriers. In the period that followed, a number of ‘trunkline’ carriers rapidly reorganized their network structures from a point-to-point (PP) system into a hub-and-spoke (HS) system.² The second effect of the deregulation on the network

¹ Some examples of e-services are e-ticketing and Internet check-in.

² According to Reynolds-Feighan (2001), this reorganization took place between 1978 and 1985. Many authors (see, e.g., Borenstein, 1989; Berry, 1994; Button et al., 2000; Oum et al., 1995; Burghouwt, 2003) put much effort into explaining the reasons for the change and the advantages

strategy was the use of the PP system by low-cost airlines such as Southwest Airlines. About 10 years later, the EU deregulation process produced similar results, although its effect on the market was not so radical. The European carriers had already concentrated intercontinental flights into an HS structure, while they developed a mixed HS and PP network for shorter distances (national and international flights).

The objective of the HS network design is the maximization of the number of city-pairs to cover all traffic segments (business and leisure). An HS network design focuses on the connectivity within hubs which is typically implemented by concentrating the flights' landing and take-off time at the hubs (hub waves). The wave design determines the connectivity of the outbound and inbound flights. The disadvantages of the HS strategy are: the lower quality service to the passenger (who would normally prefer direct flights); and an increase in operational costs for the airline. Indeed, these waves create peak times in the hubs and, consequently, congestion with possible delays, including missed connections.

The business innovations that boomed in the second half of the 1990s were the alliances and commercial partnerships, which developed into three main global alliances (Sky Team, One World, Star Alliance). A certain value for the passengers (interlining³) as well as some scale effects for the airlines, made these alliances quite successful.

1.2 The 'New Industry'

In the last quarter of 2000, the fundamentally precarious balance between revenue and cost (per available seat-kilometre) turned negative. The crisis initially started as demand slowdown followed by the cost impact of overcapacity from the supply side. Different from the situation for airlines during the Iraq war in 1991, five additional factors turned the crisis into a "perfect storm" for global aviation (Franke 2004):

1. The crisis of 2000 started at the time of a positive peak just before an economic downturn (in 1991–92 the crisis occurred at an inverse peak just before an upturn in the global economy).
2. The terrorist attacks of September 11 generated fear of air travel and constituted an exogenous demand shock.
3. The 2003 Iraq war, together with the SARS epidemic, caused a second exogenous demand shock.
4. The full-service carriers were making few business innovations compared with the network and yield management practices developed in the 1990s.

of carriers. Above all, it was emphasized that both trunk and regional carriers adopted the HS structure to exploit the dominant position of the hub and the cost advantages of a centralized network, such as economies of density and scale.

³ 'Interlining' means the use of more than one airline for a journey.

5. The Third Package of EU deregulation was applicable from 1997. One of its consequences was the boost to the low-cost carrier development as an attractive alternative for price-sensitive clients during the period of economic downturn and fears about intercontinental journeys.

The low-cost business model was developed in the early 1970s in the US (from Southwest Airlines) but it was only after more than 20 years that the analysts and airline practitioners started considering it as a serious threat to the full-service model. Nevertheless, it was initially perceived only as a regional phenomenon, limited to the US or the United Kingdom and to a successful separate niche market, characterized by passengers with low willingness-to-pay and connecting secondary city-pairs. But nowadays, the scenario has changed. The low-cost carriers experienced fast growth after 1999 (see Fig. 1.2⁴) and often compete with the full-service carriers on the same routes and for coincident segments.

However the low-cost airline models have evolved differently per continent while the traditional airlines have responded to the low-cost competition by reducing costs despite continuing to lag far behind the low-cost model.

Francis (2006) highlighted some of the factors that have acted as catalysts for the development of low-cost carriers. These factors are the following:

- Deregulated markets
- Entrepreneurs

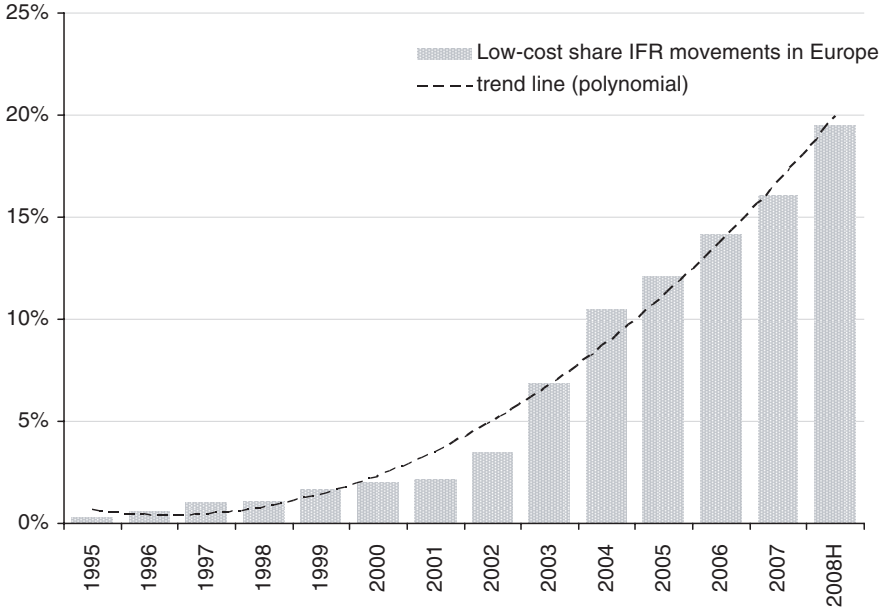


Fig. 1.2 Growth of low-cost carriers in Europe (Source: EUROCONTROL 2007)

⁴ EUROCONTROL is the European Organization for the Safety of Air Navigation.

- Population and relative wealth
- Airport availability/capacity sold cheap and free of congestion to allow intensive operations
- Internet diffusion in order to ease sales, simple tariff price transparency, circumnavigation of travel agent control of distribution channel

Francis identified a strong relation between the intensity of these factors and the development of local societies. This is a determinant for the position of the different countries and continents in the market development life cycle of low-cost airlines. Table 1.1 compares the life cycles of these services across the world as presented in a study of the European Parliament’s Committee on Transport and Tourism.

Market liberalization has been an indispensable condition for the introduction of low-cost airlines in all geographical contexts but by itself this is far from being sufficient to encourage their evolution over the life cycle indicated in Table 1.1. On the other hand it is doubtful whether without sufficient levels of the catalytic factors, the authorities would have introduced the market deregulation present nowadays in Europe and US.

The competitive pressure associated with the evolution of low-cost models affected the traditional airlines models. Their reaction was to tend to adopt cost-cutting strategies as they were driven to adopt some of the characteristics of the low-cost airlines in an attempt to survive in this new deregulated environment.

Before the liberalization, the limited scope of the alliances developed in the 1990s, together with the high coordination costs and the unwillingness to merge further, meant that major cost reduction potential was not fully realized. It is questionable whether the commercial alliances helped to prepare the full-service carriers for the economic crises and the low-cost challenge. Nevertheless, the new century began with a phase of EU airline consolidation through mergers and acquisitions. KLM Royal Dutch Airlines acquisition by Air France in 2004 showed its competitors what can be achieved with greater scale in the highly fragmented industry.

Table 1.1 Market developments of low-cost airlines (Source: European Parliament Study 2007)

Life cycle stage	USA	CANADA	Europe			ASIA	Rest of the world
			UK	Mainland	East Europe		
1. Innovation	▲	▲	▲	▲	▲	▲	▲
2. Proliferation	▲	▲	▲	▲			▲
3. Consolidation	▲	▲	▲	▲			
4. 2nd phase of entrants	▲						
5. Consolidation	▲						
6. Market maturity	▲						

1.3 The Objective of this Study

In the aviation industry various actors such as authorities, airports, airlines and passengers combine to determine the endogenous dynamics. These dynamics, together with the exogenous forces, affect the airline strategy and business organization. The current evolution of the aviation sector in Europe can be described in terms of the combination of two main factors: (1) The liberalization process which started in the EU during the 1990s and the succeeding boom of the low-cost carriers. This process has radically modified the competitive environment where traditional airlines operate. The market contestability has increased, as demonstrated by the increased number of competitors or potential competitors on the different routes. The nature of competition has changed, as new entrants or potential entrants have different business models, especially concerning the network organization (i.e. the low-cost carriers); (2) Specific exogenous factors such as terrorism, epidemics, and globalization have pushed the aviation industry into a ‘perfect storm’. There is need for a debate on the future of the aviation sector and the survivability of the evolution of the business models. The main concern is how the traditional model, successful during the 1980s and 1990s, is evolving in a market crowded by low-cost carriers.

The objective of this study is to analyse the new strategic conduct of the full-service carriers (or legacy carriers) in a more liberalized European market in terms of how they have coped with global economic crises and increased competition with low-cost carriers.

To accomplish this objective, three important research questions are addressed:

- How can *full-service carriers* react in the short-term to survive the global crises and still maintain a long-term network strategy? Specifically, how did the European carriers cope with the recent global crises?
- How do the *full-service carriers* compete in pricing, and how did they react to the low-cost carrier’ entry?
- Is the *hub-and-spoke* configuration still a possible network strategy when competing with point-to-point network operations? Can we empirically detect the network design of European carriers?

The study opted for a systemic analysis to the air transport sector and develops along two parts as presented in Fig. 1.3. Part I (Chaps. 1 and 2) provides a brief analysis of the main characteristics and changes in the aviation sector, mainly from the supply side, which have followed the market deregulation. The deregulation effects on the industry have been broadly analysed by several authors looking specifically at the effect on one aspect or another of the industry, such as network development, pricing behaviour, airlines-airports relations, and alliances. We briefly present all these elements in the new perspective, that of the airlines strategy and business model. Indeed, after the deregulation we can identify three main categories of airline business models (despite the model variants within each category are several): full-service carriers, low-cost carriers and charter carriers. Thus, in Chap. 1 we attempt to provide a concise but complete panorama of the key elements of each category of business model emerging after the EU deregulation. This chapter represents the

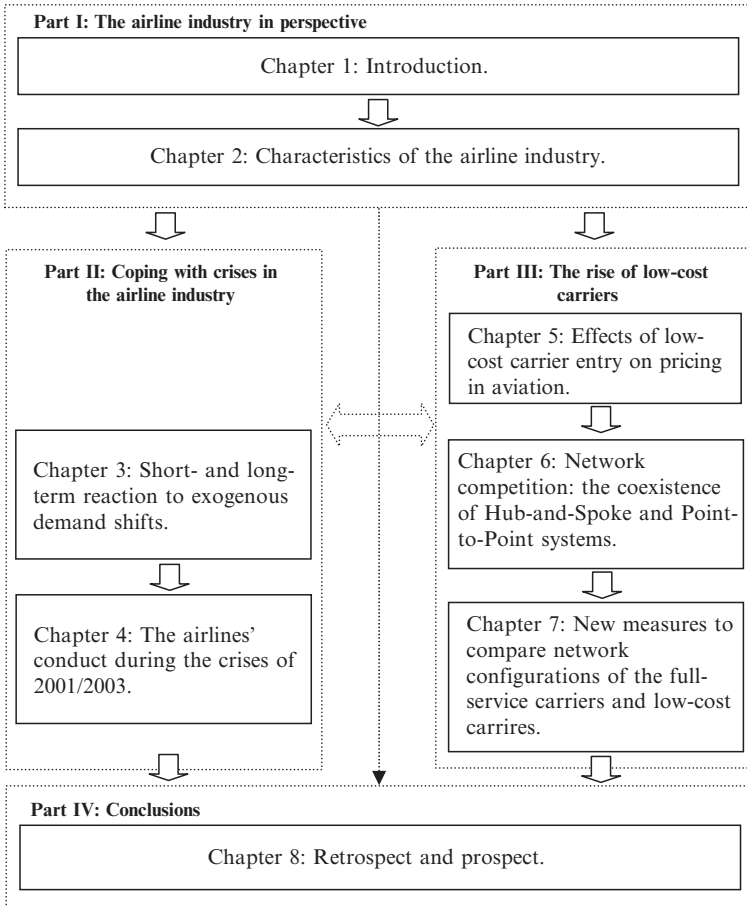


Fig. 1.3 Outline of the book

background of the research. Part II is dedicated to the first research questions from both an empirical and a theoretical perspective. Two terrible events have characterized the world economy: the September 11 terrorist attack on the Twin Towers in New York and on the Pentagon in Washington in 2001, and the SARS epidemic in East Asia which began in February 2003. These events have produced two dramatic crises. By analysing these two important demand shifts, we are able to detect some determinants of the full-service carriers' conduct. The idea behind our approach is simple and innovative. It is simple because we think that the carriers should have the same conduct during the crisis as during the no-crisis period, i.e. profit maximization. It is innovative—we believe—for at least two reasons.

The first reason is that the survivability maybe addressed at first glance as a short-term problem and therefore can be solved by maximizing the short-term profit. However, we think that the carrier conduct should be modelled in terms of both the

short- and the long-term profit maximization problem. This approach is supported by the assumption of the presence of *adjustment costs*: that is, carriers encounter costs in changing the network configuration, so that their choice to close a route and re-open it after the crises is both a short- and a long-term decision. The adjustment costs also induce carriers to behave strategically, a carrier that increases (or decreases) its capacity during the crisis period, forces its competitor to reduce its capacity offer in the post-crisis period. This phenomenon is known in the literature as *pre-emption*. The combination of adjustment costs and pre-emption provides an indication of the network flexibility of the carrier to adapt to the new market situations (of both crisis and no-crisis).

The second reason why our approach is innovative is that the maximization problem is presented in a dynamic game-theoretical framework organized into three stages, which are a time-continuous sequence of periods (pre-crisis, crisis, post crisis). From an empirical point of view (Chap. 4), we test the outcomes of our game theory model by measuring the variation in the carrier's capacity supply and explaining it by an econometric model based on two variables: the passenger reduction due to the shock, and the carrier's expected profitability of the market.

Part III is dedicated to answering the third and fourth research questions, i.e. the reaction of the full-service carriers to the entry of the low-cost carriers. Specifically, in Chap. 5 we investigate how the full-service carriers price-compete and respond to the low-cost carrier entry. We develop a theoretical model of airline competition, which accommodates various market structures, some of which include low-cost players. The framework is based on the recent literature on product differentiation in oligopolistic markets. We can identify two approaches to this problem in the literature: the traditional one, which models the firm's demand as a function of prices and assumes no interdependencies among markets, i.e. business travellers do not demand the leisure products and vice-versa; and the approach of Wilson (1993), Rochet and Stole (2002) and Dessein (2003) who all develop a model with market interdependencies and where the firm's demand is expressed in terms of utility levels provided to consumers by the firms.

Our model differs from the previous ones as it sets the problem in the traditional form (i.e. in terms of prices), but it takes into account the market interdependencies. This simplification is possible because we assume that qualities are exogenously determined as in traditional oligopolistic models. Hence, we arrive at our intermediate position between the traditional modelling approach and the one proposed by Wilson and others.

Moreover, we introduce the assumption that the customers are horizontally and vertically heterogeneous, i.e. in real terms different passengers live at different distances from the airports and they are sensitive to product qualities such as business and economy service. The outcomes of this model are the price equilibria for different market structures and segments (business or leisure). These results are tested by an econometric analysis based on a sample of monthly data on city-pairs routes from Italy to three European countries (Germany, the UK, and the Netherlands) including airfares for four different carriers (Alitalia, Lufthansa, British Airways and KLM). Differently from what is done in other research studies, where price dispersion or

average prices has been analysed,⁵ we perform our econometric estimation on the basis of eight market segments (six in economy class and two in business class) and four market structures (monopoly; symmetric duopoly; asymmetric duopoly; and asymmetric oligopoly⁶).

Chapters 6 and 7 deal with the fourth research question. We compare the full-service carrier with the low-cost carrier business model in terms of their network configuration. In Chap. 6, we approach the problem from the theoretical perspective of a carrier that has to decide its best network strategy. In the literature this problem is often presented as a single carrier that maximizes its profit (or it minimizes its costs). We propose to examine the problem with a game-theory approach where different carriers play their strategy depending on the possible strategy of the competitors. We assume that the carriers play three different network strategies: point-to-point (PP), hub-and-spoke (HS), or multi-hub (MH), and we identify the conditions under which Nash asymmetric equilibriums may exist, i.e. PP with HS or PP with MH. We further discuss how the outcomes of the model can be used to describe the observed coexistence of different network configurations.

Finally, the airline network configurations are empirically assessed in Chap. 7 with the aim of effectively representing the complexity of modern carriers' network design and, if possible, accounting for differences between low-cost carrier and full-service carrier networks in Europe. This is a relatively new research attempt in terms of empirical methodology, with only a few notable previous exceptions. We explain why it is a new contribution. Reynolds-Feighan (2001) identified the HS configuration of a carrier when there is a high concentration level of air traffic in both space (geographical dimension) and time (temporal dimension) by coordination of the timetables. However, while a substantial number of research studies on airline network configurations have focused on the spatial dimension, only a relatively small number of empirical studies have attempted to measure the temporal dimension of airline networks, see, e.g., Rietveld and Brons (2001); Veldhuis and Kroes (2002).⁷

Traditional analyses of airline networks have measured the network configuration by means of concentration indices of traffic or flight frequency (Caves et al. 1984; Toh and Higgins 1985; McShan 1986; Reynolds-Feighan 1994, 1998, 2001; Bowen 2002). These methodologies have mainly addressed the issue of describing and classifying networks in terms of measures of geographical concentration. These measures, such as the Gini concentration or Theil index, provide a measure of frequency or traffic concentration of the main airports. When a network structure is complex (as in reality), including multi-hubs or a mixed PP and HS strategy, the concentration indices record high values for all types of structure but fail to discriminate clearly between different network shapes.

⁵ See Borenstein (1985); Berry (1994); Borenstein and Rose (1994); McManus (2001); Macskási (2003).

⁶ For an explanation of these types of market, we refer to Sect. 5.2.2.

⁷ Burghouwt and de Wit (2003) present a remarkable literature review and classification of previous studies based on the network configuration definitions and methodologies presented by the various authors.

The temporal dimension has been analysed by, for example, Veldhuis (1997), Bootsma (1997) and Burghouwt and de Wit (2003), who calculated connectivity indexes (wave structure quality) at the hubs airport, e.g. the weighted in connection index.

Our study follows the Reynolds-Feighan definition of network configuration and therefore empirically assesses both the spatial and the temporal and combines them in one complete description of the network configuration.

Moreover, we apply two alternative empirical methods originating from social network analysis and which, to date, have never been used in the transport economics literature. These methods are in the Freeman index and what is named the Bonacich approach, which both seem to produce more meaningful results than the Gini concentration index concerning their capability to detect the geographical shapes.

Part V provides the conclusion of the study. The answers to the research questions are discussed and the results of our studies are proposed as stepping stones to point the way to new research directions.