Contestability and deregulation in the Airline Industry

Qiaozhi Liang

6354571

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Supervisor: Professor Gamal Atallah

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Abstract

The global airline industry is an important part of the world economy, because it is a major economic force for transportation, technology, manufacture and many other areas. Nowadays, air travel remains a growing industry and it continues to promote economic growth, international investment, world trade and tourism. With low cost carriers providing direct services and hub-spoke carriers enlarging their network systems, the airline industry has shown dramatic development over the past 20 years. With the airline industry developing faster and faster in a competitive market, a global market gradually formed. In order to achieve seamless travel, the airline industry uses alliances, which permit member carriers to share profits through a formula-based system and offer extensive code-share options for its customers. As a result, an airline can offer greater value to passengers by extending its network with other airlines.

Keywords: Airline industry, Regulation and deregulation, Global alliances, Hub-and-spoke system

TABLE OF CONTENTS

1. Introduction

The global airline industry is an important part of the world economy, because it is a major economic force for transportation, technology, manufacture and many other areas. With low cost carriers providing direct services and hub-spoke carriers enlarging their network systems, the airline industry has shown dramatic development over the past 20 years. Currently, the global airline industry includes more than 1500 airlines providing service to more than 3500 airports and operating over 23,000 aircraft. The international airline industry has been able to cover almost every country and reach nearly every corner of the world. The volume of world air travel has increased by about 5% per year over the past 30 years (International Labour Office, 2013). Nowadays, air travel remains a growing industry and it continues to promote economic growth, international investment, world trade and tourism. As technologies yielding new types of planes are wanted, broader global networks are reinforced.

Looking back on history, the airline industry is more than 100 years old, starting with the first airlines between New York and California in 1909. The airline industry was developed in natural monopolistic environment from the beginning. It was very difficult for a small company to enter or exit the airline industry without extremely abundant assets in a natural monopolistic market.

Lack of competition was a typical characteristic of inefficient monopolies which led to overpricing of tickets, lack of technological innovation and low quality of service (Klein and Wiley, 2003). In this situation, the types of airplanes and routes remained unchanged for a long time. In order to keep airlines operating, airline companies could only increase the airfares. In

reality, high ticket prices did not always translate into high profits, and they caused airlines to grow slowly.

The airline market gradually evolved into a contestable market. A contestable market shares some characteristics both with monopolistic and competitive markets. The contestable market doctrine plays an important role in the airlines sector. A contestable market means that a firm can make a temporary profit then exit without paying any entry or exit fee. However, it is also very difficult for airline market to fully satisfy the assumptions of a contestable market. The airline industry experienced ~~in~~ a remarkable revolution in the 1970s. After deregulation, the airline industry became a competitive market. The most important advantage of a competitive market is innovation and competition. In order to survive in such competitive environment, airlines tried to increase levels of services and technology. All airline companies tried their best to develop more advanced technology of planes, provide better services and control tickets prices in order to survive in a competitive market (Captain and Sickles, 1997).

With the airline industry developing faster and faster in a competitive market, a global market gradually formed. Global alliances, a key and major strategy of the airline industry, provide operators many benefits. In order to achieve seamless travel, the airline industry uses alliances, which permit member carriers to share profits through a formula-based system and offer extensive code-share options for its consumers. As a result, an airline can offer greater value to passengers by extending its network with other airlines.

The goal of this paper is to identify trends and issues in the airline industry. The paper is divided into five sections. Section 2 will analyze several traditional regulation policies of the airline industry. Section 3 will discuss some market structures which can be applied to the

industry. In section 4, the experiences of different countries with the airline industry is presented. Section 5 will summarize and conclude the paper.

2. Traditional regulation policies

2.1 Airline natural monopoly: monopolistic versus competitive market

Currently, many countries still have their own airlines which are operated by government. In general, the airline industry is prone to natural monopoly, due to its economies of scale, sunk costs and universality of service. These factors imply that it is hard for a company to enter the airline industry without extremely abundant assets. Moreover, new competitors were blocked from entering the market by a set of stringent laws designed to protect national airlines (Captain and Sickles, 1997).

In 1977, Baumol provided the definition of natural monopoly: "An industry in which multiform production is more costly than production by a monopoly" (Baumol, 1977, p. 810). For the airline industry which needs tremendous investment, highly sophisticated technology and professional management, a large scale of production is required. However, with the expansion of the industry, the disadvantages of monopoly gradually emerged. Since the mid-1980s, several airline industries in North America, Europe and parts of Asia have been liberalized through deregulation. At the same time, deregulation has removed or weakened many of the constraints on pricing , routes, capacity and frequencies.

Lack of competition is a typical characteristic of inefficient monopolies which leads to overpricing of tickets, lack of technological innovation and low quality of service. Overpricing is augmented by extreme price differentiation and creates confusion to consumers. Here is an example: "It costs $352.50 for a round-trip coach ticket between Boston and Washington, a distance of 406 air miles. But if you want to go to London, 3,267 miles away, it costs as little as $298 provided you meet the restrictions" (Kahn, 2002, p. 40). These differentials do not

constitute price discrimination, but reflect differences in marginal costs. From this example, the customers can spend less money to travel nearly 10 times the distance. Most customers find such price anomalies unfair. Without competition, the airline industry typically ignores the passengers' complaints.

In fact, the price on most routes in Europe has been consistently higher than prices charged for similar distances in the United States. Bilotkach et al. (2013) study fares for travel between New York and London, and find that fare-setting strategies differ between airlines. Fares for business travel usually vary more than fares targeted on leisure travelers. Moreover, the European airline industry has been found to be inefficient relative to US carriers. Ng and Seabright (2001) estimate the reason for this phenomenon to be the lack of competition in a monopolist market, which causes the low productive efficiency in the European airline industry. They pointed out that "the European airline industry is currently operating at cost levels some 25% higher than they would be if the industry had the same ownership and competitive structure as the U.S. industry" (p. 614).[1] At a 1984 conference, the Federation of European Consumers found that compared to getting together anywhere in Europe, it would cost less to fly all their delegates to Washington, DC. The reason for this has been attributed to the duopolistic situation between member states which prevented new entry in the intra-European airspace.

[1] Ng and Seabright (2001) estimate substantially larger returns to density, with an elasticity of marginal cost with respect to spoke density out of hub airports of -0.3 to -0.4 from their structural model of demand and profit-maximization.

In reality, high ticket prices do not mean high profits. Sometimes, lower prices will attract more customers. Even though the profit from each trade will be less, the total profits can be more because of more trades. In general, most incumbents consider that, after improving the airline services, improving the technology, decreasing the ticket prices, the airline companies will incur higher costs in a competitive market than in a monopolistic market. The natural monopoly argument of the airline industry is about whether the cost of the main airlines will rise when there are additional competitors on the same routes. Under a competitive environment, most of the airlines made higher profit with increased passengers and this created a mutually beneficial result for both consumers and firms. Moreover, benefits are also derived from the increased distance and fuel efficiency of the craft (Adrangi et al., 1999).

During the 1980s, laissez-faire policies were enacted which affected the market structure in many U.S. industries. The domestic airline industry is a typical example. The architects of deregulation in general and economists in particular argued that the major benefit of the airline industry deregulation was that the differential price-marginal cost among short, medium and long haul trips would be eliminated (Adrangi et al., 1999).

Similar to the U.S., when the ‘liberalization’ movement spread to Europe, these monopolies were ended and prices moved to a more competitive level. The 1992 ‘liberalization’ program (Doganis, 1994) includes decreasing tariffs in goods and services from one nation to another as well as non-tariff barriers. It promoted the European airline industry into a more competitive environment.

In a monopoly market, innovation and marketing techniques take a back seat. Under regulation, the types of airplanes and routes remained unchanged for a long time. However, after deregulation, the airline industry entered an era of free development and free competition. Wide, stretch bodied aircraft are a symbol of advanced technology, and the percentage using turbo propulsion provides a measure of potential productivity of capital. In the twentieth century, progressive improvements in aircraft capacity, speed and range helped set the pace of globalization. On the one hand, better airplanes become a key point in a competitive market. Moreover, the new turboprop flies at approximately treble the speed of previous jet equipment (Capatin and Sickles, 1997). At the same time, modern airplanes are quieter, more comfortable and consume less fuel than older ones.

On the other hand, the airlines of most countries moved to a "hub-and-spoke-system" (Kole and Lehn, 1999). An airline hub is an airport which acts as a transfer port to bring passengers to their final destination. Air Canada bought 40 new airliners to upgrade its fleet for new routes between 1983 and 1994. And in the U.S., some airline companies started to build 'small hubs'.

However, economists hold different ideas on the linkage between technological innovations and deregulation. Gordon (1990) treats improvements in aircraft design as determined primarily by exogenous factors. He doubts the conventional idea that airline deregulation would accelerate the rate of technological change, and finds that the improvements are caused by aircraft manufacturers and not deregulation. On the other hand, Baltagi et al. (1995) proved that the development of technology stimulated a more efficient route structure.

Lack of competition affects service quality in the airline industry. During the period the level of services in most countries was poor and rapidly deteriorating especially in on-time performance (Mazzeo, 2003). Even though passengers kept complaining about substantial delays to most airlines, the airline companies still ignored this situation. Suzuki (2000) proposed an aggregate-level Markovian type model which was calibrated with US data to research the relationship between on-time performance and market share in the airline industry. The results indicate that, for all carriers in their data set, passengers are likely to be loss averse with respect to on-time performance. In a competitive market, consumers can respond to poor service quality by switching to a competitor, but this option is not available under monopoly. Therefore, the incentives to provide high quality services are very limited for a monopolist. However, in 1986 after deregulation, British Airways tried to improve service quality especially regarding on-time performance. British Airways (BA) and United Airlines signed an agreement which enabled the airlines to share passengers and improved the quality of service for time-conscious business travelers. As a result, BA's load-factor on the transatlantic sector increased by almost 40% (Roller and Siekles, 1994).

2.2 Economies of scale

Economies of scale are always considered as a prominent characteristic of the airline industry. Increasing returns to scale imply that large firms are more efficient than small firms. Therefore, minimizing the long run average total cost is the aim of each airline company (Tybout, 2000).

It is difficult to define airline output before 1944 due to measurement problems. Koontz (1951) was the first scholar to compare the difference between economies of size and density. He defined density of operations as the number of available ton miles (ATM) per station operated. “The real economies of size are matters of density, rather than the mere size of total operations; and the density is, of course, largely a matter of route structure although they tend to be affected by the aggressiveness of management in offering a quantity and quality of service and through effective selling” (p. 139). Antoniou (1991) concluded that “a unidimensional measure of size is not sufficient to capture the full range of services offered by airlines” (p. 162). Later, several authorities adopted Koontz’s ideas that an ATK (available-ton km) is often not equivalent to another ATK and provided a multiproduct approach to study the airline industry. They distinguished between scheduled revenue ton-miles and non-scheduled ones. Therefore, several investigators use Ton-miles Performed (TMP) to measure airline output or scale.

Based on several previous empirical studies of airline costs, Kirby (1986) researched the economies of scale in the airline industry in Australia and produced the following formula:

TMP= PORTS x ASL x ALF x AAS x ADPP

PORTS represents of the number airports served; ASL represents average stage length; ALF represents average load factor; AAS represents average aircraft size and ADPP represents the average number of departures per port. Under this model, the author not only used information on the multiproduct nature of the aggregate output but also considered the construction of an output index factor as well (Kirby, 1986).

The degree of scale economies determines the minimum efficient production level. For example, if a small sized firm (plant) can still produce at competitively low costs, this is attributed to technological factors (Bergman, 2003). Levine (1965) questioned the existence of increasing returns to scale. Although the airlines have equal cost structures, economies of scale at the firm level would cause the optimum to have only a single supplier; diseconomies of scale at the firm level would require two identical airlines to split the optimal output in equal portions. They showed that an industry could be highly efficient in a monopolized market. However, in practice, airline cost functions may be more likely to show increasing rather than decreasing returns to scale.

Most researchers agree that economies of scale and passenger density may exist in the airline industry, but empirical estimates of their magnitude have found fairly modest advantages of size. In airline networks, holding network size constant (airports or routes served) and structure (average stage length), returns to density have been estimated as the change in total cost of increasing passenger traffic (passenger-miles). Elasticities of total cost with respect to density are around 0.85 (Ng and Seabright, 2001). That is, when doubling passenger traffic on a given network, there is nearly a 15% reduction in average costs. Moreover, there seems to be little correlation between overall size of operations and unit cost across major U.S. airlines. After more than 25 years, there is no evidence that cost advantages are giving the largest airlines increasingly dominant positions (Borenstein and Rose, 2008).

There are many types of scale economies, such as internal and external. If the individual firm can reduce average costs by operating at a higher scale, scale economies are internal. If the industry is larger, the costs of the firm will be lower when the individual firm

operates at constant returns to scale (CRS). According to Verhoef and Pels (2004), the first-best charge includes two elements: the marginal external cost imposed upon the competitor, and a demand-related subsidy to counter overpricing due to market power. When the degree of scale economies is defined for a given level of congestion, if asymmetry exists, first-best charges will give rise to the elimination of the least efficient airline with neutral or positive scale economies at the firm level.

Pursuit of economies of scale is a very significant strategy for the airline industry. Attempting to reach an optimal production scale must deal with constraints relating to technology, capital, labor and market size. A global airline market brings more opportunities for the airline industry to attain efficiency. In the modern world, international economies of scale have already become an important trend. For example, Air Canada has developed international markets all over the world. When it was founded in 1937, it only provided service between some major cities within Canada. After the Canadian government deregulated the airline industry in 1988, Air Canada began to expand its international services. Today, it offers services to more than 700 destinations in more than 100 countries and is the 13th largest airline company in the world (CBC news, 2009).

3. Market structure

3.1 The theory of contestable markets

A contestable market shares some characteristics both with monopolistic and competitive markets. A contestable market may have only one seller which can be a multiproduct firm, and is characterized by zero economic profits in the long run. Furthermore,

firms produce at rates of output at which price is equal (or approximately equal) to marginal cost (Mckenzie and Christopher, 2006).

A contestable market is vulnerable to "hit and run" behavior. This means that a firm can enter and take advantage of high prices, if an industry is making supernormal profits. The firm will leave if prices fall and the industry is no longer profitable. Therefore in a contestable market a firm should be satisfied with normal profits otherwise it would encourage hit and run tactics. The mere threat of entry in a contestable market is sufficient to prevent supra-competitive pricing (Strassmann, 1990).

The contestable market doctrine plays an important role in the airlines sector. Under regulation, the companies are protected by government regulations. However, the companies still aim at being free from taxes and tariffs and to benefit from government subsidies and enforced monopoly. After deregulation, which started in the U.S. in 1978, most authorities believed that a contestable market in the airline industry should be like this: competitors can enter the airline market at any time, while consumers can easily switch between carriers (Martin, 2002).

According to the contestable-market hypothesis, potential competition is quite effective. Even if an industry is completely monopolized, the existence of potential competition may be enough to force the monopoly to set competitive prices. Bailey and Friedlander (1982) argued that: "City pair markets are characterized both by easy entry and exit and significant economies of scale... potential competition may be an adequate policeman in such markets" (p. 1026). He also pointed out that although a route is flown by a single carrier, other carriers who have stations at both end-point cities can easily enter the market

when profits appear promising. The reason that airline markets can be contestable is that their capital costs are not sunk. From Bailey's argument, it seems easy to change a monopolized market to a contestable market. When one airline route brings a huge profit for firm A, it will stimulate other firms to add a new route. According to the limit-pricing theory (or theories), potential competition is of some importance. Even though the incumbent firm may prevent entry through a limit price, the price is at least reduced below the monopoly level.

According to the critics of these theories, potential competition may not be effective at all. The basic argument is that the incumbent has no reasons to reduce prices before entry. When a potential competitor decides whether to enter or not, it will rationally look at the market conditions that will prevail after entry, not at the price level before entry (Bergman, 2003).

In addition, the skills required to effectively manage airlines changed with deregulation. Before deregulation, managing the regulatory process was an important skill for managers, while after deregulation, there was greater demand for managing in competitive environments (Kole and Lehn, 1999).

The airline industry in Australia is useful to test Baumol's contestable market model. Thirty years ago, Australia had two airline companies. One major airline, TAA (Trans-Australia Airline), was government-owned and very successful while the other one, AAA (Ansett Airlines of Australia), was owned by a group of shipping companies and was unsuccessful. At that time, the airline industry in Australia was a natural monopoly. But the Australian government decided to keep both companies in order to maintain a certain level of competition. In spite of the Civil Aviation Agreement Act of 1952, AAA still went bankrupt at

last because of inferior technology and lack of capital. The failure in Australian airlines emphasizes that a single supplier dominates with large capital and advanced technology. Both of these factors are entry barriers protecting the incumbent. Each new supplier will find that it is very difficult to enter into the market without superior technology. The case proves that the technology should be at the same level for all companies in a contestable market.

By now, it is well confirmed that airline markets are not perfectly contestable. However, it is also very difficult for any market to fully satisfy the assumptions of contestability. Therefore, we generally use "degree" to adjust whether a market is close to a perfectly contestable market (Scheraga, 2004).

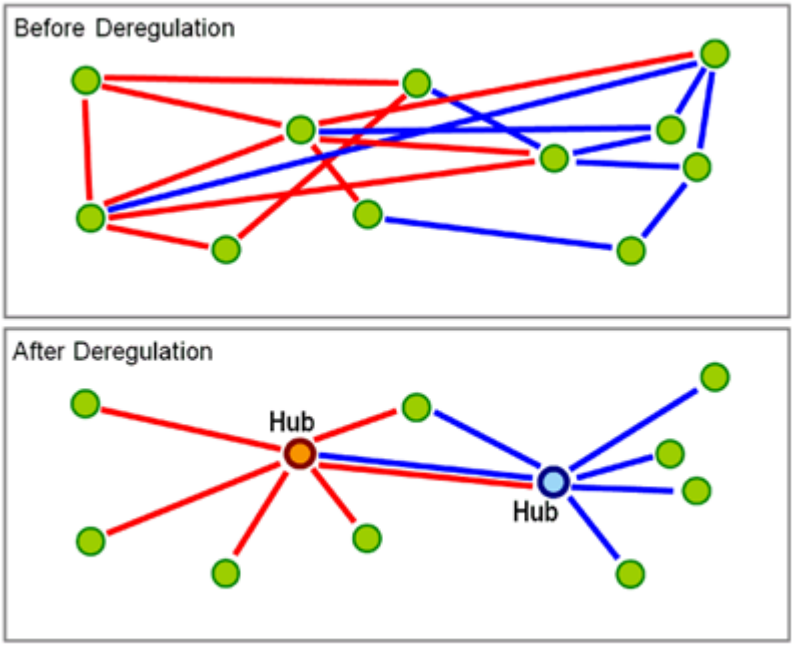
3.2 Entry and exit

In theory, it is easy for any company to enter or exit a contestable market. On the other hand, this market indeed brings benefits to consumers. Bergman (2003) states that the threat of entry can induce incumbent firms to reduce price and improve quality. When new firms enter into an industry, the threat of entry could still have some effect on fares. They will also bring changes in demand and technology. At the same time, more firms stimulate competition. Moreover, these new firms will break the monopoly and affect the levels of production efficiency.

Joskow et al. (1994) considered the relationship between the incidence of entry and exit and the level of prices pre-entry or -exit. They used "yield "which represents average revenue per passengers that fly at each fare price. They found that carriers enter city pairs, if those city pairs fit well in an established route network or in a new network in the making, and

whichever service would be low-cost. Carriers exit city pairs on whichever service would be high-cost because they do not fit well in an established route network.

Figure 1 - Hub differences between regulation and deregulation



Source: Siddiqui (2008)

For many years the conventional wisdom was that fixed costs had a significant effect on industrial concentration. Fixed costs lead to increases in both industrial concentration and profits. Moreover, fixed costs give rise to scale economies. Empirical research on the role of fixed costs on entry and exit decisions has shown that fixed costs cannot straightforwardly explain short-run changes, even if scale economies can explain long-run trends (Bresnahan and Reiss, 1994).

Since airline deregulation has been accepted by several countries (Australia, Europe, and the U.S. for example), it has caused a dramatic change in the industry. Airline deregulation gives rise to a removal of entry, exit and price restrictions, which attracts a large number of new carriers. In this competitive market, all the airline companies have to try their best to provide quality services and low fares. Empirical papers from the airline industry indicate that incumbents decrease price and maintain output in response to entry while

survivors increase both price and output in response to exit. After deregulation, airlines are free to make their routes and prices (Smith and Cox, 2007).

Several airlines decided to use a hub-and-spoke system. Hub and spoke is arranged like a chariot wheel, in which all traffic moves along spokes connected to the hub at the center. Hub-and-spoke system has many advantages. In a 'hub-and-spoke' network, an airline concentrates most of its operations in one airport. In this way, most passengers travel through a hub airport, from which all connections are extended like the spokes of a wheel. This network allows quite remarkable cost savings on account of the economies of scale, scope and density inherent in a network structure. A hub allows an airline to serve a large number of routes. Many airlines are now providing passengers with longer routes at their particular hub airports by a change of plane at the hub (Borenstein, 1989).

Hub-and-spoke network systems have a big effect on the entry and exit decision of rival airlines. The challenges for foreign and domestic entrants are different. A lot of countries have their own trade protections, and foreign entrants may suffer cost disadvantages and their lack of familiarity with local markets. Foreign entrants may be less constrained by the need to achieve minimum efficient scale in limited domestic markets. It is possible for foreign entrants to significantly underprice domestic incumbents because of factor price or technology advantages. In the situation where foreign entrants occupy the low price, standardized mass market segment and domestic firms occupy up-market custom niches, domestic entrants may be noncompetitive. Geroski (1995) found that foreign entry cannot stimulate as many incumbents to increase productivity as domestic entry does; but foreign entry is also impeded when entry of domestic firms is blocked.

In general, there are two viewpoints about the hub-and-spoke network system regarding its effects on competition and fares. One assertion is that this system can provide more profit to airlines under monopoly. Berechmand and Shy (1996) showed that if an airline firm chose a network structure, flight frequency increases and price decreases. In this situation, passengers also gained extra benefits. Firstly, these passengers saved money. In the previous non-hub system, travellers have to buy two tickets if they want to go to a city which does not have a direct route from their starting place. Second, they saved time. Moreover, the airline firm chose a hub-spoke network if this extra benefit was large. If not, the airline firm chose a point-to-point network. On the other hand, Spiller (1996) proved that a hub-and-spoke system can allow airlines to exploit economies of density. Moreover, regional carries might not survive in hub-spoke networks. Hendricks et al. (1997) studied this problem. They concluded that "the complementarities associated with a hub-spoke network can deter regional carriers from entering" (p. 300).

Peteraf (1995) emphasizes several advantages of hub-and-spoke network systems. A hub-and-spoke structure requires fewer flights. If we have *n* nodes, only *n*-1 routes are enough to connect to each other. Moreover, it creates advantages of scope. Therefore, it provides better utilization of existing capacity. Furthermore, spokes are simple, so it is easy to create new routes and for airlines to find the best route. Therefore the average cost of creating a new route in this structure is lower. Compared with a linear origin-destination, the cost of adding a new spoke is averaged over many other spokes. Today, most airlines have their own "hub".

3.3 Sunk costs

Clark (1994) states that sunk costs are an important element for a company to design and constitute their strategy. Moreover, sunk costs are a useful analytic tool to help us understand economic stability and industrial rigidity. In economics, sunk costs are past opportunity costs that have been incurred and cannot be recovered.

Sunk costs can constitute an important barrier to entry. Sunk investments that give rise to these barriers may be endogenous (for example, the prophase brand-building expenses such as advertising); or largely exogenous (for example, the production facilities with little value in other uses). In either case, sunk costs will put investments at risk due to the uncertainty of successful establishment in the market (Cabral, 2008).

Steele (1996) points out that the founders of price theory and opportunity costs were aware of sunk costs and argued strongly in favor of their exclusion from the costs of present or future actions. The logic was that the costs are no longer part of the opportunity cost since they are already foregone. Two kinds of fallacies about sunk costs have been identified. The first fallacy is due to the inclusion of sunk costs, when current projects are considered less profitable. Since even if the project is terminated these costs will not be recovered, there is no point during the assessment of profitability to take them into account. The second fallacy is that unfinished projects, in which the firm has incurred the irretrievable expenditures, should be finished just in case some costs might be recovered. Again, since even if the project is completed, it is uncertain if sunk costs will be recouped or not, they should not influence the decision to continue (Steele, 1996).

Schwartz and Reynolds (1983) have argued that contestable markets might only exist in a small neighbourhood of costs above zero sunk cost. Several economists argue that sunk costs are not taken into account when people make rational decisions.

Baumol et al. 1982 wrote that "The need to sink costs can be a barrier to entry" (p. 291). In one formalization it appears that the risk affects an entrant's expected rental rate of capital services as well as that "Any such difference in rental rates must be attributed to the possibility that the entrant may find himself forced to depreciate his capital fully during the disequilibrium period" (Martin, 2002, p. 291).

Baumol has modified the traditional contestable markets ideal and focused on different types of sunk costs since 2002. In his opinion, firms invest fixed sunk costs that are mandatory and substantial. In the 1980s, most economists believed that airline markets were becoming more and more contestable. In general, the airline industry is considered to have low sunk costs and low entry and exit barriers. Since aircraft is mobile and can be transferred to other markets, the cost of an airplane is not regarded as sunk: "in the long run, sunk costs are zero" (Baumol and Willing, 1982, p. 405). For example, a particular route where there are fixed costs (airfield) may considerably exceed their sunk costs because aircraft, may be used in other city pair markets. However, passengers prefer not to switch carriers along a route. This realistic problem creates a challenge to new entrants. If the incumbent has better information about passengers and their preferences, the entrant's expected sunk costs will be higher (Baumol and Willing, 1982).

Dunne (2011) argues that "a fundamental determinant of industry structure is the level of the sunk costs" (p. 2). If sunk costs are high, the industry will be concentrated. He considers

production facilities, advertising and R&D expenditures as the most important sunk costs. Hence, industries that are intensive in advertising and R&D can be expected to be concentrated, even in large countries.

Margaret and Suslow (2002) proved that many of the sunk costs are associated with intangibles. These include start-up losses, local advertising costs, and transaction costs. Advertising and R&D expenditures are endogenous choice variables for the firm and tend to increase with market size. Compared with a major carrier, a new incumbent has to spend much more to enhance its local identity. Moreover, a major carrier already has a reputation for safety. Sunk costs do not only exist in "neighbourhoods", but are also robust in the airline industry as a whole (Martin, 2002).

We can use sunk costs to explain the reasons for short run changes. For example, because of the deterrent effect that sunk costs exercise on newcomers, the number of firms may not increase with demand expansion. Similarly, in the presence of significant sunk costs related to exit, price decline or temporary demand slow down does not necessarily entail the exit of incumbents. Thus, sunk costs can increase concentration of industry or widen the range of prices between the firms that will enter or exit the market (Bresnahan and Reiss, 1994). At the same time, their impact on the size growth of firms or external financing of capital investment are also important factors (Cabral, 2008) .

Sunk cost is a barrier to entry. When part of incumbents' costs are sunk, entry renders part of the incumbents' capital stocks superfluous. Also, it reduces incumbents' rental cost of capital services, either to the resale value of capital or to zero. With lower economic costs and compared with the situation where costs are not sunk, incumbents produce more, for any

output level for the entrant. If incumbents' costs were not sunk, the entrant's equilibrium output would be higher, and entry would be more likely to be profitable (Martin, 2002).

3.4 Access to global markets

In many sectors of the economy, alliances have become a key strategy for companies, from manufacturing to service industries. Having coordinated flights can increase service levels and reduce consumer perceived risks. With the increase of international tourist arrivals, transfers bring the risk of missing connections and losing baggage. There is a view that airlines which do not take part in alliances will be severely disadvantaged. Also, carriers which are out of major alliances may be forced to become niche players (Oum and Park, 1997).

In fact, global alliances provide operators at least five main benefits: (a) national governments impose a tax for new route access into the market in order to protect the existing airline companies; (b) economies of scale and cost reductions, density and scope; (c) coordinated prices and schedules to optimize the demand for every flight; (d) opportunities to raise barriers and to reform industry structure against new entrants (Oum and Park, 1997); (e) An alliance airline can provide more itinerary choices to its customers. Sultan and Simpson (2000) suggest that consumer loyalty can be developed by providing bundled product and service packages, which will increase the value of the offer. As a result, an airline could offer greater values to passengers by extending its network with other airlines.

Most of research on alliances for the airline industry has focused on the firm's perspective. Price, product, promotion and placement are the four basic factors which affect a company developing to a global company. Moreover, the impact of traffic output , cargo

services (Morell and Pilon, 1999) and economic output (Oum and Park, 1997) can also affect the success of airline alliances. Due to the preference of passengers for extensive networks, wider route networks could attract more travelers. Entering a new foreign market, or even expanding in the same market will imply financial, political and market risks with which firms must contend (Morell and Pilon, 1999).

Oum et al. (1993) offer a more comprehensive definition of a global airline network, "a global airline network formed by a group of affiliated airlines which offer seamless services to consumers through a joint use of computer reservation systems, through fares and ticketing, automatic baggage transfer, coordinated flight schedules, code-sharing of flights, joint marketing, sharing of a frequent flier program, etc" (p. 15). The current belief in the airline industry is that when passengers transfer from one airline to another, they always want seamless travel (Bissessur and Alamdari, 1998).

In order to achieve seamless travel, the airline industry uses global alliances. The global alliances permit member carriers to share profits through a formula-based system and offer extensive code-share (an airline attaches its designator code to a service operated by another airline flight) options for its consumers. Codesharing has been positioned as a consumer-oriented initiative. Furthermore, with extended network offered by an alliance, it is much more convenient to make redemption of points for awards with any alliance partner for a greater variety of destinations (Sultan and Simpson, 2000).

Normally, studies on alliances have concentrated on operational and strategic problems related to the firm, such as partner relationships, partner selection, management issues and types of alliance (Bucklin and Sengupta, 1993).

Source: World Tourism Organization (UNWTO), 2012

As shown in figure 2, the United Nations World Travel Organization (UNWTO) recorded 980 million tourist arrivals in 2011, up from 536 million in 1995. Until 2008 the pattern was one of steady growth, with the exception of a plateau between 2000 - 2003 as a result of events such as September 11, SARS and global economic stagnation.

All top carriers are involved in one of the major global alliances (Gallacher, 1999). There were more than 280 alliances between 136 airlines in July 1994. Six years later, this number had increased to 579 alliances between 220 airlines. In 2011, there were more than 100 countries which signed “Open skies” agreements with the United States. Today, the industry serves nearly four million passengers per day (Robyn et al., 2007).

Currently, there are three major alliances worldwide: Star Alliance, Sky Team and One World. The Star Alliance was founded in 1997, and now has 28 member airlines operating more than 21,100 flights every day. These flights reach 1,356 airports and cover 193 countries,

with 678.5 million passengers annually (Shenzhen Daily, 2012). The second is Sky Team alliance which was founded in 2000. Since November 2012, SkyTeam flies to 1,000 destinations in 187 countries, and operates about 15,500 daily flights. Moreover, the alliance has 525 lounges around the world to serve 552 million passengers annually. The third alliance is One World alliance which was founded in 1999. By July 2011, One World alliance had already reached more than 870 destinations within 146 countries. It operates over 9,300 daily flights, carrying 335 million passengers on a combined fleet of over 2,400 aircraft (General Aviations News, 2011).

The events of September 11th 2001 caused an enormous financial crisis for the world airline industry. The disadvantage of the global market from excessive integration seemed to be realized in one night. Not only U.S. airlines suffered losses, but also non-U.S. Airlines. Wall and Sparaco (2007) found that European airlines announced reductions in workforce and service. However, this crisis promoted an intensified use of Information and Communication Technologies (ICTs).

4. The evolution of deregulation

4.1 Non-hub airports in the U.S.

Under regulation, airlines did not compete fiercely in the U.S. (Ben-Yosef, 2005). In 1938, the Civil Aeronautics Act (CAA), in which the industry succeed in establishing a system of protective economic regulation, was worked out. The CAA was an important milestone of the American airline industry (Borenstein and Rose, 2008).

Limited routes, low innovation and high price led to the regulation act at last ending. A

Civil Aeronautics Board (CAB) Special Staff Report published in July 1975 argued that "The industry is naturally competitive, not monopolistic" (Behrman, 1980, p. 24). They also reported that, in the last decade, the airline industry developed slowly in the U.S., only major cities such as New York, Chicago and Boston had some routes between each other. Railway and ocean were still common transportations. Monopolists spent limited amounts on improving airline services and technology (Ben-Yosef, 2005). Moreover, Behrman (1980) emphasized that the CAB refused to allow new airlines to enter the industry or existing carriers to enter each other's routes, because new entry would harm the financial interests of an existing carrier. In the mid-1970s, most of the airline carriers faced lower profits and almost could not maintain themselves. In May 1982, the CAB found that nine carriers were actually faced with "major contractions" over 7.5%. These contractions have also affected benefits for affected workers. Several states tried to deregulate. In this situation, the monopolists could not control the airline market by themselves any more. The deregulation stimulated a dramatic competition in the industry (Borenstein, 1989).

Since the American congress passed the Deregulation Act in 1978, the U.S. airline industry started to face free entry and pricing. Then, the U.S. launched a major route expansion. Airline carriers inaugurated service to new routes and new destinations across the U.S. and the Caribbean area. There was a dramatic rise in international flights from 1984 to 1996 (Southeast Asia, 2006). However, because of high fuel and labor costs, price wars and a poor economic environment, the unpredictable crisis broke incumbents' nice dream to make high profits by increasing routes through the airline industry. Bennett and Craun (1993) found that Southwest Airlines entry into the Oakland-Burbank intra-California route in 1990 resulted

in a 55 per cent price drop.

In January 1991, Pan American World Airways, which was the largest international air carrier in the United States, was forced to declare bankruptcy. In 1966, Pan American carried 6.7 million passengers and advertised its slogan “the World’s Most Experienced Airline.” Nevertheless, Pan American no longer enjoyed the official patronage after the post-war era and it had to attend the free market competition. With the advent of the first Gulf war, the price of fuel rose significantly. These unforeseen events faced Pan American to declare bankruptcy. Pan American failed in adjusting its management from a monopoly market to a deregulated one (Kahn, 2002).

Table 1 - Regional jets on U.S. domestic routes

Year	Routes with Regional Jets
1990	6
1991	14
1992	55
1993	86
1994	99
1995	97
1996	74
1997	100
1998	158
1999	263
2000	460
2001	564
2002	707
2003	854
2004	925
2005	1091

Source: Pai, 2008, p. 3

In order to survive in a free market, a new business model was developed: hub-and-spoke network, which became the major business model until now. Berry (1992) estimates a structural model of demand and price competition with differentiated product in the U.S. airline industry and finds that there are many advantages for the airline company to use an airline’s hub (as described in page 16 of this paper). Shortly after gaining absolute freedom to organize their own operations, most U.S. airline

companies adopted a ‘hub-and-spoke’ system for the structure of their routes rather than operating a large number of point-to-point, non-stop routes. Under this hub-and-spoke network, variable costs decreased and demand increased. If airlines want to build the hub and spoke networks along the regulated city pairs, they need many more passengers and aircraft. The preference of regional jets on U.S. domestic routes between 1990 and 2005 is shown in Table 1. Regional jet service started in 1990 and grew dramatically after 1996 (Pai, 2008). In order to satisfy airlines’ larger geographical focus, each new hub was required to feed as many passengers as possible through its spokes. Only in this way, an airline would not lose customers and market share.

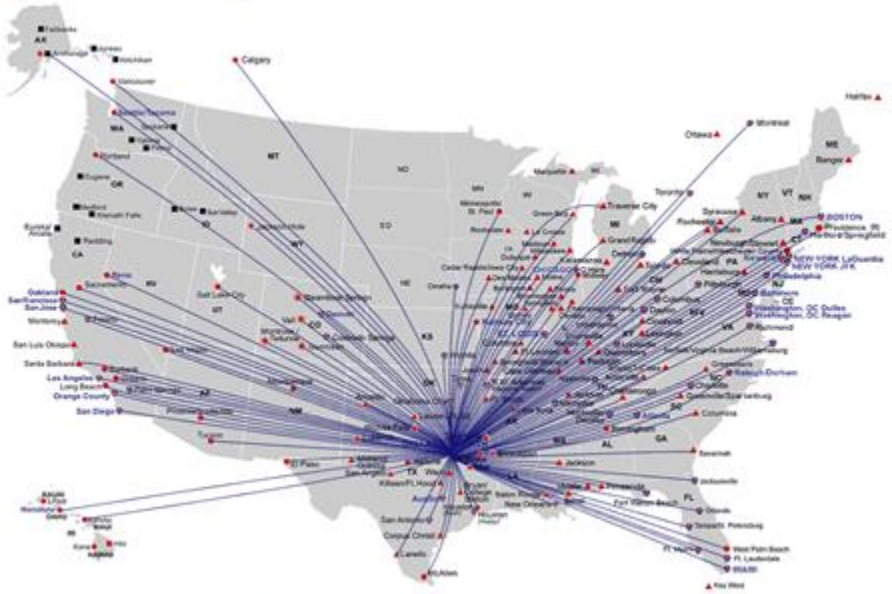
Goolsbee and Syverson (2008) show that in order to respond to the "threat of entry" by Southwest Airlines, which is a low-cost carrier, national carriers are lowering fares by strengthening consumer loyalties prior to entry of Southwest.

Cento (2007) identified the major changes happening in the U.S. market after almost 25 years since deregulation. These changes include many aspects: waves of mergers among the major carriers, entry of the low-cost carriers, general decline of airfares, rapid growth in the number of air travelers, the emergence of the hub-and-spoke system, and increased variability in fares across the market.

Airlines may abandon a broader approach to travel and integrate activities closer to the travel value chain. There may exist a potential market to build alliances with high speed rail providers, by taking closer account of customer preferences, and from customers who are willing to pay for seamless travel (Bissessur and Alamdari, 1998).

In fact, ~~if~~ everything else equal, a hub-and-spoke network can save cost in connecting the same nodes. In this structure, travelers can be free to create various channels. Moreover, this large network really reduces average cost through economies of scale, scope and density. Furthermore, the passengers enjoy the low-fares and benefits of schedule coordination. As a result, traveling between the cities through hubs is quite convenient for passengers to save time. All in all, a hub-and-spoke network system has so many advantages and attracts incumbents to invest and build their network systems.

Figure 3: Rout map from Dallas/Fort Worth hub



Source: American Airlines (2012)

For example, Delta Air Lines is an important airline in U.S. and is headquartered in Atlanta (Federal Aviation Administration-Airline Certificate information-Detail View, 2012). In the early 1990s, it began to operate from a small hub at Chicago. After discovering that it was a good try to build a hub, Delta continued to operate from Frankfurt Airport, Los Angeles International Airport, Orlando International Airport and a few others. Today, Delta operates seven domestic hubs and three international hubs which are Atlanta, Cincinnati, Detroit, Memphis, Minneapolis-St. Paul, New York-JFK, Salt Lake City, Paris-Charles de Gaulle,

Amsterdam and Tokyo-Narita hubs. All these commercial strategies bring Delta huge profits (Delta air lines, Oct 5th 2012).

At the same time, the other airline companies keep on enlarging their services as well. Currently, there exist several quite large hubs in United States, such as Chicago O'Hare hub, Miami hub, New York La Guardia & JFk hub, Boston & Raleigh/Durham hub, Los Angeles hub, San Francisco & San Jose hub, Dallas/Fort Worth hub. For example, Dallas/Fort Worth hub is the fourth largest International business hub in the world. In 2010, it transported 56,906,610 passengers in total. It is the main hub and largest hub for U.S. Airlines. As shown in Appendix A, there are more than 60 airlines from Dallas/Fort Worth hub to other major cities in the U.S. and Canada, such as from Dallas/Fort Worth hub to New York, Washington, Toronto, etc (Airports Council International, 2011).

Ciliberto and Williams (2010) were the pioneers to link the operating barriers directly to the "hub premium". Operating barriers include many aspects, such as limited access to ticket counters, boarding gates, baggage handling and storage facilities, as well as take-off and landing slots. However, online ticketing solves the problem of limited ticket counters. A report from the U.S. General Accounting Office (2003) shows that in the last fifteen years, online ticketing has skyrocketed, comprising more than 30% of sales in 2002 and an estimated 40% to 50% as of 2006.

In fact, a greater proportion of passengers traveling to and from network airline hubs are business travelers, purchasing more flexible and unrestricted tickets which are much more expensive. In spite of the higher price, most passengers are likely to place a high value on the convenience and time saving services which are high-frequency and nonstop flight offered by

the hub-and-spoke system (Lee and Jose, 2005).

4.2 Price wars in China

Price wars in airline markets are extensively observed and reported all around the world (Zhang and Round, 2011). Travelling by air is now very common in China. With the international airlines accessing the Chinese airline market, a ferocious price war has began. However, the prices for flight tickets are too low in some flight routes for all airlines in China. For example, the flight ticket from Zhengzhou to Shanghai which is nearly 998 miles sometimes costs only 15 dollars. Some small airline companies are very difficult to survive in such a competitive environment (SO HU news, December, 2006).

The main reason for the outbreak of a price war is the breakdown of collusion (Zhang and Round, 2011). “Chinese passengers have constantly witnessed overnight across-the-board increases in airfares” (p. 361). The situation in the Chinese airline industry is becoming anarchic. In one period, passengers could pay very low prices for flights, while in another period they have to pay tickets almost the full published fares. However, thanks to the strong competition in the airline market of China, in the years after price deregulation, passengers have enjoyed lower prices for airfares than before.

In 2004, in order to create the miracle of "one year to earn the 10-year money" (the net profit increases almost 9 times compared with the previous year), the Chinese airline industry apparently contributed to the domestic price war in full swing. Since the Sino-US aviation agreement came in force in 2004, low-cost airlines flourished in China. It is a huge challenge for the Chinese airline industry to develop in the face of well-established international players.

After a long periods of losses, the Chinese airline industry finally claimed to be profitable in 2004 (Yahoo news, January, 2005).

This huge profit is the product of price wars in the airline industry in China since 2004. Because the price war brought the lower airfares and better services than before, it made the number of passengers increase and increased the profit of the airline industry. For example, on the route from Shenzhen to Beijing, Air China offered an 80% discount from 15 to 16 December 2004 whereas the discount previously offered was only 30% at most (Youth Times, December, 2004). China Southern and Shenzhen Airlines matched this low price a few hours later and all flights in the following days were soon fully booked. However, this short price war ended days later after an “emergency meeting” between the sales managers of China Southern and Air China. All airfares rose to around 50% of the normal prices on 19 December 2004. This pattern of behaviour has been repeated on many city-pair routes from time to time in China. Facing this quick growth, Zhang and Zhou (2010) believed that the reason for this performance was the price war that stated in 2004.

This high level of competition could generate profit growth in the short term but it would also bring more problems such as flight delays and reduced flight safety. In order to save costs, some airline companies used smaller aircraft which have higher safety concerns. In November 2004, a small flight (CRJ-200) from the Yunnan branch of China Eastern airline crashed. It left 55 people dead and cost about 180 million Yuan.

At present, the greatest threat to China's civil aviation industry is not only intense domestic competition, but also the more powerful competitors from the international market. In 2005, China's airline industry was facing international competition (Lu, 2006). Firstly, the

official implementation of the Sino-U.S. aviation agreement made more international airline companies finally receive the “pass” to enter the Chinese market. Secondly, "cheap aviation" that was a whole new concept of civil aviation, landed into the Chinese airline market. At the same time, the simultaneous appearance of the domestic private airlines (Eagle, Spring and Autumn, Okay), changed the situation where the Chinese civil aviation industry was controlled by large Chinese national companies for 50 years. In order to develop in such a competitive market, China’s traditional airline companies (Air China, China Eastern Airlines, China Southern Airlines and Hainan Airlines) has to solve the following problems:

1. Flight delay problem

Flight delays are caused by several factors such as weather conditions, airport congestion, airspace congestion, use of smaller aircraft by airlines, etc (Vinayak and Mazhar, 2012). Flight delays are a common feature of the Chinese airline industry and the problem heavily affects the development of the industry. For example, there was a big snow in Beijing on February 15th 2005 which was the last day of the Spring Festival. According to statistics, there were more than 400 flights delayed in the Beijing Capital International Airport only on February 15th (Sina news, 2005). Several passengers from different flights put forward a claim for compensation to the airlines.

Regarding this situation, the Chinese traditional airline company should do their best to decrease delay problems and publish a series of policies in order to make up the loss of passengers. For the Chinese civil aviation industry, flight delays have always been a serious problem which has even evolved into a vicious conflict between passengers and airlines in recent years. From an economic efficiency rationale, airlines should be required to pay for the

bulk of flight delays remediation efforts (Britto et al., 2012). Only if the compensation for flight delays becomes reality, the Chinese civil aviation industry will be more competitive and develop further.

Although the Civil Aviation Administration of China (CAAC) published the "Flight delays economic compensation guidance" to solve the flight delays problem since late June 2004, many conflicts still could not be resolved. The fundamental reason was that the "Flight delays economic compensation guidance" was based on the basic methods to solve compensation problems specified only by the airlines themselves. Passengers should be entitled to compensation for flights where arrival is delayed by more than 3 hours and when the delay is not due to extraordinary circumstance (Brussels, 2011). It is very important to provide a standard of compensation clearly in order to make the Chinese airline industry more formable.

2. Truly equal installments on flights between China and the United States

The Sino-U.S. Aviation agreement fundamentally reshaped the commercial aviation relations between China and the United States. In all the Chinese civil aviation history, it is the first time that the domestic market became open. The agreement provides that Sino-U.S. airlines can have equal installments in the number of aircraft, fleet security, and domestic airlines in the future. The formally signed "Agreement" means that Chinese State General Administration of Civil Aviation intends to change from previous protectionist policies. By taking advantage of global alliance membership, Chinese airlines will gradually shift their focus from domestic to international markets to become global competitors (Airline Business, April 19th 2011).

3. Private capital enters the Chinese airline market

While the concerns about the effect of the Sino-U.S. Aviation Agreement on the domestic civil aviation industry have not been resolved, a new aviation concept and business model arises in the domestic civil aviation market in China. Thailand Asian Airlines has announced that it received the pass to become the first approved low-cost carrier flying into Chinese airspace. During the years from 2005 to 2007, the company has opened Thailand to Chengdu, Kunming and Xiamen routes. CAAC repealed rules that used to limit the introduction of private capital, and ensured that private capital has equal opportunity to enter this critical industry in order to encourage and attract private capital to invest in the civil aviation industry (Lin, 2012). This means that the CAAC has to open the door for both civil and international private capital to the low-cost aviation market in China.

For several major domestic civil aviation firms, there will be more pressure because the China civil aviation industry needs to compete not only with international airlines but also with other transportation modes such as high-speed railway (HSR). By 2012, China has already established the world's largest HSR system and it is a large threat to airline market. Price wars between airlines and HSR will inevitably occur. In order to survive in the price war, the carriers must increase their competitiveness in international markets and develop effective hub-and-spoke networks in order to achieve sustainable growth in the coming years. For the Chinese government, long term investment at hub airports and support to low-cost carriers are also essential (Fu et al., 2010).

The Chinese aviation industry is still at the primary stage of competition. Many observers worry that it is very difficult to develop the Chinese own airline industry in this

situation. Although opening the market brings the threats, it is necessary to improve efficiency and lower prices. The civil aviation industry in china has realized a high level market-oriented innovation through a three decade long industry reform, thus now prices are more responsive to the market (Zhang, 1998).

4.3 Low cost airlines in Europe

In Europe, aircraft is the second most important mode of transport, only behind the private motor car in most countries. Nearly 14% of Europeans choose air travel for long distance trips (more than 100 km) on their holiday travel (European Commission, 2003). Obviously, for the topography of Europe, air travel has absolute advantages. Island destinations like Cyprus, the Balearic or the Canary Islands and long-haul destinations across Europe are almost uniquely reached by air.

Pompl (2002) states that in the traditional model, airlines aimed to minimize consumer surplus and divided the market according to different levels of willingness and ability to pay. The European airline market is characterized by two major different airline business models: the full service airlines and the low cost airlines. In 1993, 'liberalization' of the European airlines market took place with free pricing and cabotage. In fact, these liberalized bilateral agreements were first introduced on the U.S. and intra-European markets. Although deregulated areas support the expansion of low-cost carriers, Southeast Asia and Oceania are still subject to regulation in the sharing of the sky. The low-cost business model has emerged in those geographical areas after five years in 1999. Plans are underway to develop such enterprises in Saudi Arabia and Mexico (Beigbeder, 2007). Borenstein (1989) states that in the

U.S., low-cost carriers (LCC) have become very popular since the 1990s. However, in Continental Europe, low cost air travel has become more popular only recently with a huge number of start-ups since 2002.

Francis et al. (2006) state three ways to develop the low cost business model: 1. Southwest copy-cats: This category consists of the airlines which were founded from independent entrepreneurs and these carriers stand closest to the Southwest model. 2. Subsidiaries: Typically, those airports already have LCCs, which are subsidiaries of national carriers. 3. Diversified charter carriers: These are low cost subsidiaries which are founded by charter carriers to provide scheduled LCC flights and are state subsidized.

According to Beigbeder (2007), a low-cost airline has several characteristics: 1. Connections with airports not always focused mainly due to lower taxes and a higher rotation of flights. 2. Only one standardized offer with a single class for travelers, similar cost structures with charter airlines. 3. Concentration on the price factor; in order to reduce costs, the airline companies only provide minimal simplified services. 4. Reduction of individual space in each unit, for more seats. 5. Using a larger rotation of aircraft, for saving time to stop or changing secondary airports.

In Europe, the low cost airline sector has grown immensely and has experienced a large number of failures or take-overs. According to Barrett (1999), one important requirement to develop a successful low cost airline is a large support by customers. European low cost airlines such as Ryanair (Ireland) and Easy Jet (UK) have been very successful in attracting customers with their low airfares over the last years. But in the following years, passengers might have accepted the low level of services provided by the airlines and expect the low cost

airlines to provide additional services under the growing competitive environment. Thus, LCCs were successful at first, because they have a strong appeal to customers. However, with the development of new low-cost airlines, some of the incumbent network carriers would probably not survive. Airlines such as Ciao Fly, Goodjet, AirLib or Aeris Express could not be profitable enough to maintain their activities on the market in the nineties. The established European airlines have all faced pressure in the last few years, with a drop in profitability. This situation forced them to rethink their traditional business model.

In order to explain why the low cost carriers have experienced decreasing annual passenger growth year after year, Boston Consulting Group (2004) revealed that these carriers had already taken up to 60% of the passenger growth from the legacy airlines. In 2002, European Low Fares Airline Association (ELFAA) conducted a study which concluded that approximately 40% of the traffic was substitution, while the remaining 60% was stimulated (CAA, 2006). Moreover, according to Lawton (1999), a low price cannot guarantee customer loyalty, but it will increase the number of low cost airlines on the market. At the same time, the lowest price cannot prevent the company from losing market share. Furthermore, the customers increase their demand for new experiences and the satisfaction of their needs. After comparing several airlines, customers become less loyal to any particular supplier.

LCCs promote intense competition in the airline industry. In order to be profitable, one of the key strategies for airlines is the choice of network. Reynolds-Feighan (1994) stated that "no matter for a passenger or freight operator, the operation and profitability of an airline depends crucially on the network over which services are offered. The airline's network represents at once its production plan and its product" (p. 195). Numerous studies have

attempted to analyze the use of hub-and-spoke (HS) networks in a deregulated market. Borenstein (1989) finds that higher airfares follow with more routes and more hubs. Hub airports could easily win new hub carriers. Europe already has relatively stable hub and spoke networks. Adler (2005) argued that in spite of the market and network advantages enjoyed by the large, established carriers, the airfares would still fall in a competitive market.

As hub operation is a specialized investment, hub competition in the airline industry is limited by relatively high switching costs. Air service agreements restrict traffic rights and make switching unattractive in some cases. Moreover, as many hubs are slot coordinated, it is not possible to trade slots so that airlines are locked in. Operating a hub system is much harder in Europe than in United States. Adler (2005) argued that the spatial size of European countries is relatively smaller than United States. As a result, short distance travel between different cities within a country will make airline travel unappealing. Compared with flying between two domestic endpoints, a preferred choice would be to simply take the train or the bus. Even worse, the European government remove the subsidies, which exposed the airlines to losses. These changes are argued to lead to the following results: 1. An increase in service frequency and a decline in aviation prices; 2. A decline in the total number of active airlines (Adler and Golany, 2001). In order to provide information on the most adaptable and profitable hub-spoke networks available under a competition environment, Adler (2005) develops a model framework and applies it to Western Europe. Europe is now reaping the benefits of its own process of airline deregulation, a process that has been more gradual than in the U.S.

Figure 4. European Low Cost Carrier route network in 2000

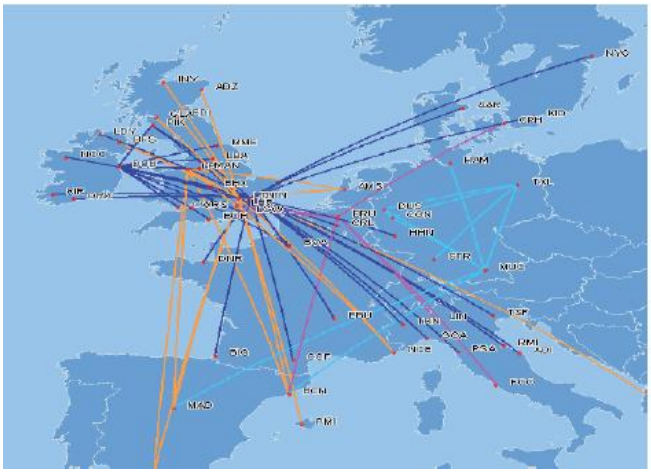
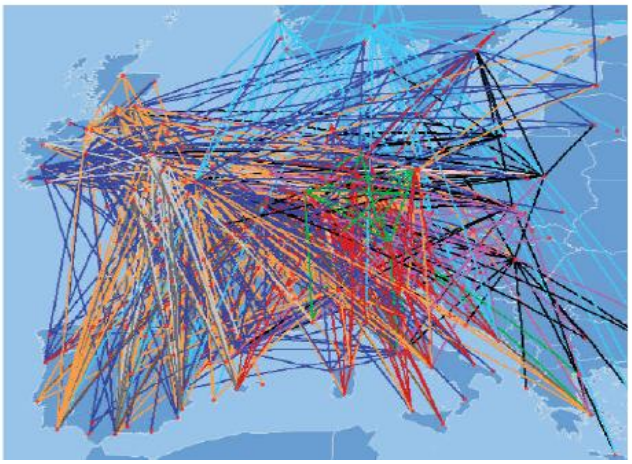


Figure 5. European Low Cost Carrier route network in 2006



Source: CAA, 2006

5. Summary and conclusion

Aviation is at the heart of global economic development. At the same time, global economic growth will shape future aviation. The growth of aviation as well as its local and global impacts has created serious problems which must now be studied. Further steps are needed to truly liberalize this global industry.

In this paper, we discussed the recent history of the airline industry. We showed how the airline industry changed from a monopolistic to a competitive market. Also, the advantages and disadvantages of different market structures were argued. In order to survive in such a competitive environment, airline companies should develop more advanced technology for planes, provide better services and control ticket prices.

In the first section, we introduced the current situation of airline industry. We stated

that the essential strategy for airlines was to develop in a global market.

In the second section, we reviewed the traditional regulation polices and compared the monopolistic and competitive markets. We analyzed the advantages and disadvantages in these two markets. We discussed different measures of airline output and found that international economies of scale are important.

In the third section, we considered the different possible market structures. We discussed the opportunities and threats of each market structure from different aspects, such as entry/exit, suck costs and access to global markets. We concluded that participating in airline alliances was the best way to survive in today's market.

In section 4, we analyzed the evolution of the airline industry in the United States, China and the Europe. The United States adopted the hub-and-spoke system. China gradually begins to open its market and is still at the primary stage of competition. During this process, Chinese aviation faces several obstacles. However, the only way to keep developing for the Chinese airline industry is to enter the international market. By developing new low-cost airlines, Europe extends its airline network worldwide. But compared with the U.S., European airports are still inefficient.

Bibliography

Adrangi, B., Chow, G., Raffiee, K., (1999) "The Effects of Market Structure and Technology on Airline Fleet Composition after Deregulation", *Review of Industrial Organization,* 15(1):77-88.

Airports Council International, (2011) *Passenger Traffic 2010 Final*, Retrieved August 6, www.aci.aero/.

Airline business, (2011) *China's air transport plan: rising dragon*, April 19th, www.flightglobal.com/news/articles/chinas-air-transport-plan-rising-dragon-355695/.

Adler, N., (2005) "Hub-Spoke Network Choice Under Competition with an Application to Western Europe", *Transportation Science*, 39(1):58-72.

Adler, N., Golany, B., (2001) "Evaluation of deregulated airline networks using data envelopment analysis combined with principal component analysis with an application to Western Europe", *European Journal of Operational Research,* 132(2):260-273.

Antoniou, A., (1991) "Economies of scale in the airline industry: the evidence revisited", *Logistics and transportation review,* 27:159-184.

Bailey, E.E, Friedlander, A.F., (1982) "Market structure and multiproduct industries", *Journal of Economic Literature,* 20:1024-1048.

Baltagi, B.H., Griffin, J.M., Rich, D.P. (1995) "Airline deregulation: The cost pieces of the puzzles", *International Economic Review*, 36(1):245-260.

Barrett, S., (1999) "Peripheral market entry, product differentiation, supplier rents and sustainability in the deregulated European aviation market", *Journal of Air Transport Management*, 5(1):21-30.

Baumol, W.J., Elisabeth B.E., Willig, R.D., (1977) "Weak Invisable Hand Theorems on Pricing and Entry in a Multiproduct Natural Monopoly", *American Economic Review*, 41(2):350-365.

Baumol, W.J., Panzar, J.C., Willig, R.D., (1982) *Contestable Markets and the Theory of Industry Structure,* Harcourt Brace Jovanovich Inc..

Behrman, B., (1980) "The Civil Aeronautics Board", in James Q. Wilson (ed.), *The Politics of Regulation*, Basic Books.

Ben-Yosef, E., (2005) *The Evolution of the US Airline Industry: Theory, Strategy and Policy,* Springer.

Bennett, R.D. and Craun, J.M., (1993) *The airline deregulation Evolution Continues: The Southwest Effect* , US Department of Transportation mimeo.

Beigbeder, C. (2007) "Le 'Low Cost': un levier pour le pouvoir d'achat?", Ministère de l'économie, des finances et de l'emploi , 15:1-189.

Berechman, J., Shy, O., (1996) "Airline Deregulation and the Choice of Networks", *Advances in Spatial Equilibrium,* 8:56-138.

Bergman, M., (2003) *Potential Competition: Theory Empirical Evidence and Legal Practice*, Discussion paper 1-19, Uppsala University.

Berry, S., (1992) "Estimation of a Model of Entry in the Airline Industry", *Econometrica*, 60:889-917.

Bilotkach, V., Fageda, X., Flores-Fillol, R., (2013) *Airline Consolidation and the Distribution of Traffic between Primary and Secondary Hubs*, Research paper 1-37, *Adreçar comentaris al Departament d'Economia / CREIP.*

Bissessur, A., Alamdari, F., (1998) "Factors affecting the operational success of strategic airline alliances", *Transportation*, 25, 331-355.

Borenstein, S., (1989) "Hubs and High Fares: Dominance and Market Power in the U.S. Airline Industry", *The RAND Journal of Economics*, 20:415-436.

Borenstein, S. and Rose, L.R., (2008) *How Airline Markets Work...Or Do They? Regulatory Reform in the Airline Industry*, Working Paper 1-105, University of Chicago.

Bresnahan, T., Reiss, P., (1994) "Measuring the Importance of Sunk Costs," *Annales D'Economie et de Statistique*, 34:181-217.

Britto, R., Dresner, Voltes, A.M., (2012) "The Impact of Flight Delays on Passenger Demand and Societal Welfare", *Transportation Research: Logistics and Transportation Review,* 48(2):460-469.

Brussels, (2011) *A Budget for Europe 2020: the current system of funding, the challenges ahead, the results of stakeholders consultation and different options on the main horizontal and sectoral issues*, Working paper 1-215, European Commission.

Bucklin, L. and Sengtupa, S., (1993) "Organising Successful Co-Marketing Alliances," *Journal of Marketing*, 57(4):32-46.

Butler, D.L., (2002) "Information control and the United states airline industry", *The Newest Version Written testimony before the National Commission to Ensure Consumer Information and Choice in the Airline Industry*, 1:1-19.

CAA, (2006) *No-frills Carriers: Revolution or Evolution?*, Nov 15th, www.caa.co.uk/docs/33/cap770.pdf.

Cabral, L.M.B., Ross, T.W., (2008) "Are Sunk Costs a Barrier to Entry?", *Journal of Economics & Management Strategy*, 17(1):97-112.

Captain, P.F., Sickles, R.C., (1997) "Competition and Market Power in the European Airline Industry: 1976–90", *Managerial and decision economics*, 18:209–225.

CBC News, (2009) *Air Canada History*, May 14th, http://en.wikipedia.org/wiki/Air_Canada.

Cento, (2007) "Assessment of new hub-and-spoke and point-to-point airline network configurations", *Transport Reviews*, 27(5):529-549.

China Daily, (2012) *Izzie Lin Private Capital Amounts to 72.4 Billion Yuan in China's Civil Aviation Industry,* August 13th, http://www.wcarn.com/cache/news/20/20822.html.

Ciliberto, F. and Tamer, E., (2009) "Market Structure and Multiple Equilibria in the Airline Industry", *Econometrica*, 77(6):1791-1828.

Ciliberto, F. and Williams, J., (2010) "Limited access to airport facilities and market power in the airline industry", *Journal of Law and Economics*, 53(3):467-495.

Clark, G.L., (1994) "Exit, the firm and sunk costs: reconceptualizing the corporate geography of disinvestment and plant closure", *Progress in Human Geography*, 21(3):338-358.

Daraban, B., Fournier, G.M., (2008) *Incumbent responses to low-cost airline entry and exit: A spatial autoregressive panel data analysis*, Working paper 15-24, Florida State University.

Delta air lines, (2012) *Delta expands Paris service airline maintains capacity discipline while assigning new routes*, http://news.delta.com/index.php?s=43&item=1724.

Doganis, R., (1994) "The impact of liberalization on European airline strategies and operations", *Journal of Air Transport Management*, 1:15-25.

Doole, I., Lowe, R., (2008) *International marketing strategy*, Seng Lee Press.

Dunne, T., Klimek, S.D., (2011) *Entry, Exit and the Determinants of Market Structure*, Working paper No. 15313, National Bureau of Economic Research.

European commission, (2003) *Commission of The European Communities*, Jan 21th, http://eur-lex.europa.eu/LexUriServ/site/en/com/2003/com2003_0027en01.pdf.

Federal Aviation Administration-Airline Certificate information-Detail View, (2012) *Federal Aviation Administration,* July 8th, www.webcitation.org/5vt5CKeQc.

Francis, G., Humphreys,I., Ison, S., Aicken, M., (2006) "Where next for low cost airlines? A spatial and temporal comparative study", *Journal of Transport Geography* 14(2):83-94.

Fu, X., Oum, T.H., Zhang, A., (2010) "Air transport liberalization and its impact on airline competition and air passenger traffic ", *Transportation Journal*, 49(4):24-41.

Gallacher, J., (1999) "Circling the globe", *Airline Business*, 7:34-37.

General Accounting Office, (2003) "Airline Ticketing: Impact of Changes in the Airline Ticket Distribution Industry", *General Accounting Office Reports & Testimony,* 3:749.

General Aviations News, (2011) *100 years of flying high*, Oct 6th, www.trichyportal.com/forum/viewtopic.php?f=3&t=461.

Geroski, P.A., (1995) "What Do we Know about Entry?", *International Journal of Industrial Organization*, 13:421-440.

Gordon, R.J., (1990) *Productivity in the Transportation Sector*, Working paper 3815, National Bureau of Economic Research.

Goolsbee, A. and Syverson, C., (2008) "How Do Incumbents Respond to the Threat of Entry? Evidence from the Major Airlines", *Quarterly Journal of Economics*, 123(4):1611-1633.

Hendricks, K., Piccione, M. and Tan, G., (1997) "Entry and exit in hub-spoke networks", *RAND Journal of Economics*, 28(2):291-303.

International Labour Office, (2013) "Civil aviation and its changing world of work: Issues paper for discussion at the Global Dialogue Forum on the Effects of the Global Economic Crisis on the Civil Aviation Industry", *Geneva,* 1:1-46.

Joesch, J.M., Zick, C.D., (1994) "Evidence of changing contestability in commercial airline markets during the 1980s", *Journal of Consumer Affairs*, 28(1):1-24.

Joskow, A.S., Werden, G.J., (1994) "Richard L. Johnson, Entry, exit, and performance in airline markets", *International journal of industrial organization,* 12:457-471.

Kahn, A.E., (2002) "The Deregulatory Tar Baby: The Precarious Balance Between Regulation and Deregulation, 1970-2000 and Henceforward", *Journal of Regulatory Economics*, 21(1):35-56.

Kirby, M.G., (1986) "Airline Economics of 'SCALE' and Australian domestic air transport policy", *Journal of Transport Economics and Policy,* 20(3):339-352.

Klein, B., Wiley, J.S.W, (2003) "Competitive price discrimination as an antitrust justification for intellectual property refusals to deal", *Antitrust Law Journal,* 70(3):599-642.

Kole, S.R., Lehn, K.M., (1999) "Deregulation and the adaptation of governance structure: the case of the U.S. airline industry" *Journal of Financial Economics,* 52(1):79-117.

Koontz, H.D., (1951) "Economic and managerial factors underlying subsidy needs of domestic trunk line air carriers", *Journal of Air Law and Commerce,* 18(1):127.

Lawton, T.C., (1999) "The Limits of Price leadership: Needs-based Positioning Strategy and the Long-term Competitiveness of Europe`s Low Fare Airlines", *Long range planning,* 32(6):573-586.

Lee, D. and Jose, M., (2005) "The Impact of Passenger Mix on Reported 'Hub Premiums' in the U.S. Airline Industry", *Southern Economic Journal*, 72(2):372-394.

Levine, M.E., (1965) "Is regulation necessary? California air transportation and national regulatory policy", *Yale Law Journal*, 74:1416-1485.

Lu, H.T., (2006) *China Daily,* May 25th, http://usa.chinadaily.com.cn/

Margaret, L., Suslow, V., (2002) *What Determines Cartel Success?,* Working Paper 02 - 001 University of Michigan Business School.

Martin, S., (2002) "Sunk cost and entry", *Review of Industrial Organization,* 20:291-304.

Mazzeo, M.J., (2003) "Competition and Service Quality in the U.S. Airline Industry", *Review of Industrial Organization*, 22:275–296.

Mckenzie, D., Christopher, W., (2006) "Estimating Production Functions Using Inputs to Control for Unobservables", *Review of Economic Studies,* 70(2):317-341.

Morell, P.S. and Pilon, R.V., (1999) "KLM and Northwest: A survey of the impact of a passenger alliance on cargo service characteristics", *Journal of Air Transport Management,* 5:153-160.

Ng, C.K., Seabright, P., (2001) "Competition, Privatization, and Productive Efficiency: Evidence from the Airline Industry", *The Economic Journal*, 111:591-619.

Oum, T.H., Stanbury, W.T., Tretheway, M.W., (1993) "Airline Deregulation in Canada and its Economic Effects" *Transportation Journal*, 20(4):4-22.

Oum, T.H. and Park, J.H., (1997) "Airline alliances: current status, policy issues and future directions", *Journal of Air Transport Management*, 3(3):133-144.

Pai, V.A., (2008) *Essays in Transportation Economics*, Working paper 1-103, University of California.

Peteraf, M.A., (1995) "Sunk Costs, Contestability and Airline Monopoly Power", *Review of Industrial Organization*, 10(3):89-306.

Reynolds-Feighan, J. (1994) "The EU and US air freight markets: network organization in a deregulated environment", *Transport Reviews: A Transnational Transdisciplinary Journal*, 14(3):193-217.

Pompl, W., (2002) *Luftverkehr: Eine ökonomische und politische Einführung*, Heidelberg.

Robyn, D., Reitzes, J., Moselle, B., (2007) *"Beyond Open Skies: The Economic Impact of a US-EU Open Aviation Area"*, The Brattle Group, 1:50-73.

Scheraga, C.A., (2004) "Operational efficiency versus financial mobility in the global airline industry: a data envelopment and Tobit analysis", *Transportation Research Part A: Policy and Practice* 38A(5):383-404.

Schwartz, M., Reynolds, R.J., (1983) "Contestable Markets: An Uprising in the Theory of Industry Structure: Comment", *American Economic Review*, 73:488-490.

Shenzhen Daily, (2012) *SZ Airlines expands through Star alliance*, December 3rd, http://szdaily.sznews.com/html/2012-12/03/content_2299765.htm.

Siddiqi, A., (2003) *Deregulation and Its Consequences*, Centennial of Flight Commission.

Sina news, (2005) *Flights delayed due to big snow in Peking*, Feb 16th, http://news.sina.com.cn/s/2005-02-16/09125114662s.shtml.

Southeast Asia, (2007) *Prying open Asean's Skies*, July 6th, http://atimes.com/atimes/Southeast_Asia/IG06Ae01.html.

Smith J., F.L., Cox, B., (2008) *Airline deregulation*, The Concise Encyclopedia of Economics.

SO HU News, (2006) *Low air fare from Zhengzhou to Shanghai*, April 8th, http://news.sohu.com/20061226/n247258063.shtml.

Spiller, P., Berry, S., Carnall, M., (1996) *Airline Hubs: Costs, Markups, and the Implications of Customer Heterogeneity*, Working paper 183-213, University of California, Berkeley.

Steele, D. R., (1996) "Nozick on Sunk Costs", *Ethics*, 106(3):605-620.

Strassmann, D.L., (1990) "Potential Competition in the Deregulated Airlines", *The Review of Economics and Statistics*, 72:696-702.

Sultan, F., Simpson, M.C., (2000) "International service variants: Airline passenger expectations and perceptions of service quality", *Journal of Services Marketing*, 14(3):188-216.

Suzuki, Y., (2000) "The Relationship between On-Time Performance and Airline Market Share: A New Approach", *Transportation Research Part E*, 36:139–154.

Tybout, J., (2000) "Manufacturing firms in developing countries: How well do they do, and why?" *Journal of Economic Literature*, 38:11-44.

Verhoef, E.T., Pels, E., (2004) "The economics of airport congestion pricing", *Journal of Urban Economics, 55:*257-277.

Vinayak, D. and Mazhar, A. (2012) "The Impact of Airline Flight Schedules on Flight Delays", *Manufacturing and Service Operations Management*, 14(3):423-440.

Wall, R., Sparaco, P., (2007) "A Mad, Mad World: European Perspective: Airline Industry is Woefully Inadequate", *Aviation Week & Space Technology*, 8:425-430.

Wolf, H., (2004) "Airport Privatisation and Regulation: Getting the Institutions Right", *The Economic Regulation of Airports*, 2:201- 212.

Yahoo news, (2005) *China Aviation Industry Profit in 2004*, January 18th, http://biz.cn.yahoo.com/050118/16/6pqw.html.

Youth Times, (2004) *Short-term low ticket price in airline*, May 1st, www.qnsb.com/

Zhang, A., (1998), "Industrial reform and air transport development in China", *Jounal of air Transport Management*, 4:155-164.

Zhang, Y. and Round, D. K., (2011) "Price Wars and Price Collusion in China's Airline Markets", *International Journal of Industrial Organization*, 29(4):361-372.

Zhang, Z.J. and Zhou, D.S., (2010) "The Art of Price War: a Perspective from China", *International Journal of China Marketing*, 1:1-28.