
The IMPACT OF MARKET LIBERALIZATION ON THE FORMATION OF AIRLINE ALLIANCES

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ABSTRACT

There has been concern raised about how airlines in the Asia Pacific (AP) region are slow in response to the liberalization of world airlines, compared with North America (NA) and the European Union (EU). There is little rigorous analysis that has examined the impact of market liberalization on formation of airline alliances. This research explores how strategic alliance activities are evolving and the critical factors that impact on the formation and development of airline alliances. Findings show the initiation of regional and more liberalized bilateral, or open skies, agreements have removed some of the impediments to structural changes in international aviation. Airlines in more liberal markets enter into greater numbers and more integrative forms of alliances. Also, the general examination of airline performance within the liberalisation process shows there is a significant difference in airline performance between the markets, and that airlines, on average, achieve better results of operation if the market is more liberal. Since currently access to new markets is still restricted, strategic alliances continue to be an important tool for airlines as they seek to expand their own networks to provide new service in a market. This suggests that regulatory coordination (or strategic airline alliances) and liberalization of international aviation reinforce each other and should therefore be pursued simultaneously.

RESEARCH ISSUES

In the last decade, it is not just the number of alliances that has increased; there are also various features of the alliances that have emerged (Wang & Evans, 2001). The term airline alliance has been used to describe an accord, partnership, cooperative agreement, joint operation, marketing alliance or code sharing agreement (IC, 1997). The strategic alliances forged in air transport markets also include intercontinental alliances (Oum & Taylor, 1995). Intercontinental alliances are the largest and fastest growing type of international alliance. Across-border alliance crosses

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geographical areas like AP, Europe and NA continents through activities like code sharing. Their aim is to expand operations abroad.

A joint venture is another type of airline alliance. This has been used to jointly develop, market, and improve airline performance through collaboration between international airlines, and to pool resources and benefit from economic scale and link (Dussauge & Garrette, 1995). Further, some airline alliances have the form of cross border equity deals (Rimmer, 1997). Equity deals refer to the agreements made under the bilateral system of air services and involve coordinating, such as routing decisions, joint fares, and sharing in cargo reservation and databases. From 1993, both joint activities and marketing alliances have progressed. Some carriers initially created frequent flyer programs (FFP) and joined together to handle ground service through joint services and marketing, sharing capacity and joint operation of the FFPs.

In 1994, the form of airline alliances moved towards a range of multilateral air transport agreements, such as single-skies agreements, air transport liberalization (open skies agreements), multilateral aviation rights, and cooperative agreements. From 1995, airline alliances have moved further towards the development of regional aviation blocs, blocking space agreements, and open skies agreements. Further, five major global groupings emerged in the airline industry in 1996, after a spate of alliance-building activities that started in 1994. The Star Alliance was formally established in 1997, followed by oneworld in 1998. In the meantime, more airlines entered these two global alliances or other global groupings (Oum, Park & Zhang, 2000). While more dynamic airline alliances have emerged, there are also some memorandums of understanding signed between countries, which enable operating the Fifth and Seventh Freedom Rights of Air, with some even including agreements of domestic flights (cabotage).

Since the 1944 Chicago Convention, all commercial aspects of international air transport have been governed by bilateral air service agreements (ASAs). Each international airline faces a complex web of bilateral ASAs signed by its home state (Oum & Yu, 1997). Air service rights are a product of a complex global network of bilateral ASAs that guarantee scheduled and non-scheduled (charter) airlines certain traffic freedoms (PC, 1998). The existence of the bilateral agreements has greatly constrained the freedom of individual scheduled airlines, and has limited competition in the international air transport industry (Oum & Yu). These constraints restrict which airlines may offer international services from their airports and to and from what points abroad airlines may offer international services. International air transport is both location-constrained and nationality-constrained (Staniland, 1997).

Facing these constraints, entering into strategic airline alliances is the major means for international carriers to obtain access to new markets, and to provide new services (Oum, Park & Zhang, 2000). With the development of strategic airline alliances, some liberal forms of formation have emerged in the aviation markets. As indicated by Rimmer (1997), there is a growing pressure to replace the bilateral system by a liberal multilateral system based on deregulation and the United States' open skies agreements. As the current regulatory system, including bilateral ASAs impediments, the initiation of regional and more liberalised bilateral, or open skies, agreements has removed some of the impediments to structural changes in international aviation (Oum et al., 2000).

With the US currently pursuing open skies agreements in world aviation markets, the Australian Industry Commission questioned that the US had not signaled its intention to hold open skies agreement discussion with Australia (PC, 1998). In fact only a few Asian Pacific (AP) region airlines have been invited to enter open skies (Eleck, Findlay, Hooper, and Warren, 1999). As the US bilateral open skies agreements provide its carriers more access to the global market, countries that do not enter into such agreements with US risk a loss of traffic (Eleck et al., 1999; Hooper & Findlay, 1998; PC, 1998). For example, the recent agreements negotiated between the US and Japan, and the US and Singapore enable US airlines to pick up traffic in a signatory country and carry them to other destinations (PC, 1998). On the other hand, although the airlines of the two Association of Southeast Asian Nations (ASEAN) economies have alliance agreements with the US, the agreements only offer the ASEAN carriers access on their direct routes to the US, but not necessarily between themselves (Eleck et al., 1999).

At present, it is generally seen that Asian airlines have been slow and entered few alliances with each other or other airlines (Hooper, 1997). In most Asian countries, governments still maintain restrictions in free trading policy (Hooper, 1997; IC, 1997; Oum, 1998; PC, 1998). There has been concern raised about how airlines in the AP region are slow in response to the liberalization of world airline markets, compared with NA and the EU. The question follows as to what are the critical factors involving the formation of alliances. Answering this question is pivotal for the studies of the development of strategic airline alliances. However, there is little rigorous analysis that has examined the question.

Previous research takes a general perspective of the objectives for forming alliances, and hence regards motivations, antecedent and environmental concerns as important factors influencing the propensity of a company to enter an alliance (Glaister, 1996; Varadarajan & Cunningham, 1995; Vyas, Shelburn & Rogers, 1995). This research

considers more specific factors and attempts to provide a detailed examination on the impact of liberalization on the development of strategic alliances, particularly the dynamic features of alliances. In pursuing liberalization, it has been argued that liberalization of the bilateral service trade hinges not on the process of trading itself, but rather on the conditions under which providers of services are permitted to establish an actual direct or indirect presence in a specific national market (Staniland, 1997).

The above discussion shows the central research problem: *What are the critical factors that impact on the formation and development of airline alliances?*

In tackling this research problem, several research issues have been identified:

1. *What is the liberalization process in NA, the EU and the AP region?*
2. *How are the major carriers in the three aviation markets involved in strategic airline alliances?*
3. *What are the critical factors involved in formation and development of strategic airline alliances?*
4. *Is there a significant difference between airline performance of the airlines in the three aviation markets, and, if so, does the difference result from the market liberalization process?*

Undertaking these research issues, a theoretical study is conducted, followed by an empirical investigation of the hypotheses.

LIBERALIZATION PROCESS AND DEVELOPMENT OF ALLIANCES

This section attempts to address the research issues through a theoretical examination of the liberalization process of NA and EU, and the aviation market situation in the AP region. It aims at developing theoretical models and hypotheses for an empirical investigation of the research issues.

The US Deregulation

After 1978, the US domestic air transport markets were deregulated, following the Airline Deregulation Act of 1978 and the International Air Transport Competition Act of 1979 (IATCA, 1979). The deregulation of US domestic air transport markets demonstrated the advantage of a competitive airline system. The deregulation enabled launching other policies to maximize consumer benefits through preservation and extension of competition between airlines in a fair market place (IATCA). Following the domestic market deregulation, a series of crucial bilateral negotiations

were conducted over the period 1977-1982. Also, some bilateral agreements were signed between the United States and 23 other countries (Oum, 1998). The effects of the liberal bilateral agreements were a dramatic expansion in the number of airlines operating, the total scheduled capacity offered in those markets, and the number of US gateway points with direct services to European or Asian destinations (DOT, 1998; PC, 1998).

In March 1992, the US offered to negotiate trans-border open skies agreements with all European countries. The open skies regime enables US carriers to pursue more liberal forms of alliances in the world air transport markets. The first US open skies deal was signed in September 1992 between the US and the Netherlands. In fact, the KLM Royal Dutch Airlines and Northwest Airlines (KLM/NW) alliance started in 1989 (Airline Alliance Survey, 1999; 2000). KLM and NW, as alliance partners, have long-haul code sharing and comprehensive marketing agreements, in the North Atlantic, in the US, Europe, Africa and the Middle East (GAO, 1995). They also have a joint FFP. They cooperate on ground handling, sales, catering, information technology, cargo and maintenance, and joint purchasing (Alliance Survey, 1999).

In 1993, the US Department of Transportation (DOT) granted anti-trust immunity to the alliance between NW and KLM, which allows the airlines from both countries unrestricted entry and capacity rights between and beyond both countries (PC, 1998). This permitted the airlines to conduct extensive code sharing and to jointly market capacity and determine fares without fear of legal challenge from the competing airlines (IC, 1997).

US aviation policy (see Table 1) appears to have recognized the importance of having unrestricted market access (PC, 1998). Under the open skies regime, the US extended invitations to enter into open aviation agreements to a number of countries that it believed shared its vision of liberalization, offering important traffic flow potential for its carriers (PC, 1999). The US had signed a total of 28 agreements by January 1998 with a range of countries in Europe, Central America and South America. Following the successes in Europe, the US started to shift the focus of its international aviation policy to Asia.

While US airlines were moving fast toward air transport market globalisation, the European market also made steady progress from a very fragmented market to a single market. This process is discussed below.

The EU Single Market

Before we start to examine the process of EU developing a single market, it is necessarily to review the EU itself. The EU consists of fifteen member states: Austria, Belgium, Denmark, Finland, France, Germany,

Table 1. US open skies policy

Item number	ITEMS
1	Open entry on all routes between the bilateral partners;
2	Unrestricted rights for partner airlines to operate between any international gateways in the US and participating countries, including to intermediate and beyond points;
3	Unrestricted capacity, frequency and aircraft on all routes;
4	Flexibility for airlines in setting fares within certain guidelines;
5	Liberal charter and cargo arrangements;
6	The ability of carriers to convert earnings into hard currency and return those earnings to their homelands without restriction;
7	Open code-sharing opportunities;
8	Rights for carriers to perform their own ground handling in the partner country;
9	The ability of carriers to enter freely into commercial transactions related to their flight operations; and A commitment for non-discriminatory operation of, and access to, computer reservation systems.

Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom (UK). Before the mid-1980s, bilateral agreements had governed international aviation policies within the EU. Most member states of the EU had their own national carrier, which is generally considered to be a matter of national importance. The existence of bilateral treaties caused the market to be tightly regulated, behind high entry barriers, and hence the European airline industry was very fragmented before liberalization. Consequently, European air traffic was not very efficient. Costs, and therefore prices, were high.

To improve the efficiency of the airline industry, deregulation was introduced through three phases, termed as three policy packages. The first package became applicable beginning January 1, 1988. The second package was approved in June 1990, and the third package was approved in June 1991, but went into effect on January 1, 1993 (Graham, 1997b; PC, 1998). The implementation of the three packages was completely finished in 1997 (Graham, 1997). The first package allowed the airlines to increase their capacity shares on the routes between countries, allowed access to the markets and set the airfares. The second package removed airport deregulation in the position of the fourth freedom services and loosened capacity sharing contracts (see Table 2). It provided protection against discrimination of the airlines by their nationality in the cases of getting licenses in different member states.

In the phase of implementation of the third package, the EU airlines were allowed to freely set airfares (but has been limited by safeguards against predatory pricing) since 1993. From April 1997, the airlines have been allowed to fill a maximum of 50% of seats in a stopover in another

member state. The seventh freedom has also been permitted (see Table 2). Further, cabotage right, that is, operating domestic services, was also permitted. The third package, therefore, has removed most of the remaining regulatory constraints on intra-EU air transport. The only exceptions are some Public Service Obligation (PSO) routes, which remain protected from competition (Graham, 1997).

Table 2. The Seven Freedom Rights of Air

Item number	ITEMS
1	The right to fly over another country without landing.
2	The right to make a landing for technical reasons (eg. refuelling) in another country without disembarking or picking up revenue traffic.
3	The right to carry revenue traffic from your own country to another country with which you have an air services agreement.
4	The right to carry revenue back to your own country from a country with which you have an air services agreement.
5	The right of an airline from country A to carry revenue between country B and other countries, C, D, etc.
6	The right of country to exercise two sets of third and fourth freedom rights (A-B and A-C) but use its base at A as a transit point.
7	The right of an airline formation country to carry revenue traffic between two points with another country.

After the EU aviation market was liberalized in April 1997, EU carriers were allowed to enter into alliances unless they resulted in a virtual monopoly (McNeil, 1993). Pricing, market entry requirements and capacity were also determined by the airlines instead of respective governments or other bodies. By liberalizing the bilateral agreements among the members, EU carriers are able to fly between member states without restriction (Park, 1997; Button, 1997). Similar to the US domestic market, any EU registered carrier has the right to run domestic services within any of the EU's 15 member countries, as well as in Norway and Iceland. National ownership rules have been replaced by EU owner criteria. Airlines have been given freedom to set fares, with safeguards against predatory pricing through competition rules. The single European aviation market thus became the world's largest single aviation market with more than 370 million potential passengers in 1997.

Asian Pacific Cooperation

The AP region includes Japan, Taiwan, Korea, the People's Republic of China and other small nations, and includes Australia and New Zealand. A tourist boom and traffic growth in this region has led to Australia and New Zealand becoming major destinations (Wang, Pensde & Prosser, 1998), and hence alliances set up by Australia with other countries are significant.

Qantas ranks among the twelve largest international airlines in the AP region, with the others being China Airlines, Cathay Pacific, Garuda Indonesia, Japan Airlines, Korean Air, Malaysia Airlines, All Nippon Airways, Air New Zealand, Philippine Airways, and Thai Airways International. The International Air Transport Association (IATA) forecasts that air passenger traffic will grow from 13.2 million in 1995 to 40.3 million in 2010 with an annual growth rate of about 7.7% (IATA, 1997). Traffic between ASEAN to other regions is also predicted to grow at a rate between 7.4% and 8.9% with the busiest routes being between ASEAN and Northeast Asia.

Whilst the US and the EU markets have progressed with the expansion of air route networks, the airlines in the Asian Pacific region are also developing cooperative strategies. The privatization of Qantas and Australian started in 1991. In September 1992, Qantas acquired Australian Airlines saying that it planned to create a seamless domestic and international airline service and by October 1993, Australian was no longer being promoted as a separate entity. British Airways was permitted to purchase 25% of Qantas in March 1993 and by November 1995 the privatization process was completed. In 1993, Australia witnessed a very large increase in domestic passengers numbers following deregulation of international flights (Healey, 1994).

In November 1996, the Australian and New Zealand governments signed an agreement allowing designated carriers to fly within and between the two countries provided they are at least 50% owned and controlled by nations of either country.

Except for a few regional blocs for example, between Singapore and Brunei, there has been no other breakthrough among the ASEAN members (Airline Alliance Survey, 1999). The US and Singapore's establishment of an open skies agreement with the Philippines showed no progress, due to Philippines Airlines' poor financial performance in recent years, which would undermine its competitive position under an open skies environment (Airline Alliance Survey, 1999). Thus it is still too early to say what steps and measures are required that will make ASEAN a truly multilateral open skies region. It has been argued that this may be because the region is more diverse than Europe or NA, and that the airline industry in the AP region is in a relatively early state of its development and experiencing very high levels of growth (CAPA, 1996). With opportunity for profitable individual expansion, the region's airlines may have been less forthcoming in forming alliances (CAPA).

It has been recognized that while the economic crises in Asia have placed the carriers based in the region under financial stress, the process of globalization of the airline industry has taken a major step forward, for

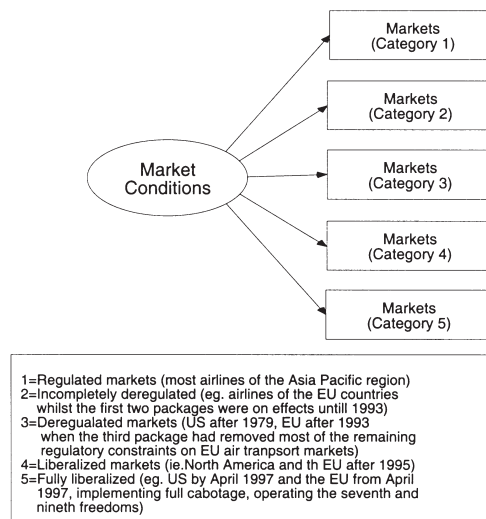
instance, the Star Alliance, oneworld, and some alliances in South East Asia (Hooper & Findlay, 1998; Oum, 1998). It is argued that some of these alliances will help the Asian carriers in the short-term, in some cases, with injections of capital, through sharing the use of resources, by consolidating traffic and improving utilization of aircraft and by strengthening market positions (Hooper & Findlay, 1998; Oum, 1998). The decision by the government of Thailand to privatize Thai Airways attracted major world airlines as potential bidders. The current wave of alliance formation in Asia will help the region's airlines rationalize services, consolidate traffic and improve their finances, but it also will play a role in deciding the competitive strength of the major global alliances at key Asian hubs (Hooper & Findlay, 1998; Oum, 1998).

RESEARCH MODELS AND HYPOTHESES

The above discussion shows that liberalization processes differ strongly between regions. From 1988 to 1993, EU countries were in the process of deregulation while the first and second packages were in effect. The US was deregulated after 1979. Since 1995, NA and the EU had been in the process of liberalization. The US domestic market was fully liberalized from April 1997 followed by the EU market. From 1997, the EU market has also implemented full cabotage.

Based on the above examination, this research identifies five categories of market conditions representing each liberalization process of the three markets (see Figure 1).

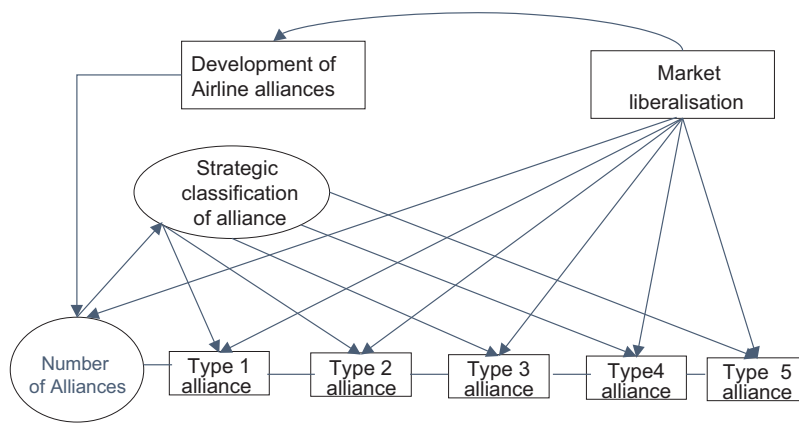
Figure 1 Specification of market conditions (NA, EU, AP)



Source: developed for this research

These specific market conditions are to be used in conjunction with the development of different types of strategic alliance, to examine whether a market condition has an effect on formation of airline alliances. Undertaking the analysis, the research develops a conceptual model, shown in Figure 2.

Figure 2 Conceptual model : Impact of market liberalization



Source: developed for Research Issues

This model seeks to consider the impact of the market liberalization process of NA, the EU and the AP regions on the airlines entering number and types of strategic alliances, in that more liberal markets can lead to more number and integrated types of strategic airline alliances. Towards testing the research assumptions, some theoretical and structural equation models are developed, and described below.

First, the research presumes that there are differences between the number and types of alliances of the carriers. This presumption is expressed as

$$\sum (al)_i \neq \sum (al)_k \dots\dots\dots(3.1) \quad i=1,2,3 \quad i \neq k$$

$$\sum_{j=1}^5 (al)_{ij} \neq \sum_{j=1}^5 (al)_{kj}$$

where $\Sigma (al)$ stands for the sum total of alliances, subscript i and k is a market, respectively, subscript j is an alliance specific dummy variable, and $\sum_{j=1}^5$ is the sum total of one type for the five types of alliances.

For testing the presumption expressed in equation (3.1), the research sets up a hypothesis as: **H 1: There is a significant difference in the number and forms of strategic airline alliances between the three aviation markets.**

The research also presumes that airlines with their aviation markets in different liberalization process have entered different number and types of strategic alliances. This is expressed in the equations as:

$$\sum (al)_{iz} \neq \sum (al)_{ig} \dots \dots \dots (3.2) \quad z = 1, 2, \dots, 5, \quad z \neq g$$

$$\sum_{j=1}^5 al_{iz} \neq \sum_{j=1}^5 al_{ig}$$

where the subscript i is a carrier, z is a specific dummy variable of market conditions of i (z is not equal to g). $\Sigma(al)$ is a sum total of airline alliances, and $\sum_{j=1}^5 al_{iz}$ is a sum total of j (one type) of the five types of alliances of i with the market condition as z .

Based on the presumption expressed in equation (3.2), the research sets up the hypothesis for tests as: **H 2: There is a significant difference between the airlines in involving strategic airline alliances with different market conditions.**

The research further presumes that the development of an airline alliance is the effect of the market liberalization, as well as other factors including year and passenger market size. It hence expresses the function of the development of an airline alliance in a structural equation model as:

$$Y_i = f(A_i, Z_i, T, Q_i, \omega_i) \dots \dots \dots (3.3)$$

where Y_i is the dependent variable, referring to carrier i 's alliances, f includes a set of functional variables in that A_i is a specific-alliance dummy variable of i , Z_i is a specified market condition of i , T is year indices, and Q_i is the total passengers of i , and ω_i is a term of unobservable effects that may influence the development of i 's airline alliances.

As an airline may have several types of alliances and experienced various market conditions in the period of 1989 and 1999, the structural equation model (3.3) is hence specified:

$$\begin{aligned} A &= A(a_1, \dots, a_5), \\ Z &= Z(z_1, \dots, z_5), \dots \dots \dots (3.4) \\ T &= T(yr_1, \dots, yr_n) \end{aligned}$$

where a_1, \dots, a_5 refers to Type 1 to Type 5 alliances, z_1, \dots, z_5 refers to the liberalization process of 1 to 5, yr_1, \dots, yr_n refers to the year dummy variables of 1989 to 1999, and q is the number of passengers of market i .

For consistency of the functional structure and estimating the parameters of the development of airline alliances, we denote model (3.3) in the regression. The regression is expressed as:

$$\ln Y_i = \beta_0 + \beta_1 A + \beta_2 Z + \beta_3 T + \beta_4 \ln Q_i + \varepsilon_i \dots\dots\dots(3.5)$$

where Y is the aggregate annual alliance of i , A is the overall total alliance, including each specific type of alliances of i , Z is the specific market condition of i , T is a specific alliance dummy variable, Q_i is the total passenger traffic of i , and β is a parameter vector needs to be estimated.

Based on the structural equation model (3.3), a hypothesis is set up for the test as:

H 3: Market liberalisation leads to the development of strategic airline alliances.

The above examination presumes that market liberalization can impact on the formation and development of strategic airline alliance. The research initially also presumes that market liberalization and strategic airline alliance can affect airline performance. It hence predicts that airline performance of NA and EU markets may have been more enhanced than the AP market, due to the difference in numbers and scopes of airline alliances and market liberalization processes of the three markets. In testing these presumptions, the last two hypotheses set up for tests as:

H 4: There is a significant difference between airline performance of the three markets.

H 5: Airlines achieve better results of performance when aviation markets are more liberal.

In the next section, this research introduces statistical methods for testing these hypotheses.

STATISTICAL METHODS

The theoretical study in the above section identified five categories of market conditions that can be examined, representing the liberalization process of the three aviation markets as shown in Figure 1. The categories of market conditions in the ordinal scales from 1 to 5 are to be used in conjunctions with the development of different types of strategic airline alliances. This enables the analysis of how the market liberalization affects formation of strategic airline alliances. The alliance data used in the analysis are adopted from Wang (2001). In that the researcher identifies five major categories of current airline alliances, based on serious examinations on 11 years of the major airlines' alliance activities. The five types of alliances are seen in hierarchical ranges, from the simple affiliation

to more integrative forms of alliances, and hence can be treated as ordinal data variables in the analyses, shown in Figure 3. Several other dummy variables are also employed in the tests, and shown together in Table 3.

Figure 3 Hierarchical ranges of the five types of airline alliances

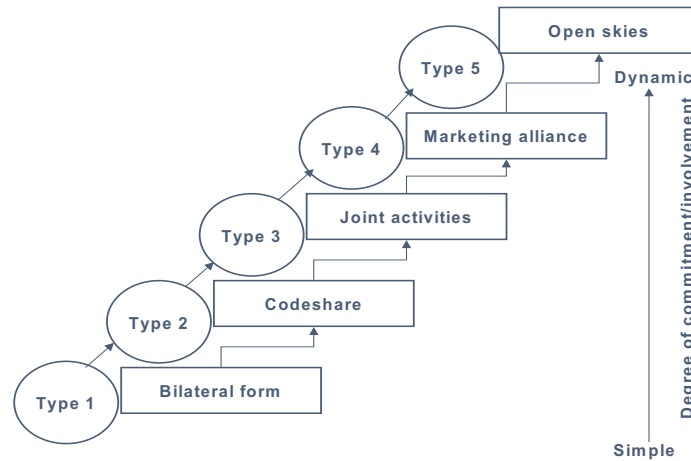


Table 3. Measures and variables employed by this research

VARIABLES	SPECIFICATIONS	
Types of alliances	Type 1	Bilateral
	Type 2	Code sharing
	Type 3	Joint activities
	Type 4	Market alliances
	Type 5	Open skies
Market conditions	Category 1	Being regulated
	Category 2	In the progress of deregulation
	Category 3	Deregulated
	Category 4	In the progress of liberalization
	Category 5	Being fully liberalized
Year indices (dummy variables)	1, ...,11	1989-99
Phases of alliance development	1	1989-92
	2	1992-95
	3	1995-97
Markets	$i, \dots, g \quad i \neq g$	NA, EU, AP
Performance variables		Passenger numbers Passenger kilometres Passenger revenues Average price of per passenger kilometre

The examination focuses on three markets, NA, the EU and the AP region, as listed in Table 3. The samples used for the observation of airline

alliances are 27 major carriers in the three markets, described in Table 4. The 27 major airlines are the members of the International Civil Aviation Organization (ICAO). These airlines are also the major international airlines or flag carriers of the three markets. Further, they are where the critical issues raised by previous studies, and hence the focuses of this research began.

Table 4. The 27 major international airlines examined

NA AIRLINES	DESIGN CODE	EUROPEAN AIRLINES	DESIGN CODE	ASIAN AIRLINES	DESIGN CODE
Air Canada	AC	Air France	AF	Air India	AI
American	AA	Alitalia	AZ	Air NZ	NZ
Continental	CO	British Airways	BA	All Nippons	NH
Delta Airlines	DL	KLM	KL	Cathay Pacific	CX
Northwest	NW	Lufthansa	LH	Air China	CA
SAS	SK	Swissair	SR	Japan Airlines	JL
United	UA	Virgin Atlantic	VIR	Korean	KE
Canadian	CDN			Malaysia Airlines	MH
USAir	AL			Qantas Airways	QF
				Singapore	SQ
				Thai Airways	TG

The research hypotheses involve an analysis of variance, and hence ANOVA technique is employed. This enables the comparisons of the means of numbers and types of airline alliances between the five groups, and seeks whether there is a significant difference between the groups based on the likelihood ratios (F ratio) obtained. By the same technique and procedures, the research also tests the differences in airline performance between the different aviation markets. A *t*-test is also employed. Through *t*-test the researcher is able to further compare two sample means between before and after the liberalization. An ANOVA essentially answers the simple question of whether there is a difference between the groups. This is path analysis, which analyses indirect effects (Tabachnick & Fidell, 1996).

Some research issues study hypotheses and structural equation models (SEM). Thus regression together with testing SEM are further employed. SEM is rather a confirmatory test to seek direct effects (Tabachnick & Fidell, 1996). Some parts of the analyses also used curve estimation to show model fit by the recommended cut-off value ($p < .05$). Essentially, normality of data variables is required in estimations done by methods of maximum likelihood and generalised least squares (Bacon, 1997). The analysis therefore employs both normal plots and normality test, based on the Kolmogorov-Smirnov test and the critical ratio and modification of skewness and Kurtosis's statistic. Results of the analyses are reported in the next section.

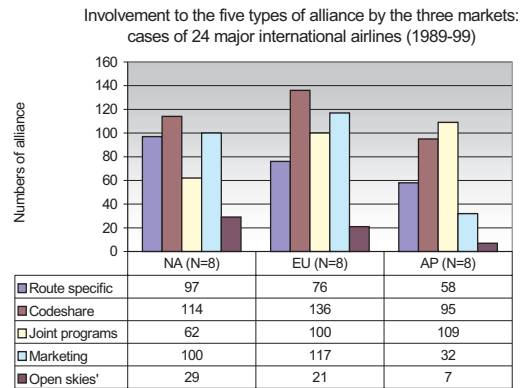
RESULTS

Descriptive Results

First, the descriptive statistics are reported. Figure 4 shows that the airlines of the AP region introduced the largest number of new bilateral services from 1989 to 1994 and that these airlines also had the largest increase in the number of joint programs from 1989 to 1999. According to the total numbers of alliances formed during 1989 and 1992, the airlines of the AP region were at the head of the alliance activities.

The airlines of NA and the EU developed alliances by more dynamic forms, including code sharing, marketing alliances and open skies agreements. These airlines were more rapid in expanding the air route networks. Comparatively, the airlines of the AP region forged more joint activities but there were very few alliances signed under the US open skies regime during that period of time except for a few regional open skies agreements in the so called East Asia Triangle. There were a fewer airlines in the AP region entered global marketing alliances from 1996 to 1999.

Figure 4.



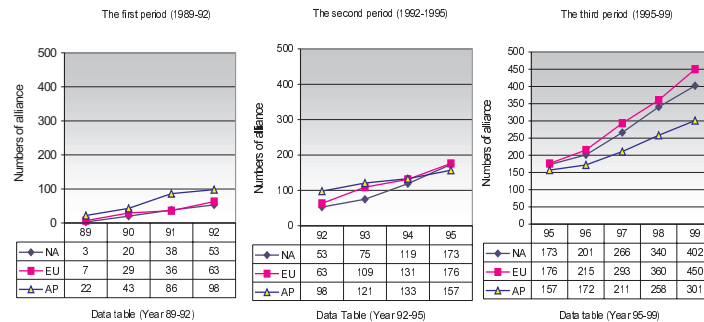
Data table

The descriptive examination on the development pattern of the airline alliance activities found that between 1989 and 1999 airline alliance activities were in three distinct growth phases. The results are shown in Figure 5. This figure first shows the wave appeared as a more flat up-growth between 1989 and 1992. The second wave occurred in the period of 1992 and 1995. In this period of time, the alliance activities had an increase,

and the increase became greater following the US signing of the first open skies agreement in November 1992. The third growth appeared between 1995 and 1999, and the growth was more rapid, showing more alliances formed during this period of time.

Results in Figure 5 also show that the airlines of the AP region were leading in strategic alliance activities between 1989 and 1995, followed by the EU. However, the AP airlines were generally slow in developing alliances from 1992 and 1999. On the other hand, the airlines of NA and the EU had more rapid progress after the 12 European countries had completed the liberalization in 1993, and the US established the open skies regime after 1992. As the growth trends show, after 1992 the airlines of NA and the EU became very active in developing alliances and the numbers of alliances had even merged together up with the airlines of the AP by 1995. Soon after 1995, both the airlines of NA and the EU markets took over the airlines of the AP region by a rapid development in the numbers of alliances.

Figure 5. Alliance involvement of the three markets 1989-99



Note: These figures use accumulated data of alliances

Following the descriptive study, the research explored data distribution for normality, and results are shown below.

Test of Data Normality

Before testing the hypotheses, the analysis first explored the data normality since normal distribution is essential for estimations done by methods of maximum likelihood and generalised least squares. The criteria value for testing the normality is from a z -distribution, based on a significance level desired (Hair, Anderson, Tatham, & Black, 1995).

Following the guidelines the threshold value of standard score (z -score) is calculated, and a value exceeding ± 3.5 is used as a critical ration for rejecting the assumption about normality of the distribution for this research. Also, if the data is normal distribution, its probability should be bigger than $p < 0.01$ (Norusis, 1993).

In examining the data normal distribution, *SPSS Data Exploration* was used, through which skewness and kurtosis statistics were obtained, and then calculated. The z -score obtained by skewness statistics was then divided by the standard error. The z -score of kurtosis followed the calculation procedures of $z\text{-score} = \sqrt{\text{kurtosisstatistic}/\text{std.error}}$. These z -scores were then checked against the critical ratio desired ($z\text{-score} = \pm 3.5$). The test results show that all the alliance and performance data form a normal distribution, except open skies alliances where the skewness critical ratio is 2.5, satisfying the threshold value (see Tables 5a and 5b).

Table 5a. Results of normality test of the alliance data

	KOLMOGOROV-SMIRNOV		SKEWNESS	KURTOSIS
Variables	Statistic	Df	(Critical ratio)	(Critical ratio)
Route specific (bilateral)	0.16	286	1.10	0.56
Code share	0.20	286	1.60	2.60
Joint activity	0.17	286	1.40	1.90
Marketing	0.24	286	1.09	1.90
Open skies	0.38	286	2.50	6.70*
Total alliance	0.14	286	1.30	1.60

*departs from a normal distribution

Table 5b. Normality test results of the performance data

	SKEWNESS STATISTIC		SIG.	KURTOSIS STATISTIC	Pr	SIG
Variables	Z score	Pr(Z \geq 0.49)		Z score	Pr(Z \geq 0.49)	
Price p. p (US\$)	-0.75	-0.29	0.19	1.17	0.38	0.28
P. revenue (US\$ 000,000)	0.98	0.34	-0.24	-0.84	0.29	-0.19
Revenue p. kilom. (000,000)	0.98	0.34	-0.24	-0.95	0.34	-0.24
Revenue passenger (000,000)	0.27	0.12	-0.02	-0.84	0.29	-0.19

The following are results from examining the research hypotheses developed in the previous section through the analysis of variances, t -tests and the test of structural equation models.

Test of Hypotheses

This research initially predicted that the NA and the EU airlines could have engaged in more numbers and dynamic features of alliances than that of the airlines of the AP region, as outlined in the previous section. The results presented first are from testing ***Hypothesis 1: There is a significant difference in the number and forms of strategic airline alliances between the three aviation markets.***

The results in Table 6 show that there is a significant difference between the three markets in the numbers of joint activities ($F = 5.05$, $df = 2$, $p < 0.007$). The means show that the NA airlines on average engaged in more alliances (mean = 5.2) than the EU airlines (mean = 4.5), and the AP region airlines (mean = 3.3). Second, the results show that there is a significant difference between the three markets in numbers of joint activities ($F = 6.2$, $df = 2$, $p < 0.002$), marketing alliances ($F = 17.4$, $df = 2$, $p < 0.000$), open skies agreements ($F=28.5$, $df=2$, $p < 0.000$) and route specific services ($F = 12.5$, $df = 2$, $p < 0.000$). However, there is no significant difference in the number of code sharing activities between the airlines of NA, the EU and the AP region. The AP airlines, in fact, forged more numbers of joint activities than the airlines of the other two markets, as the means show. Test results corroborate the descriptive study to support *Hypothesis 1*.

Table 6. Different number and features of alliances between the three aviation markets

Variables	F	Df	Mean			Sig.
			NA	EU	AP	
Annual new alliances	5.05	2	5.2	4.5	3.3	0.007
Route specific (bilateral)	12.5	2	7.8	3.4	5.4	0.000
Code share	2.5	2	5.5	6.1	4.2	0.086
Joint activities	6.2	2	3.5	4.8	6.1	0.002
Marketing	17.4	2	4.5	5.6	1.7	0.000
Open skies	28.5	2	1.1	0.8	0.06	0.000

Since this research also predicted that, due to the differences in the liberalization process, the NA and the EU airlines could have engaged in more numbers and dynamic features of alliances than that of the airlines of the AP region, the examination also tested: *Hypothesis 2: There is a significant difference between the airlines in involving strategic airline with different market conditions.*

This test employed two statistical methods. Table 7 shows results from ANOVA, in that the means of several independent samples are compared in respect of the five market conditions. First, Table 7 shows that the mean of annual number of alliances was 2.81 if the markets were regulated, and the mean of annual number of alliances was 2.43 during the process of deregulation, and the number reached 3.29 when the market was deregulated. For the airlines in the process of liberalization the mean of annual number of alliances was 5.75, and soon it became 8.67 when the market was fully liberalized. The test results also show that there is a significant difference between the annual numbers of alliances ($F = 8.28$, $df = 280$, $p < 0.04$).

Table 7. Difference in alliances between market conditions

Variables	F	Df	Means					Sig.
			Z=1	Z= 2	Z= 3	Z= 4	Z= 5	
Annual alliance	8.28	280	2.81	2.43	3.29	5.75	8.67	0.04
Route spc. (bilateral)	44.2	280	0.98	0.72	1.15	0.53	0.14	0.00
Code share	8.22	280	0.48	0.77	1.10	2.50	2.04	0.04
Joint activities	31.6	280	1.04	0.65	0.74	1.65	1.73	0.00
Marketing	20.3	280	0.17	0.70	0.73	1.75	1.89	0.00
Open skies	75.3	280	0.00	0.04	0.23	0.50	0.50	0.00

$z=1,2,\dots,5$ the five stages of market liberalization process

The analysis also found that there is a significant difference between the means of bilateral services with the market conditions ($F = 44.2$, $df = 280$, $p < 0.00$). However, this test does not show the number of bilateral services increased in line with the process of liberalization. For example, the mean of bilateral services was 0.98 when the market was regulated, and the number became 1.15 when the market was deregulated. However, this number decreased to 0.53 while the markets were in the process of liberalization, and then dropped to 0.14 when the market was fully liberalized. These results suggest that the number of airlines' route-point specific services were generally decreased during this period of time. This suggests a bilateral agreement, as a reciprocal service agreement, can be forged between two countries regardless of whether a market is liberalized or regulated.

On the other hand, the number of marketing alliances and open skies agreement was increased in respect to each process of market liberalization as the means show in Table 7. These results indicate that bilateral service agreements, once the major means for airlines to access a new market, were

being replaced by other strategic airline alliances. For example, the mean of marketing alliances was 0.17 when the market was regulated, and this number became 0.73 when the market was deregulated, and increased to 1.15 while the markets were in the process of liberalization, and then arrived at 1.89 when the market was fully liberalized. The results from comparing the sample means also show that there is a significant difference between the numbers of codesharing ($F = 8.22$, $df = 280$, $p < 0.04$), and the number of joint activities ($F = 31.6$, $df = 280$, $p < 0.00$).

In order to focus on the three liberalization processes (regulation, deregulation and liberalization), a *t*-test is used. This test compared the means of the same carriers at two different stages in each analysis. Model 1 ($Z_1 \leq Z_3$) compares the number of alliances a carrier entered into when the market condition were at stage one (regulated) compared with when they were at stage three (deregulated). Model 2 ($Z_3 \leq Z_5$) compares the number at stage three with stage five (fully liberalized); and Model 3 ($Z_1 \leq Z_5$) compares stage one with stage five. The test results are shown in Table 8.

Table 8. Alliance development with market liberalization

Variables	Model 1 $Z_1 \leq Z_3$	Model 2 $Z_3 \leq Z_5$	Model 3 $Z_1 \leq Z_5$
Total alliances	(2.94)***	(2.99)	(7.08)***
Route specific (bilateral)	(2.25)	(1.92)*	(2.14)
Code share	(1.87)**	(1.64)**	(2.92)***
Joint activities	(2.74)*	(2.28)	(3.41)**
Marketing	(2.11)	(2.17)	(3.19)*
Open skies	(1.0)	(1.08)	(1.31)**

Z_1 = regulated, Z_3 = deregulated, Z_5 = fully liberalised

*The numbers in parentheses are means

* $p < .05$, ** $p < .01$, *** $p < .001$

In Table 8 the results in parentheses are means, which indicate how the numbers of and types of airline alliances were different at the three stages. For example, the mean of the annual number of alliance was 2.94 when the market was at stage one, and became 2.99, then increased to 7.08 at stage three. The results also show that an airlines formed significantly larger number of joint activities when its market was liberalized than if regulated ($p < .01$). Also, an airline's number of code sharing and route specific services was increased significantly if the market was deregulated. For example, an airline's number of joint activities was significantly different ($p < .01$) with the market condition as stage five, compared with stage one. Generally, airlines obtained greater numbers coming from the increased integrative forms of alliances after the markets were liberalized. The results

from both ANOVA and t-test supported hypothesis 2.

The above tests find that there is a significant difference between the numbers of airline alliances in the different market conditions. It hence follows the question concerning the parameters of the increase in the numbers and types of airline alliances. The analysis further tested the structural equation model, to show empirical evidence of the causal-effect relationship between market liberalization and airline alliances. As the research initially presumed, more liberal markets led to more numbers of integrative alliances formed in the markets. As outlined in Section 3, it further tested ***H 3: Market liberalization leads to the development of strategic airline alliances.***

Undertaking this hypothesis, three tests were conducted following the structural equation model (3.2) developed through the theoretical study in an earlier section. The first test took year as a parameter of airline formation and the results for $Y = \int (\text{Year})$ in Table 5 show the coefficients of the estimations, in that the development of each type of alliances were significantly related to the year dummy variables. The second test took market conditions (liberalization process) as a parameter of alliance formation, and the results for $Y = \int (Z)$ showed that the dependent variables of the types of alliances were significantly related to the control variables of market conditions, and the market conditions significantly affected the development of code sharing ($F = 45$, $p < .01$), marketing alliances ($F = 31$, $p < .001$), open skies agreements ($F = 31.5$, $p < .001$), and total alliances ($F = 87.2$, $p < .001$).

The third test used three variables—market condition, year and passenger market—that tested the structural equation $Y_i = f(A_i, Z_i, T, Q_i); \omega_i, \dots$ (3.3). The results show the parameters of alliance development are market conditions, year dummy, and the passenger market ($F = 87.2$, $\text{Adj}^2 = 0.62$, $p < 0.001$). Additionally, this model showed a better fit, as the value of adjusted R^2 was 0.62, compared with the other adjusted R^2 as shown in Table 9.

Table 9. Development of alliances with market conditions (model tests)

Variables	Model 1	Model 2	Model 3	df
	Y= ((Year) Coefficient	Y = ((Z) Coefficient	Y= ((Z,YR,Q) Coefficient (2 Stage least squares)	
Total alliances	0.65*** (10.4)	0.65*** (14.3)	1.1*** (9.2)	162
Route specific (bilateral)	0.49*** (5.7)	0.43*** (7.9)	0.56*** (4.5)	160
Code share	0.59*** (7.33)	0.59*** (12.4)	0.44*** (3.3)	162
Joint activities	0.63*** (7.1)	0.27*** (4.7)	0.69*** (4.7)	162
Marketing	0.25*** (3.1)	0.65*** (14.6)	0.79*** (5.4)	162
Open skies	0.12** (1.5)	0.66*** (15.4)	0.76*** (5.1)	162
Model summary	Model 1 Adjusted $R^2=0.39$	Model 3 Adjusted $R^2=0.45$	Model 3 Adjusted $R^2=0.62$	

p <.01, *p <.001

^o The number in parentheses are T value

Finally, model fit was examined. This examination predicts through curve estimation the value of the increases of alliances resulting from the markets being more liberal. The estimation used the predicted value and residual, and the upper and lower 95% confidence limits for the predicted value (Norusis, 1993). This estimation also plotted the curve based on observed and logarithmic value. Both the results from model prediction and fitting show that the model is fit. Due to space limits these tables are omitted from this paper.

Based on the results of the above examinations, it is concluded that the variables that have contributed to the development of airline alliances were market conditions, year dummy variables and passenger market growth. As the market conditions are specified in ordinal ranges and used as dummy variables, which measures whether a formation of alliance as a result of the market condition change, the results through the linear regression suggests that more liberal markets led to more integrative form of strategic alliances. The test results obtained through the multiple tests agreed with each other to show that hypothesis 3 is supported.

As the central research problem undertaken by this research is examining the impact of market liberalization, the analysis further attempts to explore whether there is a significant difference in airline performance between the three aviation markets as a result of market liberalization and airline alliances. The research finally was directed at answering the last research issue by testing hypothesis 4 and 5.

The test results (see Table 10) show that the airlines' general performance in NA, the EU and the AP regions are significantly different, with the exception of operation revenues. The estimated mean on average price of airlines of EU was twice of that of the airlines of the AP region. The results of $X^2 = 49.8$, $p < .001$ show that the average price of airlines of the three markets are significantly different. The estimated means of passenger numbers and passenger kilometres of the airlines of NA were double the airlines of the AP region. The results show that the passenger numbers ($X^2 = 55.7$, $p < .001$) and passenger kilometres ($X^2 = 46.6$, $p < .001$) of airlines of the three markets are significantly different. Generally airlines of NA and the EU had larger profits and productivity than the airlines of the AP region and the average price of per passenger kilometres was much higher of the EU airlines (see Table 10). The results support *hypothesis 4*.

Table 10. Difference in airline performance between the three markets

Variables	US (1), EU(2), AP (3)	Number of observations	Mean Rank	Chi-square X^2	Asymp Sig
Passengers	1	62	111.57	55.7	0.00
	2	28	70.57		
	3	67	52.39		
Price of P.P.	1	67	95.75	49.8	0.00
	2	28	112.21		
	3	64	49.42		
Passenger klm	1	60	115.42	46.6	0.00
	2	38	75.58		
	3	67	58.18		
P. revenue	1	52	75.38	0.72	0.70
	2	31	67.58		
	3	60	71.35		

Results from testing *hypothesis 5* show that airlines achieved better results of performance when operating in more liberal market conditions. The results are shown in Table 11. These results show that there is a significant difference between the airlines' performance in different market conditions, with the exception of passenger operation revenues. Passenger number estimates are nearly three times more when the estimation with the market condition as 5 in contrast to 1. Also, the airline in the liberalized markets gained much larger passenger operation revenues than, in regulated market. Results show that generally, market liberalization contributed to better airline performance. Thus, *hypothesis 5* is also supported.

Table 11. Difference in airline performance between different market conditions

Variables	Z=1,....,5	Number of observations	Mean Rank	Chi-square (X ²)	Asymp. Sig
Passengers	1	32	35.44	38.2	0.00
	2	24	59.27		
	3	61	97.84		
	4	32	93.75		
	5	8	109.75		
Passenger klm	1	32	41.19	33.6	0.00
	2	29	68.89		
	3	62	97.00		
	4	34	99.24		
	5	8	123.88		
Price of P.P.	1	29	50.45	21.1	0.00
	2	24	76.50		
	3	63	80.52		
	4	34	98.71		
	5	9	110.28		
P. revenue	1	30	65.30	1.3	0.53
	2	24	69.71		
	3	46	73.50		
	4	34	72.75		
	5	9	90.00		

CONCLUSION

The research commenced with an attempt to address the research problems of the development of airline alliances and the critical factors involved in the development. The descriptive results show that the three distinct growth phases of the development of airline alliances corroborated the processes of the liberalization in the three aviation markets.

The tests of the hypotheses show that there is a significant difference between the development of airline strategic alliances with in different market conditions. Airlines in liberalized markets involve larger numbers and deeper scope of alliances than the airlines in regulated markets. Essentially, there is a positive relationship between the developments of alliances and the liberalization of air transport markets. Importantly, the results from the general examination on airline performance between the different markets with different market conditions show that there is a significant difference in airline performance between the three markets, and the airlines achieve better results of operation in the more liberalized markets.

These findings indicate that market conditions are significantly important for a formation of strategic alliances particularly for the dynamic

features of alliances. Market liberalization is also important for airline performance. Countries liberalizing the air transport markets enable their airlines to forge more numbers and integrative forms of alliance, towards building up global air transport networks. Based on the research findings, it can be suggested that airline alliances are an important strategy, particularly for the carriers of the AP region. Traditionally Asian businesses have frequently used joint activities. Airlines in the AP region have entered considerable numbers of joint activities and marketing alliances, including regional blocks, which have already benefited the airlines in term of performance.

It has been questioned that the US bilateral open skies agreements provide its carriers more access to the global market and countries that do not enter into such agreements with the US risk a loss of traffic (PC, 1998; Eleck et al., 1999). Consequently, open skies agreements may enable carriers who have the freedom to exercise market power to be dominant in the markets. Thus, regarding formation of strategic alliances, countries need to be cautious in policy making. It is essential for governments and organizations to protect developing markets and smaller carriers, to encourage competition, and also maintain necessary control over larger carriers so they its do not take advantage of the freedom to exercise power with the potential of becoming monopolistic. On the other hand, it is also important for government organizations to recognize that regulation can restrict not just the development of airline alliances but also the economic gains.

Due to the liberlization process of the Asian countries, strategic airline alliances crossing continents are still facing lots of impediments. Countries like China, due to market regulation and competitiveness, may not agree on open skies policy unless the air services are pooled with those of other goods and services (Oum et al., 2000). Thus intra-Asian open skies policy will allow the Asian carriers to compete effectively with the US carriers in their back yard (Oum, 1998). It will also allow major Asian carriers to set up an efficient multiple hub network covering the entire Asia continent effectively (Oum, 1998).

This research suggests that trade opportunities may be enhanced by an across-the-board approach, to enable a like-minded sub-group of countries to negotiate air transport and other goods and services trade together. The application of multilateral negotiations may be therefore encouraged where more than two counties take part simultaneously and broad categories of goods and services could be discussed more streamlined negotiations. A regional approach simultaneously resulting in to liberalizing all trades, including air transport, is likely to be more successful than negotiating air

transport matters separately from other goods and services trade matters (Oum et al, 2000).

The fact of economic growth and the tourism boom of the AP region will contribute to the passenger traffic growth, including passenger travel kilometers. However, the increasing rates of passenger operation revenue and average price of per passenger kilometers are not increased greatly, compared with the airlines of NA and the EU (Wang, 2001). This situation could also push the airlines of the AP region to be more involved in strategic alliances. Also, the external force of global alliances being formed by several major carriers residing in different countries is expected to strengthen over time (Eleck et al., 1999; Oum et al., 2000). This would also contribute to the promising future of the AP airlines entering more dynamic alliances.

While market entry or new service to a market is restricted, alliances will continue to be an important tool for airlines to seek in order to expand their own networks. The current regulatory system, including bilateral ASAs, poses impediments to structural changes in international aviation (Oum et al., 2000). The initiation of regional and more liberalised bilateral, or 'open skies, agreements has removed some of the impediments. This suggests that the coordination of regulatory alliances and the liberalization of international aviation reinforce each other and should therefore be pursued simultaneously.

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