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Modeling the Effects of Air Transport Liberalization on the Airline Industry

An Honors Thesis Presented

by

Pukar KC

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Abstract

The thesis develops theoretical models to examine the effects of air transport liberalization on the airline industry. The models make use of Nash non cooperative, Stackelberg and Cournot game models to illustrate how the airline industry is impacted when liberalization in the form of granting air traffic rights and antitrust immunity to airlines is implemented. Beginning with the discussion of regulation in the airline industry, the thesis goes on to study the spread of air transport liberalization in several parts of the world. The effects of liberalization are analyzed in context of air fares, route operation structure, and strategic behavior of airlines. The study shows that while it is not clear that liberalization would lead to a decrease in fares in all routes, it does lead to airlines forming a hub and spoke operation structure, and engenders incentives among airlines to collude to achieve lower operating costs and higher profits.

Introduction

It has been more than one hundred years since humankind has learnt how to fly, and commercial airlines today are one of the biggest industries in the world. This high technology industry has generated tremendous employment, and has enabled the development of trade and tourism everywhere. It has also facilitated globalization by the virtue of which we feel as if the world has become smaller.

For decades, the airline industry remained one of the most regulated industries. The Airline Deregulation Act of 1978 in the United States challenged the age old dogma that commercial aviation should be tightly regulated and monitored by the government. The act was followed by a wave of liberalization, and many parts of the world reaped the benefit of handing over the airlines to market forces. The influence of the government in the airline industry has sharply declined.

It must be noted that Air Transport Liberalization primarily entails two aspects: deregulation and privatization. The models in the study will be primarily concerned with deregulation, specifically in the context of relaxing the ease of entry in the aviation market. Also, rules and regulations governing the airline industry also pertain to issues related to safety measures. Airlines have to adhere to such rules established by their home countries. For instance, all commercial aircraft based in the United States have to follow guidelines set up by the Federal Aviation Administration (FAA) during takeoff and landing. In the context of this study, deregulation does not imply the relaxation of such safety measures.

It is interesting to note that relaxing the ease of entry into one's aviation market has numerous political complications. For example, a state will not allow aircrafts from its enemy

state to pass over its territory. Thus, political reasons may take precedence over economic logic in the airline industry. However, this study will only focus on the economic aspects of airline deregulation. Inclusion of political considerations may distort the models presented in some ways.

The airline industry is also dependent on a variety of other geo-political issues. For instance, sharp rise in oil prices will tremendously increase the cost of airline services, which in turn will increase air fares. However, the study will exclude the discussion of how such issues impact the airlines. In addition, liberalization creates several effects, some of which spill over to other industries. For instance, airline deregulation may create a boom in the tourism industry. However, the study will only focus on the effect of air transport liberalization on the airline industry.

The study begins with an overview and discussion of regulation in the airline industry. The history of regulation in context to air services is also discussed. Liberalization is introduced in the chronological chain of events as a movement that succeeded regulation. The first and second chapters primarily serve as a background of the study. Chapter three develops a model to analyze the effect of liberalization on air fares. The following chapters develop models that explore the impact of liberalization on operation structure of the carriers, and their strategic interactions among one another. The conclusion summarizes the key ideas, and indicates how the models could be used in analyzing the developments in the airline industry.

Chapter 1: Overview of Economic Regulation in the Airline Industry

Why regulate?

The airline industry had remained a highly regulated industry until the wave of liberalization initiated by the Airline Deregulation Act (ADA) in the United States in 1978. Following the ADA, several countries adopted liberalization as a strategy to make their respective airline industries more competitive. Before beginning to analyze the impact that liberalization has created or is predicted to create, it is important to understand why this industry was highly regulated by states and international organizations in the first place.

The airline industry has some features that set it apart from other industries. First of all, airlines serve a non-differentiated, almost homogenous product. The product of a commercial airline is either transportation of passengers or freight. The service provided by an airline is only an intermediary; the product is not considered an end in itself. For instance, a tourist wanting to travel to Budapest will use the services of an airline. However, the air ticket to Budapest cannot be considered the end product that the tourist is seeking. It is only a means that enables the tourist to reach the desired destination. Nevertheless, in current times, airlines have made several endeavors to diversify their product, such as introducing first and business class seats, quality food and beverage services during the flight. Many airlines have also launched frequent flyer programs that induce consumer brand loyalty.

Despite such efforts, on the larger scale, airlines can still be considered to be providing an undifferentiated product, and, consumers prefer competitive prices in this industry compared to products of other industries. A traveler would be less likely to care about which airline he/she is

flying with since all of them provide the same good. Thus, the strongest parameter that differentiates one airline from the other would be fares. Therefore, the airline industry is tremendously price competitive.

The airline industry is also considered to be relatively easy to enter. This is because, unlike other manufacturing industries, aviation does not require the setting up of a factory, collecting raw materials, transporting the physical product to several places, etc. Furthermore, marketing an air ticket is much simpler; it does not require the physical transportation of the material from one location to another.

Due to such features of the airline industry, industrial economists that have historically favored airline regulation argue that liberalization leads to wasteful competition. Due to the relative ease of entry, new market entrants can provide substantial competition to existing carriers. It was also believed that the ease of entry in an unregulated aviation market would allow it to get saturated and unprofitable in a relatively short period.

Due to price sensitivity in the industry, every carrier would also realize that lower fares would give it a superior advantage over its rival firms. Price wars would start and airlines would drive their competitors out of business. The airline would deliberately set lower fares which would be unprofitable in the short run, but profitable in the long run since, by then, its competitors would be out of business. In such market conditions, only the airline that would have long term access to capital would be successful.

In an attempt to lower fares, some held the view that airlines would compromise the safety of aircrafts. Safety measures comprise a significant proportion of a flight operating expense. In order to lower fares in a price war, an airline could try to minimize its production

costs by reducing spending on safety measures. This would increase the chances of accidents occurring and jeopardize the lives of traveling passengers.

Furthermore, some have considered air transport to be a public utility, or at least a quasi-public utility. Doganis (*Flying Off Course*, 2002, pages 48-49) argued that the external benefits arising from civil aviation were such that the industry needed to be regulated in order to ensure that any benefits were not jeopardized. Apart from purely economic, the benefits of air transport are also political and social. There are several world regions that cannot be accessed by ground transportation. In order to keep the population living in these regions connected to the rest of the world, it is vital that flight services operate there. There may be little profit in operating flights in such regions. However, the government has the obligation to operate flights there. If air transport were to be totally unregulated, private airlines would have little motive to serve unprofitable regions.

Another reason why regulation was highly imposed in commercial aviation in the past was the state of aircraft technology. Only with the introduction of jets such as the DC-3 in the 1940s did the airline industry begin to get profitable. Still, productivity was relatively low and the private sector was considered incapable of entering this industry. In the 1960s, turbo jets led to a dramatic increase in speed, while aircraft size did not increase appreciably (Doganis, *Flying Off Course*, 2002, page 9). The introduction of wide-body fuselages and of Boeing 720B in the latter period of the 1960s led to the airline industry boom. Such technological advancement halved the unit costs per available ton kilometer in constant value terms between the 1960s and 70s (Doganis, *Flying Off Course*, 2002, page 10).

Historical Regulatory Framework in the Airline Industry

The airline industry has historically been a highly regulated business. This has allowed several entities such as governments and trade groups to manipulate the industry. Until the reversal of U.S. aviation policy in 1979, three regulatory systems were prevalent: bilateral air service agreements, inter-airline pooling agreements and pricing agreements negotiated through the International Air Transport Association (IATA) (Doganis, *Flying Off Course*, 2002, page 26). Also prominent are international agreements such as the Chicago Convention signed in 1944 which formalized the International Civil Aviation Organization (ICAO).

The type of regulations considered in the airline industry can be broadly classified under two categories: economic and non-economic. Economic regulation pertains to airline business decisions such as market access, fare control, and cap on the number of flights a carrier can operate. Non economic regulation deals with the set of rules established that ensure standard safety measures are adopted by airlines. These include licensing rights, aircraft operating conditions, aviation technical manpower, etc. By deregulation and Air Transport Liberalization, we only consider the relaxation of economic regulations governing air transport.

The Chicago Convention

Signed by 52 member states in 1944, the Chicago Convention (CC) is one of the most prominent agreements that govern the airline industry. This multinational agreement is crucial in three aspects of international air transport: exchange of air traffic rights, fare control and freight tariffs and the control of flight frequencies and capacity (Doganis, *Flying Off Course*, 2002, page 30). In addition, the convention also set up the International Civil Aviation Organization (ICAO),

which acts as an intergovernmental agency to provide a forum for the discussion of key aviation related issues.

Article 1 is the most important feature of the convention with regards to air traffic rights and states that "the contracting states recognize that every state has complete and exclusive sovereignty over the airspace above its own territory" (Chicago Convention, 1944, article 1). Furthermore, Article 6 states that "no scheduled international air service may be operated over or into the territory of a contracting state, except with the special permission or other authorization of that state, and in accordance with the terms of such permission or authorization". Thus, the convention enforced the doctrine of airspace sovereignty for member states. This also introduced the concept of traffic rights, which are more popularly called "freedoms in the air".

Traditionally, there are regarded to be 5 "freedoms in the air", with the addition of 3 supplementary rights. They are described as follows (Forsyth et al., *Preparing ASEAN for open skies*, 2004, pages 126-129):

With respect to Country 'A',

First Freedom: The privilege to fly over a treaty partner's territory (B) without landing.

Second Freedom: The privilege to make a technical landing in a treaty partner's territory (B) without picking up or letting off revenue traffic.

Third Freedom: The privilege to carry revenue traffic from the carrier's national territory (A) to a treaty partner's territory (B).

Fourth Freedom: The privilege to carry revenue traffic from a treaty partners territory to the carriers own territory.

Fifth Freedom: The privilege to carry revenue traffic between two or more treaty partner nations (B to C and/or D) on flights operating out of or into a carrier's national territory (A).

Supplementary rights:

Sixth Freedom: The privilege to carry revenue traffic flown between two treaty partners (B to C) operating through a carrier's territory (A).

Seventh Freedom: The privilege to carry revenue traffic flown between the territories of two nations (B to C) by a carrier operating entirely outside its own territory (A).

Eighth Freedom (Cabotage rights): Continuous cabotage occurs when a foreign carrier flies between two domestic points in a foreign country and carries domestic passengers between the two points as an extension of a route originating in its home country whilst discrete cabotage occurs when there is no connection between the two points and a flight originating in the home country.

The participants at Chicago did manage to agree on the mutual exchange of the first two freedoms (Doganis, *Flying Off Course*, 2002, page 30).

Bilateral Air Service Agreements (ASAs)

Since the Chicago Convention only managed to have member states to agree on the first two air traffic freedoms, the exchange of other freedoms became a bilateral agreement issue among countries. These are agreements that one state can have with another for granting carriers from the other country specific air traffic freedoms. The purpose of such agreements is to control market access. For instance, country X can sign a bilateral Air Service agreement with country Y with the terms that any aircraft from country Y will be granted fourth freedom rights. By virtue

of this agreement, any airline from Y can now carry revenue traffic from any airport in X. Some bilateral ASAs can also limit the frequency and capacity of flights being operated by participating parties. These agreements work on the principle of reciprocity, i.e. if X grants Y fourth freedom rights, then Y must also grant X the same level of rights.

Pooling Agreements

Whereas Bilateral Air Service Agreements take place between two states, Pooling Agreements can take place between two airlines. These are formal/informal agreements that enable competing carriers to cooperate with one another to decide on the frequency of flights, fares, etc. Thus, it is an anti-competitive agreement which serves to the benefit of the firms. In the years up to the early 1990s, such agreements generally took the form of revenue-sharing pools, or less frequently, revenue and cost-sharing pools (Doganis, *Flying Off Course*, 2002, pages 36-37). Because of anti-trust laws in the United States, pooling agreements on flights to/from the U.S. were banned. In December 1987, the European council of ministers decided to make pooling agreements illegal under the "First Package" on air transport liberalization.

IATA

Founded in Havana in 1945, the International Air Transport Association (IATA) has remained an important institution that has pursued the interests of its member airlines. IATA annually publishes key statistics about the aviation industry and conducts research. It provides a counterbalance to ICAO, an intergovernmental organization established during the Chicago Convention. Another important function of the organization is to manage the operation of the Clearing House that settles inter airline debts arising from inter airline traffic. Such debts arise when one airline provides services to passengers that hold tickets of another airline. Today, 240

airlines are members of IATA, and they collectively account for 84% of total air traffic (iata.org).

IATA was formed with the objective of acting as a supply cartel for airlines. Historically, the organization was involved in setting fares and cargo rates for member carriers. Until 1979, the process for establishing fares involved the so-called Traffic Conferences, one covering North and South America, the second covering Europe, the Middle East and Africa, and the third the Pacific region and Australasia (Doganis, *Flying Off Course*, 2002, page 40). Fares had to be agreed unanimously, and any member airline had the right to veto against the proposition passed by other members. The overall objective of the organization was to make pricing decisions for the industry in such a way as to maximize profits for all. It was also argued that the IATA Traffic Conference system safeguarded consumer interest because it banned capacity regulation, which would have allowed airlines to extract monopoly profits. If firms are allowed to fix both prices and output levels, they can adjust both to extract the most amount of profit at the expense of the consumer. However, capacity regulation ban prevented airlines from setting output.

Although the system had some benefits, the fare setting regime became largely rigid to deal with developments in the aviation industry. With liberalization, IATA's influence declined sharply.

Chapter 2: History and Spread of Air Transport Liberalization

History of Air Transport Liberalization

Air Transport Liberalization was first achieved in the United States by the Airline Deregulation Act in 1978. In the early 1970s, the pressure to liberalize the airline industry had piled up. By then, scheduled regulated carriers were facing enormous competition from non-scheduled charter airline operators. Non scheduled operators had the advantage of being flexible in their flight operations since they did not fall under any regulatory system. Furthermore, several Asian Airlines such as Garuda Indonesia, Singapore Airlines and Malaysian Airlines started launching fares that were outside the IATA tariff system. By offering service standards well above those specified by IATA, they were capturing a growing share of scheduled traffic on trans-Pacific routes and on services from East Asia to Europe (Doganis, *Flying Off Course*, 2002, page 50) and IATA was increasingly losing its influence.

The first monumental step taken towards Air Transport Liberalization in the United States was the Kennedy Report published in 1976. The report, under the leadership of Senator Edward Kennedy concluded that "the airline industry is potentially highly competitive, but the Civil Aeronautics Board's system of regulation discourages the airlines from competing in price and virtually forecloses new firms from entering the industry. The result is high fares and security for existing firms. But the result does not mean high profits. Instead, airlines – prevented from competing in price – simply channeled their competitive energies toward costlier service: more flights, more planes, more frills… The remedy is for the Civil Aeronautics Board to allow both new and existing firms greater freedom to lower fares and…to obtain new routes."(Dempsey et al., *Airline Deregulation and Laissez-Faire Mythology*, 1992, page 176).

By 1978, committees of both the Senate and the House of Representatives were working on draft versions of bills to reform airline regulation. On October 24, 1978, in the closing hours of the 95th Congress, Democrat James E. (Jimmy) Carter, signed into law the Airline Deregulation Act (ADA), which proposed a gradual shutting-down of the airline industry's regulatory incubator, including the demise of the CAB itself in 1985 (Havel, *Beyond Open Skies*, 2009, page 252). The primary proposals under the ADA were as follows (Doganis, *Flying Off Course*, 2002, page 52):

1. An end to all controls over domestic routes and fares. Thus, the Civil Aeronautics Board (CAB) was eventually eliminated in 1985.
2. Relaxation of charter rules, as were limits on the right of scheduled carriers to operate charters.
3. Revision of US aviation policies with other countries.

The revision of US aviation policies with other states initiated the open market phase of liberalization and introduced the concept of "Open Skies".

Introduction of Open Market and Open Skies Aviation Policy

Open market aviation policy implies the relaxation of bilateral and multilateral air traffic agreements among states to allow more market access for airlines from states participating in the agreement. The revision of the US-Netherlands air services agreement signed in March 1978 became the trendsetter for subsequent 'open market' bilateral. The key terms of the agreement are as follows (Doganis, *Flying Off Course*, 2002, page 53):

1. Multiple designation accepted (i.e. more than one airline from each country)

2. US airlines given unlimited authority from any points in the US via intermediate points to Amsterdam and points beyond, with full traffic rights.
3. Dutch airlines given only five points in the United States.
4. No capacity or frequency restrictions.
5. No restrictions on sixth-freedom traffic.
6. Unlimited charter rights between any points in either territory.
7. Country-of-origin rules for scheduled tariffs (i.e. each government to set its own rules for tariffs originating in its own country).

The US-Netherlands open market policy amendments were followed by similar negotiations with Belgium, Germany and Singapore. The open market bilateral still had some restrictions on flight operations, for instance Dutch airlines were given only five points in the US. Thus, open market bilateral eventually evolved into open skies bilateral agreements. In September 1992, the Dutch and the US governments signed what was effectively the first "Open Skies" agreement. The key features of the agreement were as follows (Doganis, *Flying Off Course*, 2002, page 62):

1. Open route access – airlines from either country can fly to any point in the other with full traffic rights.
2. Unlimited fifth-freedom rights.
3. No tariff controls.
4. Airlines free to code share or make other commercial agreements.
5. Break of gauge permitted.

Liberalization Spreads

Europe

Upon realizing the effects of airline deregulation in the US, consumer pressure for liberalization was building up throughout the 1980s in Europe. Just like the US, countries in Europe revised their bilateral air service negotiations. In addition, Europe went through multilateral negotiation that was initiated by the European Court of Justice and the European Commission.

When the United Kingdom revised its bilateral air service agreements with the Netherlands in June 1984, it became the first bilateral deregulatory act between two European states. Later that year, the UK renegotiated agreements with Germany, Luxembourg, France, Belgium, Switzerland and Ireland. Soon, other European states followed up on the UK's footsteps. It was not until the adoption of the Single European Act in 1986 that the transformative phase in EU air transport policy commenced, beginning a decade-long transition to become Europe's "Single Aviation Market" (Havel, *In Search of Open Skies*, 1997, page 101). The 'December 1987 Package' of measures, agreed at that time by the European Council of Ministers was the first significant step towards liberalization of air transport policy in the continent (Doganis, *Flying Off Course*, 2002, page 55).

With the virtue of the Package, the competition laws that were mentioned in the Treaty of Rome could now be applied to the airline industry. This called for greater liberalization of the industry to make it more competitive, which led to the abandonment of revenue-pooling agreements among European airlines. It also led to the nullifying of inter-airline agreements that dealt with capacity planning and pricing. Following the 1987 package, a new set of rules came into existence in 1990 that further liberalized the aviation market in Europe. The final package

came into existence in 1992. It allowed for total pricing freedom for all European carriers. The air transport deregulation procedures outlined thereafter implied an end to the national rule-making power; EU states could no longer bar carriers from other EU states to enter their market. The single aviation market removed all commercial restrictions for flying regulated by national governments within the EU and transformed the air transport industry by creating conditions for international competitiveness (Maho Kawagoe, *Air Transport Deregulation in EU*, 2008, page 169).

Other parts of the World

After air transport liberalization was achieved in the US and Europe, several countries in the Middle East and Asia followed a similar trend. With regards to the Middle East, Air Transport liberalization in the Gulf Cooperation Council (GCC) is notable. The GCC comprises of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. All nations in the GCC except Saudi Arabia have signed some form of open skies agreement (World Bank, *Economic Integration in the GCC*, 2010, page 11). The GCC states have also witnessed a tremendous growth in their aviation industry. Many airlines in the region have adopted a hub and spoke system, which was possible due to liberalization. This will be discussed in more detail later.

In Australia in 1987 a new government aviation policy reaffirmed Qantas's continued role as the country's sole designated international carrier but announced the complete deregulation of domestic air services from October 1990 (Doganis, *Flying Off Course*, 2002, page 56). Such deregulatory initiatives imply that the government will stop interfering in regulating domestic fares and frequency of flights.

With regards to Asia, in Japan, JAL's (Japan Airlines) effective monopoly of international air services was broken when from 1986 onwards a domestic carrier, All Nippon Airways (ANA) was designated as the second Japanese carrier on a number of key destinations (Doganis, *Flying Off Course*, 2002, page 56). The adoption of Open Skies policy among the ASEAN (Association of South East Asian Nations) countries Vietnam, Thailand, Singapore, Philippines, Malaysia, Myanmar, Laos, Indonesia, Cambodia and Brunei has been the topic of much discussion recently. ASEAN open skies agreement aims to create a single aviation market in South East Asia by 2020, the likes of which would be similar to the EU single aviation market.

ASEAN Open Skies

A multilateral open skies agreement among the ten ASEAN states has been the topic of much discussion in recent times. The ASEAN nations vary tremendously in terms of their economic structures. Such difference is also manifested in their respective aviation industries. Aviation markets remain limited in countries such as Laos and Cambodia with per capita incomes of $417 and $311 respectively. While Brunei and Singapore have small population bases, their high per capita incomes make their citizens a large source of intra ASEAN travel. Large domestic aviation markets characterize middle-income states, namely Indonesia, Philippines, Vietnam and Malaysia (Forsyth et al., *Preparing ASEAN for Open sky*, 2004, page 71). Given these differences, a common aviation market in the region will affect the member states in different ways.

With the realization that cooperation and advances towards economic integration would prove beneficial to member states, ASEAN was formed in 1967. In 1997, the ASEAN council prepared the 'ASEAN 2020' vision, a set of policies and reforms aimed at creating closer economic integration in the region by 2020. As part of the plan to forge economic cooperation,

member states realized that there must exist a multilateral open skies agreement, which would provide unrestricted access for airlines of an ASEAN member state to operate flights in the region. The only other place in the world where such a package was passed was the EU. The ASEAN Memorandum of Understanding (MOU) on Air Freight Services signed in September 2002 was the first step towards the full liberalization of air freight services in ASEAN. A meeting held in Ho Chi Minh City in 2004 produced a draft outline for the ASEAN Action Plan for the implementation of Open Skies. The following was the timetable for reform (Forsyth et al., *Open Skies in ASEAN*, Journal of Air Transport Management, 2006, pages 143-152):

> Phase 1 (2005-2007) - double designation, move to substantial ASEAN ownership; unlimited 3rd and 4th freedom within ASEAN; and opening of secondary gateways.
>
> Phase 2 (2008-2010) - Multiple designation; restricted 5th freedom beyond rights; completion of opening up of gateways, remove restrictions on fares.
>
> Phase 3 (2011-2012) - Principal place of business for ownership; 5th freedom within ASEAN; possible 7th freedom within ASEAN, charter liberalization.

While Open Sky is targeted to be implemented by 2015, the above reforms were simply steps that would facilitate for a smoother transition to a multilateral common aviation area. However, some member states failed to achieve the targeted goals, as a result of which they may not implement the open skies agreement. Indonesia in 2010 declared that it is not ready to implement open skies by 2015 (chinapost.com).

The development of Low Cost Carriers (LCCs) is an aspect that will be tremendously affected by the agreement. An example of an LCC in ASEAN is Air Asia. From an airline with two aircraft plying six routes in Malaysia in January 2002, AirAsia has soared in the last nine

years to cover 65 destinations in 18 countries (AirAsia.com). The no-frills airline offers economical packages that have made air travel affordable to many. LCCs cannot operate under a strict regulatory regime that controls fares. Due to liberalization, their business model has prospered. An open sky environment in ASEAN will support the growth of LCCs. An example is the Singapore-Kuala Lumpur air sector which was liberalized in December 2008 to allow low-cost carriers in. From US$400 for a 45-minute return flight, fares — with all taxes and surcharges included — are now as low as less than US$100. Passenger traffic on the route also jumped by 34 percent last year compared with 2008, benefiting businesses all round (chinapost.com).

Chapter 3: Analysis of the Impact of Air Transport Liberalization on Fares

Research has shown that Airline Liberalization leads to the reduction of fares. The benefit of increased competition that accrues as a result of giving wider market access to more airlines has led to a general increase in consumer surplus. However, it is not clear if liberalization leads to the decrease in fares in all markets. It is also not certain whether the fare reduction remains permanent. This section begins with literature review of some publications that deal with the effect of liberalization on air fares. It is followed by a model that makes use of game theory to illustrate how fares are affected when a regulated market is liberalized and market access is granted to more carriers.

Literature Review:

"Economic Effects of Airline Deregulation" –Morrison, Winston

Morrison and Winston devised a way of capturing the effect of deregulation on air fares by constructing a fare deflator based on the relationship between fares, input prices, and output characteristics during the deregulated years of 1980-82. Since air fares depend on a wide array of global events such as oil prices, the authors used this technique to hold control for these variables and to solely observe the impact of liberalization on fares.

Specifically [the authors] estimate a pooled cross-section regression that relates average fare (revenue divided by passengers) to: the price of fuel (cents per gallon), average wages (dollars per year), average passenger trip distance (miles), and service quality (average number of weekly departures per city served) (Morrison, Winston, 1986, page 13). Using this method, the deflator is found by:

$$\frac{(Predicted\ fare)1983}{(Predicted\ fare)1977} = 1.93$$

The 1983 deregulated fares are then deflated by this amount to obtain estimates of 1977 deregulated fares. Now, comparison can be made between the estimated deregulated fares in 1977 and the actual fares that were prevalent then, under regulation. The results are summarized as follows:

	Actual fare		*Predicted deregulated fare*	
Route	*Discount*	*Coach*	*Discount*	*Coach*
Atlanta–Milwaukee	131	154	163	163
Boston–New York	60	70	36	59
Chicago–Dallas	146	172	130	224
Cleveland–Birmingham	146	190	148	198
Los Angeles–Washington, D.C.	333	392	155	285
San Francisco–Las Vegas	94	110	52	125

Table 1: Actual Fares and Predicted Deregulated Round Trip Fares, Selected Routes 1977, in US dollars (Morrison, Winston, *The Economic Effects of Airline Deregulation*, 1986, page 16).

Thus, it is not clear that deregulation caused fares to fall in all markets. This result is contradictory to the claims of early advocates of airline deregulation, such as Douglas and Miller, who had predicted that deregulation would benefit travelers because fares would fall, although service quality would also decrease. Morrison and Winston claim that fares fall only in high density markets where there is more potential for competition among carriers.

"The Impact of International Air Service Liberalization on the UAE" –InterVISTAS

The UAE (United Arab Emirates) is one of the leading aviation markets, and much of this success may be attributed to liberalization. To date, the UAE has signed open skies agreements with countries such as Egypt, the United States, Singapore, Spain, Luxembourg, Eritrea, and others. In other cases, the ASAs have been liberalized but stopped short of open skies. For

example, the agreement with the UK allows unrestricted capacity but still maintains restrictions on pricing and fifth freedom rights.

InterVISTAS group developed a gravity model to capture the impact of market liberalization in the aviation industry. The model has been used to analyze the impact of air service liberalization in several countries. InterVISTAS describes the model as follows:

TrafficAB = F(GDPAB, ServiceTradeAB, InterveningAB, ASAFactors(0,1)AB)

Where,

TrafficAB is the total Origin/Destination (O/D) passenger traffic between countries A and B in both directions.

GDPAB is the product of the GDP of the two countries, capturing their economic size.

ServiceTradeAB is the total amount of trade in service (i.e., not goods) between the two countries in U.S. dollars.

InterveningAB captures the intervening opportunities for closer travel than between two countries. Traffic between two countries was found to be less if there were opportunities for travel to closer countries. The intervening variable is calculated as an index of the sum of GDPs of every country that is 10% or less distant than the distance between countries A and B.

ASAFactors(0,1)AB are dummy variables capturing the presence or absence of a specific restrictions on the ASA. For example, if ASA allows flights only to certain restricted points, the dummy variable takes the value 1.

The gravity model can only estimate changes in traffic. However, the benefit of fare reduction was calculated on the assumption that traffic generation is primarily due to fare reduction. In estimating the fare reduction, it was further assumed that on country pairs which already had direct service prior to liberalization, all of the traffic stimulation was attributable to fare reductions; while on country pairs that did not previously have direct service, two-thirds of traffic increase was attributable to fare reductions (one third was attributable to improved service levels – direct service, increased frequency, etc.) (InterVISTAS, 2009, page 34). The following table summarizes their findings:

	% Reduction in Average Fare	Increase in Consumer Surplus (AED)	Increase in Consumer Surplus (US$ at PPP)
Market Access Liberalisation	21%	5,245 Million	1,311 Million
Ownership and Control Liberalisation	16%	4,195 Million	1,049 Million
Combined Liberalisation	37%	9,440 Million	2,360 Million

All financial figures are in 2008 prices.
US$ at PPP: The US$ figures have been converted in U.S. dollars at purchasing power parity, which controls for cost-of-living differences.

Table 2: Fare Impact and Consumer Surplus Benefits of Liberalization (InterVISTAS, *The Impact of International Air Service Liberalization on the UAE*, 2009, page 33)

Modeling the effect of Airline Liberalization on fares using Game Theory

Consider a non-liberalized market served by only one carrier and denote it Player 1, or P1. The market is liberalized and the possibility arises for a second and a third player to enter the market. We model airline behavior by using a two- stage Nash non-cooperative simultaneous game. Consider a case where liberalization takes place in an unsaturated high density market that has high market potential. If neither P2 nor P3 enter the market, both will not get any gain. Thus, we denote their payoff by 0. If one airline enters the market and another does not, the airline that does not enter the market will not get any gain, thus getting a zero payoff. However, for the airline entering the market, its pricing decision can be broadly classified into two categories. It could either charge lower fares than the existing market fare at the non-liberalized market, or it could charge a fare which is same or higher than the existing market fare. We will assume that the firm is least likely to charge a higher fare, since by doing so it will not be able to compete with the existing carrier, P1. However, in reality, this assumption can be challenged as the newer carrier may provide better services and charge higher fares. Note that we have assumed in our model that an airline service is a homogenous product.

P2\P3	Don't Enter	Enter
Don't Enter	0,0	0, __
Enter	__,0	__,__

Table 3: Simultaneous game between P2 and P3 in relation to entering the market

If either P2 or P3 charge a lower fare lower than the existing fare of P1, they will attract more passengers and get a higher payoff. If, however, they charge the same fare as P1, their payoff will not be as high as it would have been had they set lower fares. Thus, we assign a payoff of 10 for the airlines if they set a low fare and a payoff of 5 if they set the same fare as P1.

These values are arbitrary; what matters is that one is larger than the other and that they represent net profit.

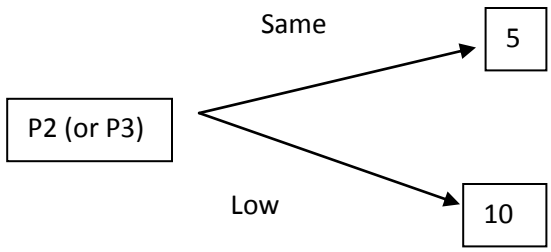


Figure 1: Pay off choice for P2 or P3

If both P2 and P3 enter the market, payoffs will be determined by a second simultaneous game, represented in Table XX:

P2\P3	Same	Low
Same	3,3	2,10
Low	10,2	5,5

Table 4: Payoffs for P2 and P3 in regards to setting the same/ lower fares

If both P2 and P3 set a fare that is same as P1, then they will both get an equal payoff. However, their payoff will be lower, since they are competing with P1. If P2 or P3 sets a low fare and the other sets a fare equal to P1, the airline setting the low fare will have a competitive advantage and thus will have a higher payoff. If both airlines set a low price, they will both have an advantage over P1. However, since P2 and P3 will be competing against each other, they will both earn a relatively low payoff, but still higher than when they had higher fares. The Nash Equilibrium of the second simultaneous game is:

$NE_{P2,\ P3}$ = [Low, Low]

Using the results of the second simultaneous game and pricing decision of P2 and P3, we can now complete the payoffs for the first simultaneous game as follows:

P2\P3	Don't Enter	Enter
Don't Enter	0,0	0, 10
Enter	10, 0	5, 5

Table 5: Payoffs for P2 and P3

The Nash Equilibrium for the game is $NE_{P2,\ P3}$ = [Enter, Enter].

Hence, the game shows that both P2 and P3 enter the market and set low fares.

Now, consider the case when liberalization takes place on a low density sector that has little market potential. Since liberalization has taken place in both markets, it will be beneficial for the airline to focus on the profit making sector. Due to liberalization, airlines now have the freedom to exit the loss making sector. This sector is less profitable. We analyze the behavior of airlines with regards to exiting the less profitable sector by constructing the following simultaneous game:

Px\Py	Exit	Don't Exit
Exit	2,2	4,10
Don't Exit	10,4	0,0

Table 6: Payoffs for players in regards to exiting/ not exiting the market.

If the airlines exit the less lucrative sector, they have a positive payoff since they can now employ the resources to the profit making sector. However, if they do not exit, they will not experience the fruits of the liberalized profit making sector.

If one airline exits and the other do not, the airline that exits will get a positive payoff since it can employ its resources to the more profitable sector. Ceteris Paribus, since the other

airline does not exit the loss making sector, the airline exiting the loss making sector will be facing less competition on the other route, thus it gets a payoff of 4. If one of the airlines exits and the other does not, the airline that does not exit the market will have a monopoly power and hence gets a high payoff of 10. The Nash Equilibrium is as follows:

NE^1 = [Exit, Don't Exit], NE^2 = [Don't Exit, Exit]

In this game, one airline exits while the other does not. As a result, we will see a monopoly arising in the market, which could lead to a rise in fares.

The game theoretic analysis shows that while in some markets deregulation leads to the fall in fares, in others fares might increase.

Chapter 4: Analysis of the Impact of Air Transport Liberalization on Operations Structure

Air Transport Liberalization has enabled airlines to adopt a more cost efficient operating structure for maximizing profit. From the traditional point to point flight operation layout, airlines have adopted the hub and spoke regime. The hub and spoke regime is characterized by the flight routing structure in which multiple locations are linked to a central hub. Passengers are usually required to transfer to another aircraft at the hub, and proceed with their journey to the final destination. This section begins with a review of some research conducted on this topic, and is followed by a model which describes how operation structure of airlines are affected when air traffic rights are granted to carriers.

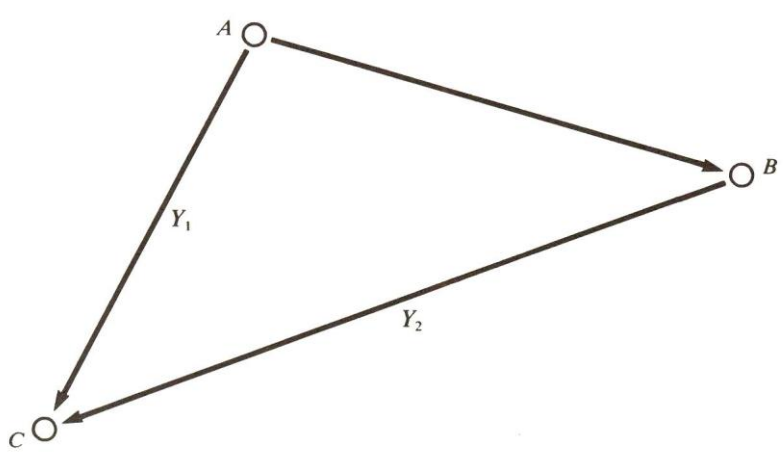
Literature Review:

"Economic Effects of Airline Deregulation" –Morrison, Winston

Morrison and Winston illustrate the economic rationale for airlines to adopt a hub and spoke system by comparing the costs involved in operating non-stop flights versus hub-and-spoke operations. Their analysis is presented as follows:

(From Morrison, Winston, 6-7):

Figure 2: Simple Transportation Network



Suppose the carrier serves route 1 (A to C), supplying output Y1 (measured in passengers), and route 2 (B to C), providing output Y2. For simplicity, there is assumed to be no traffic between A and B. The carrier has two routing options: nonstop routing, whereby traffic on each route is handled independently, and hub-and-spoke routing, whereby traffic originating from A destined for C is routed through B and combined with traffic originating at B destined for C.

The criterion for adopting a hub-and-spoke route structure, based on profit-maximizing behavior, is whether the cost saving from producing output 1 independently, exceeds the possible loss in revenue resulting from decreased passenger demand for the connecting flight A to B to C. More formally, the choice of routing operation can be determined by examining the relevant profit equations. The profit equation corresponding to the nonstop alternative is:

$$\pi^1 = P_1Y_1 + P_2Y_2 - C(Y_1, O) - C(O, Y_2);$$

The profit equation corresponding to hub-and-spoke alternative is:

$$\pi^2 = P_1Y^*_1 + P_2Y_2 - C(Y^*_1, Y_2),$$

where P_i denotes Price in market i (assumed constant across alternatives), C(.) denotes total cost, Y*1 denotes output from market 1 when routing traffic through the hub, and Y*1 ≤ Y1 because hub-and-spoke practices will increase travel time for traffic originating at A and thus possibly reduce demand. A hub and spoke is desirable if the cost saving from producing output 1 jointly with output 2 (as opposed to producing output 1 independently) exceeds the possible loss in revenue.

"The rise of the Arabian Gulf carriers: An insight into the business model of Emirates Airline"
-John F. O'Connell

The success of Middle Eastern Airlines such as Emirates Airline, Qatar Airways and Etihad Airways is laudable. In an age of intense competition in the aviation industry brought about by market liberalization, these carriers have been able to adapt to the evolving ways of the industry. For instance, Emirates Airlines has been profitable for the last 20 years, and by 2007/08, had become the world's fifth most profitable airline with net profits of $843 million. It had one of the highest operating margins of full service airlines, earning 11.6% in 2007/08 (Emirates Financial Statistics, 2007/08). In 2008, its traffic increased faster than its ability to add capacity, which resulted in its passenger load factor rising by 3.6% to an impressive 80%. By mid 2008, Emirates was operating an all wide-body fleet of 109 aircraft with a further 195 on order (Connell, 2011, pages 339-346). The home airports of these carriers have also experienced tremendous traffic growth. This paper studies how Emirates airlines' adoption of a hub-and-spoke flight operation structure enabled it to become more competitive. Such strategy was made possible due to the several open skies and open market agreements the UAE has signed with other states.

Hub-and-spoke operation enables a number of cities to be connected via a central hub. This allows passengers from such cities to travel between one another, even in the absence of a bilateral air service agreement between their respective countries. For instance, if city A and city B are connected to hub X such that country A and Country B do not share air traffic rights, but both countries share traffic rights with country X, then passengers will be travel from A to B or vice-versa by transiting through X. Here the necessary condition of course, is that X must have

6th freedom rights (The privilege to carry revenue traffic flown between two treaty partners operating through a carrier's territory) with both A and B.

Since the UAE has bilateral agreements with places such as the UK and India, Dubai has proved to be a successful hub for Emirates. Over two million passengers travel annually between India and the UK. The most recent bilateral air service agreement between the countries capped the number of weekly services for UK registered airlines operating from London Heathrow to India's two major gateways of Mumbai and New Delhi at 112, which is restrictive considering around 70% of India's domestic and international passenger traffic goes through these two major cities. This provides opportunities for the Gulf based carriers to capitalize on their 6th freedom traffic rights and move Indian traffic through their hubs to the UK market. Marketing Information Data Transfer (MIDT) shows that 62% of the traffic departing from India towards the UK is carried on direct flights shared between Jet Airways, British Airways, Air India and Virgin Atlantic. Emirates, however, has been growing its share of the UK and India markets with a 13% market share, as it connects ten cities in India and five in the UK via its Dubai hub. (Connell, 2011).

A Model to describe the impact of Air Transport liberalization on Operation Structure

To analyze how Air Transport Liberalization in terms of a country giving another country air traffic rights affects the structure of the market, we will assume that flights operate between three countries: A, B and C. Assume that each of A, B and C have their respective carriers P_A, P_B and P_C.

Before liberalizing the market, assume P_A can go from A to B, from A to C and vice-versa. Thus, it is possible for passengers to travel from B to C by transiting through A, i.e. by flying from B to A and then from A to C. Similarly, passengers can go from C to B in the same way. In the same way, P_C can go from C to B and vice-versa, and C to A and vice-versa. Thus, passengers can travel to A from B by transiting through C. Also, P_B can go from B to A and vice-versa, and B to C and vice-versa. However, P_A cannot fly directly from B to C, P_B cannot go directly from A to C and P_C cannot go directly from B to A. This information is represented in Figure X.

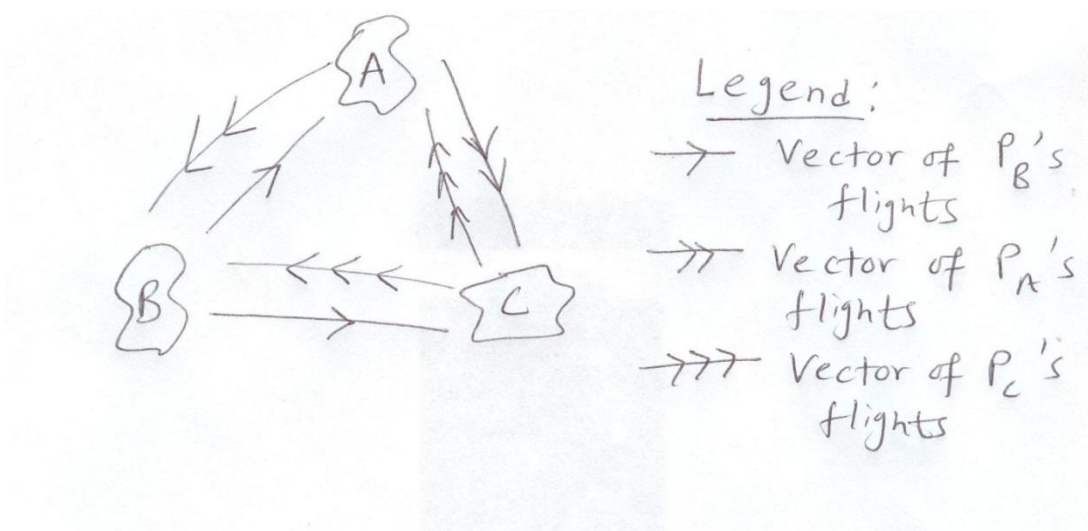


Figure 3: Vector of routes between A, B and C before liberalization

Suppose that B declares open skies with A and grants carriers from A sixth and seventh air traffic rights. The agreement is reciprocal, so carriers from B are granted sixth and seventh air traffic rights for operating flights through A. Assume further that C still has a non-liberalized market. Thus, there is less degree of competition in flights to and from C. Now, as the following figure shows, there are more alternatives for passengers to travel from A to C and B to C and vice-versa. It is interesting to note that since A and B have declared open skies with each other,

the airline market for C, a non-liberalized market is also affected. More alternatives for passengers to travel from C to B and C to A may make the market more competitive and reduce the fares on these routes. However, this depends on a range of other factors which will not be analyzed here.

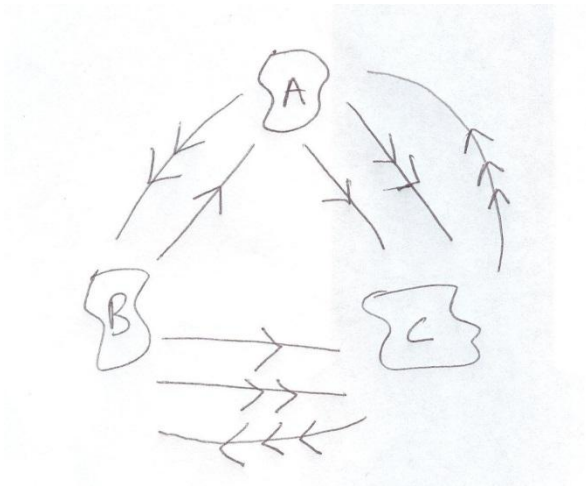


Figure 4: Vector of routes between A, B and C after liberalization

Therefore, we see that Air Transport Liberalization affects those markets that have not been liberalized.

What happens to the market over time? Consider the case of airline P_B. For simplicity, assume that P_B has one 100 passenger jet and operates sold-out flights from B to C, A to C and B to A. Each of the routes has 100 passengers respectively. In this non-stop routing option, 3 flights have to be carried out (if we consider flights as a vector of displacement between two points).

Due to liberalization, there occurs the possibility of developing a hub-and-spoke routing option. The incentive behind this is explained as follows:

For the purpose of cost minimization, the airline would be better off operating a fewer number of flights, but providing service to the same amount of passengers. Suppose that P_B purchases a 200 seat jet. .P_B has the option of flying from B to A with 200 passengers, 100 of which actually wanting to go from B to C but are flying via A as a layover. When 100 passengers get off at A, this allows seats to be available for 100 more from A to C. Thus, by operating only 2 flights, P_B can provide equivalent service for 3 routes. The same applies for P_A. B will be allowed to make A as its hub. After adoption of the hub and spoke system, air traffic resembles Figure 5:

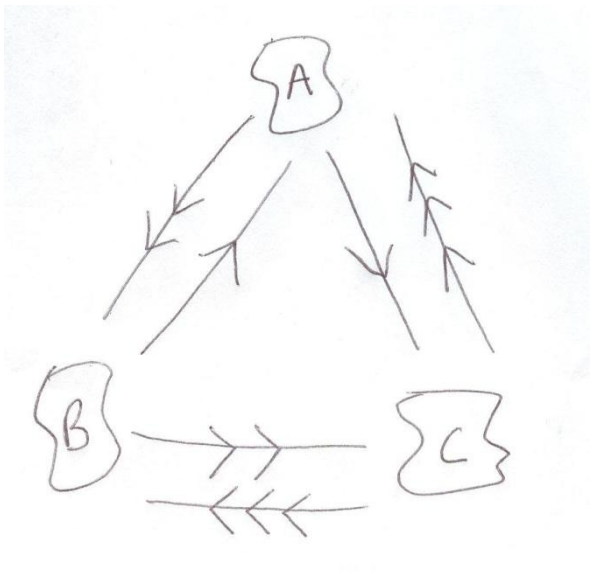


Figure 5: Vector of routes between A, B and C over time after liberalization

Cost savings of this new structure arise from economies of scope and result when economies of aircraft size are greater than the cost of rerouting traffic (Morrison, Winston, *The Economic Effects of Airline Deregulation*, 1986, page 7). Economies of size derive from more efficient use of labor and fuel associated with larger aircraft, and, because of particular airline labor practices and aircraft aerodynamics, are considerable (Bailey, Graham, *Deregulating the Airlines*, 1985, page 51).

Chapter 5: Analysis of the Impact of Airline Liberalization on the Strategic Behavior of Airlines

Air Transport Liberalization relaxed antitrust laws that allow airlines to collude. As a result, tremendous increases in airline alliances have been seen in recent times. This section begins with the review of published research about the effects of airline alliances. It is followed by a model that uses the proof of a theorem from Sherali et al. Note that although a sketch of the proof is provided, the theorem is used to support the major theory in this section.

Literature Review:

"The Price Effects of International Airline Alliances" -Jan K. Brueckner and W. Tom Whalen

Using statistical analysis, the research studies the effect of international airline alliances on fares. The authors compare non alliance fares with inter airline fares and demonstrate that alliance partners charge interline fares that are approximately 25 percent below those charged by non allied carriers. According to the theoretical model, the main source of this fare reduction is the internalization of a negative externality that arises from the uncoordinated choice of interline ''subfares'' in the absence of an alliance (Brueckner, Whalen, page 505).

Alliances provide airlines the advantage of overcoming restrictions on service imposed by bilateral air service agreements. For instance, there is a demand for passengers to travel from country A to B, and bilateral air service agreement restricts an airline from A to travel to B. In this case, the airline from A can set up an agreement with an airline of country X, which is between A and B, and has unrestricted traffic rights between both countries. Under the terms of the agreement, airline A would route its passengers through X, and have them board X's airline from the journey from X to B. Such an agreement between the carriers of A and X is known as

code sharing. It is only possible if the two airlines are participating in an alliance. Thus being in an alliance provides the airlines the advantage of greater market access. Had there been no code sharing between the two carriers, passengers would have to divide their journey into 2 parts: A to X and X to B, and purchase tickets for them separately. The authors argue that in fares in this uncoordinated regime are higher than if an alliance is present.

Furthermore, by coordinating flight schedules and ensuring gate proximity at connecting airports, alliance partners can offer greater convenience to the passenger. Alliance travel thus resembles on-line (single-airline) service, avoiding many of the inconveniences of a traditional interline trip. This effect, which attracts passengers away from non-allied carriers, is reinforced by the unification of the partners' frequent-flier programs (Brueckner, Whalen, page 506). While alliances stem from the lack of open skies agreements between countries, their formation is possible due to antitrust immunity, which comes about due to liberalization. Thus, a highly regulated airline industry would not sustain alliances.

The second advantage of an alliance lies in the realm of pricing. Since the major alliances enjoy antitrust immunity, alliance partners can engage in cooperative pricing of interline trips. By contrast, pricing of traditional interline travel is best viewed as the result of non-cooperative behavior. Because of this difference, the theory predicts that the interline fares charged by alliance partners are lower than those of non-allied carriers. Thus, in addition to offering greater passenger convenience than a traditional interline trip, alliance travel is more attractively priced (Brueckner, Whalen, page 510).

Modeling the Strategic Behavior of Airlines using Stackelberg and Cournot Firm models:

The ease of access to the market created by airline liberalization allows more airlines to start operating flights on the liberalized route. Assume that airline liberalization also grants the operating carriers antitrust immunity. Market conditions will create enough incentives for two or more firms to collude against the rest. In the model, assume P1 and P2 collude against P3 and P4. Due to the collusive forces at play, 2 distinct kinds of firms will be created in the market:

1) Stackelberg Firm: It is the less naïve firm that knows the performance function of the others (Sherali et al., *Stackelberg-Nash-Cournot Equilibria: Characterizations and Computations*, 1982, page 256). It explicitly considers the reaction of the other airlines to its output variations.
2) Cournot Firm: It attempts to maximize its individual profit under the Cournot assumption that the remaining firms will hold their output at their existing levels (Sherali et al., page 257).

The collusion of P1 and P2 resembles a Stackelberg firm; P3 and P4 are Cournot firms. However, it must be noted that the degree to which the colluded P1 and P2 resembles a Stackelberg firm depends on how much they know about the performance function of other firms. Similarly, the extent to which P3 and P4 resemble Cournot firm depends on their proximity to the Cournot assumption.

The collusion of P1 and P2 enables them to share information. Due to the accumulation of information, the colluded firm resembles the Stackelberg firm. Furthermore, from Clarke (*Collusion and the incentives for information sharing*, 1983), we have mathematical evidence to

claim that profits will be higher for firms that share information. Due to market liberalization, cooperative quantity setting becomes possible. This creates the incentive to share because comparing industry profits under private information$\sum_{i=1}^{N} \pi_i^p$, with industry profits under shared information play π^c, calculations show that:

$\sum_{i=1}^{N} \pi_i^p \leq \pi^c$ (Clarke, 1983)

Thus, collusion leads to sharing of information, and by the virtue of shared information, profits are higher. Information sharing also leads to the colluded firm resembling the Stackelberg firm. The Stackelberg firm has an advantage over the Cournot firm because of the following claim:

Proposition: The net operating cost is less than or equal to the net operating cost had the Stackelberg firm have chosen to be a Cournot firm.

Proof:

Initially, let us represent the net operating cost of carrier 'j' by using the following performance function:

$$Pj = \sum Gj(Vj, \theta) - \sum qjf_j$$

Where Gj is the aggregate cost of operating flights on route l, from locations A to B. Vj is the frequency of flights on route l. θ is the catch all variable that represents factors such as oil prices, etc. qj is the quantity of passengers for carrier j on route l. fj is the fare per passenger.

Vj has a positive correlation with aggregate costs. q_j and f_j have inverse relations among themselves due to the law of demand.

From Sherali et al (1982),

Say, for Cournot firm 3, let $f_3(q_3)$ be the total cost of supplying q_3 units of the product (In our case, it is V3 flights. Cost is given as $\sum G3(V3, \theta)$). After collusion, we assume a Stackelberg firm, denoted by Pc. Let f(x) represent the total cost of supplying x units of the product (in our case, Vc flights).

For a given $V \geq 0$, let $[q_3 (v), q_4 (v)]$ be a set of quantities, such that for each individual P3 and P4, it turns out that $q_i = q_i (v)$ solves the following:

$Minimize_{qi \geq 0}$ $\{f_i(q_i) - q_i P[q_i + V + q_j(v)]$

Then, a set of quantities (x*, q3, q4) is set to be Stackelberg Nash-Cournot equilibrium if x* solves: $Minimize_{x \geq 0}\{f(x) - xP(x + q_3(x) + q_4(x)\}$…….Lemma 1.0

Using Lemma 1.0,

Say, x* solves the problem and say ($\hat{x}$, q_3, q_4) is the Nash-Cournot-equilibrium for the 1-Stackelberg and 2-Cournot firm oligopoly. Now,

$\hat{x}$ solves: $Minimize_{x \geq 0}$ $f(x) - xP\ [x + q_3(\hat{x}) + q_4(\hat{x})]$

But since x* solves sub-game perfect, we must have:

$\{f(x^*) - x^*P[x^* + q(x^*)]\} \leq \{f(\hat{x}) - \hat{x}P\ [\hat{x} + q(\hat{x})]\}$

QED

Thus, in a liberalized market, there is strong incentive for airlines to collude.

Here, it must be realized that airlines have an incentive to collude with only those other airlines with whom they have a potential of gaining from the collusive agreement. One way in which the collusion described in the model could take place in reality would be by the formation of airline alliances. Alliances allow the member airlines to share information and act together in the market as a single dominating entity. The sharing of information gives them a distinct advantage over those firms that do not collude and have knowledge only about their own respective performance functions. In addition, as discussed in the literature review, joining an alliance also allows the member airlines to gain access to more markets. The carriers that will be unsuccessful to join an alliance due to their own limitations will remain as Cournot firms in the market.

Due to the collusive forces engendered as a result of air transport liberalization, airlines might implement a joint fare setting regime like those in cartels. Such anti-competitive forces may lead to an increase in fares, and thus the results of the first model would be violated. However, in the presence of Cournot firms that do not participate in the collusive agreement, and set fares on their own, such events would not take place. This is because when the colluded firms set higher fares, the non participants of the collusion would become more price competitive. Since we rely on the assumption that airline services are homogenous, consumers would use the services of the Cournot firms and thus the Stackelberg firms would face a loss making condition.

Furthermore, the second model suggests that due to the adoption of hub and spoke regime, liberalization affects other non liberalized markets as well. In other words, the impact of liberalization is not just limited to the markets that have been liberalized. Thus, if colluded firms

set higher fares, airlines from other liberalized markets may take advantage of the situation by operating flights with lower fares in the route in which higher fares have been implemented by the colluded firms. This would again make the high fare regime of the colluded firms to not last long.

However, in the extreme case of events where all airlines join the collusive agreement, no Cournot firms would be left. As a result, joint price as well as quantity setting would become possible. Such a regime would be reminiscent of the past when IATA acted as a supply cartel in the airline industry. Such a situation would be rare because in a liberalized market, where airlines are free to make whatever economic decisions they want, there would arise an incentive to cheat on the agreement. The carrier that cheats on the agreement would set lower fares, and would thus have a tremendous price advantage over the rest of the members of the agreement. As a result, such a collusive agreement would not last long.

Conclusion

The study developed models to describe the impact of air transport liberalization on the airline industry with regards to fares, operations structure and the strategic interaction among airlines. The conclusions of each of these models appear coherent to similar research published in the topic. Furthermore, the models presented can also be used to explain the recent developments in the industry, thus bolstering the applicability of the models.

The theoretical model developed while analyzing the effect of liberalization on fares showed that in routes that connect a hub to a hub, lead to a fare decrease, whereas on other less lucrative routes, fares tend to increase. Granting market access to more carriers gives them the option to operate or not on routes they desire. Thus, more competition is seen on lucrative routes, which leads to a downward pressure on fares. At the same time, routes where flights were forced to be operated under the regulated regime will witness an increase in fares because fewer carriers will operate there. Since private airlines are profit maximizers, they have no obligation to conduct flights to provide public utility to people. These conclusions are consistent with the findings of Morrison and Winston who claim that air fares do not decrease in all markets due to deregulation. Empirical evidence to support these claims was discussed in the section.

The model developed to assess the cost efficiency of adopting a hub and spoke flight operation structure in a liberalized market showed that airlines will eventually adopt such a structure in comparison to the point to point structure. Findings by Morrison and Winston also show the same results. Furthermore, the model's findings are supported by the recent changes commercial airlines are making today. Many have adopted the hub and spoke regime, and replaced their aircraft inventory with bigger jets to satisfy market demand.

Modeling the strategic behavior of firms using Stackelberg and Cournot games showed that there is a strong incentive for airlines to collude in a liberalized market where antitrust immunity is granted. Recent developments in the industry show that more and more airlines are joining alliances. However, it should be noted that liberalization has two kinds of effects on airline alliances: antitrust immunity allows alliances to form, but providing complete access to all international markets may make alliances vestigial; airlines will no longer need to codeshare with alliance partners to gain access to non liberalized markets.

Although the models presented are theoretical, the results are consistent with the developments in the airline industry, some of which have been discussed in the thesis. Their applicability may also be tested in examining how ASEAN open skies will change the dynamics of the airline industry in the region. This, of course, would be a topic of future research.

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