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TITLE: Modelling Strategic Alliance Partner Choice in International Airline Networks

ABSTRACT: It is generally acknowledged that consumers prefer to fly with an airline that has an extensive network. Such consumer preference is inducing airlines to form strategic alliances with foreign airlines in order to attract custom to their networks. This paper presents a framework for modelling strategic alliance partner choice in international aviation. The stated preference modelling exercise for testing the relative weights of the partner attribute is described.

KEYWORDS: strategic alliances, choice context, alliance partners, partner attributes, partner profiles

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1. INTRODUCTION

The drivers of strategic alliances in international aviation have of late received concerted attention from academics and industry analysts (see for example, Tretheway 1991; Oum et al., 1993, Youssef and Hansen, 1994; Gallacher, 1994 and Nyathi, 1993). The strategic motives for getting into a strategic alliance largely determine the type of strategic alliance that an airline would get involved in. Once the alliance type has been selected, the airline might then proceed to evaluate some potential partners. The airline would be expected to select a partner whose profile best matches its strategic motives. The important partner attributes for a given choice context are yet to be researched (Pharke, 1993).

The objective of this paper is to present a methodology of researching the relative weights of the attributes hypothesised to determine strategic alliance partner choice. The modelling exercise for determining the relative weights of the attributes are described. The paper is organised as follows; section 2 presents an analysis of the important partner attributes presented to airline managers to evaluate in a partner choice context. Section 3 addresses the modelling requirements, centred on a discrete choice model of partnership choice. New data is required. In section 4 the data collection strategy is outlined, detailing the method used to collect the data and the questionnaire design. A major focus of the empirical study is the stated preference experiment. Section 5 details the design properties of a stated preference experiment and how it is administered to a sample of airline managers worldwide. In section 6 we make some conclusive remarks.

2. AN ANALYSIS OF THE RELEVANT PARTNER ATTRIBUTES

There is a dearth of empirical evidence on the determinants of partner choice in any given choice context. This is in part due to the non availability of data, attributable largely to the reluctance of airlines to disclose market sensitive information. A review of the literature and some convenience sample discussion with airline managers suggests that there are twenty attributes that are a potential influence on partner choice. The attributes can be defined at two levels - generic and elemental levels. There are four generic and sixteen elemental attributes. They are discussed in turn.

The important attributes will depend on the context in which the choice is being made. The type of alliance that an airline wants, (that is, whether an it is an equity or marketing alliance), the partnership strategies that it wants to pursue particularly in equity alliances (that is, whether the airline wants to be an anchor carrier, or an equal partner or junior partner) and the regions that it wants to compete in (subject to the bilateral and legal constraints) are all important factors in the airline's evaluation of potential partners. The size and ownership structure of the airline are important contextual factors impacting on airline partner choice. The attributes that were found to be important from a literature search are discussed below.

2.1 EXPECTED NETWORK OUTCOMES

The first generic attribute relates to the network outcomes that an airline would like to achieve by selecting a partner with a certain profile. Oum et al. (1993) have emphasised that airlines that would like to achieve global carrier status must pay attention to their networks. The way the airline links various nodes (the spatial dimension) and coordinates schedules (the temporal dimension) defines the firm's network. There are three strategically important characteristics of the network, namely the geographical extent (that is, number of city pairs served), the geographical pattern of the network (that is, how the airline links the city pairs) and finally the scheduled frequency on the network (that is, the temporal dimension of the network).

2.11. The Geographical Extent (Size) Of The Network

The geographical extent of the network can be defined at three levels - the domestic only network, the regional network and the global or intercontinental network or the actual number of nodes and links that the airline serves (see for example Reynolds-Feighan, 1992). In the first type, the greater part of airline's operations are in its home country. The second type refers to those airlines that have intracontinental traffic and the last one refers to those airlines that have some sizeable intercontinental traffic. Airlines usually have all types of traffic, but one would expect that an airline with *global carrier* ambitions, for instance, would presumably be more interested in pursuing a larger share of intercontinental traffic. This does not necessarily mean that it would de-emphasise the other types of traffic as they can contribute to its revenues, but a global carrier would actively pursue strategies that would enable it to serve a large number of major hubs throughout the globe.

Some structural economies arise from *network size,* namely economies of network density, economies of link density and economies of scale and scope. Economies of network density arise from an increase in the amount of traffic served by an airline when the physical size of the network is held fixed. For instance, the strategic alliance of British Airways (BA) and USAir has meant an increase of feed to BA's North Atlantic traffic even though its network size has remained fixed (BTCE, 1994).

Economies of link density refer to advantages of increasing traffic volume on a particular segment of the network. Airlines may use larger aircraft on the segments and thus reduce unit costs of operation. By adding more flights on a link, an airline may reduce schedule delay and thus improve service quality. Besides, an increase in link density implies an increase in network density and hence the airline gets a double "whammy".

Caves et al. (1984) have shown that economies of scale in the airline networks are negligible. Network expansion per se will not lower unit costs, there are at best, constant returns to scale. On the other hand Youssef (1992) asserts that larger production levels or a larger number of nodes or destinations will lower costs or provide a better service quality compared to rivals. Whether economies of scale are substantial or not in the airline industry, Gallacher (1994) and the BTCE (1994) observe that airlines are constantly pursuing the growth strategy, hence there must be a perception held by airline management that economies of scale exist. Perceptions are quite important in driving strategic decisions and airline managers may enter into strategic alliances because of perceptions of gains from economies of scale.

There are also marketing factors inducing airlines to pursue extensive networks. Travel agents and passengers have a stronger preference airlines which serve a large number of destinations as the latter are more likely to receive on-line connections to more destinations and thus reduce interline connection friction. Consumers also prefer airlines with a large number of destinations since that provides them with variety when they cash-in their frequent flier points.

Depending on their strategic objectives at the time, one would expect airline management to consider the implications on the geographical size of an airline's network when choosing an alliance partner.

2.12. The Geographical Pattern Of The Network

Different economies are associated with the three geographical patterns of the airline network that have emerged since deregulation of the US domestic industry. Sorenson (1990) identifies three generic network patterns, namely the linear network, the hub-and-spoke network and the turnaround route system. Figure 1. illustrates the three configurations.

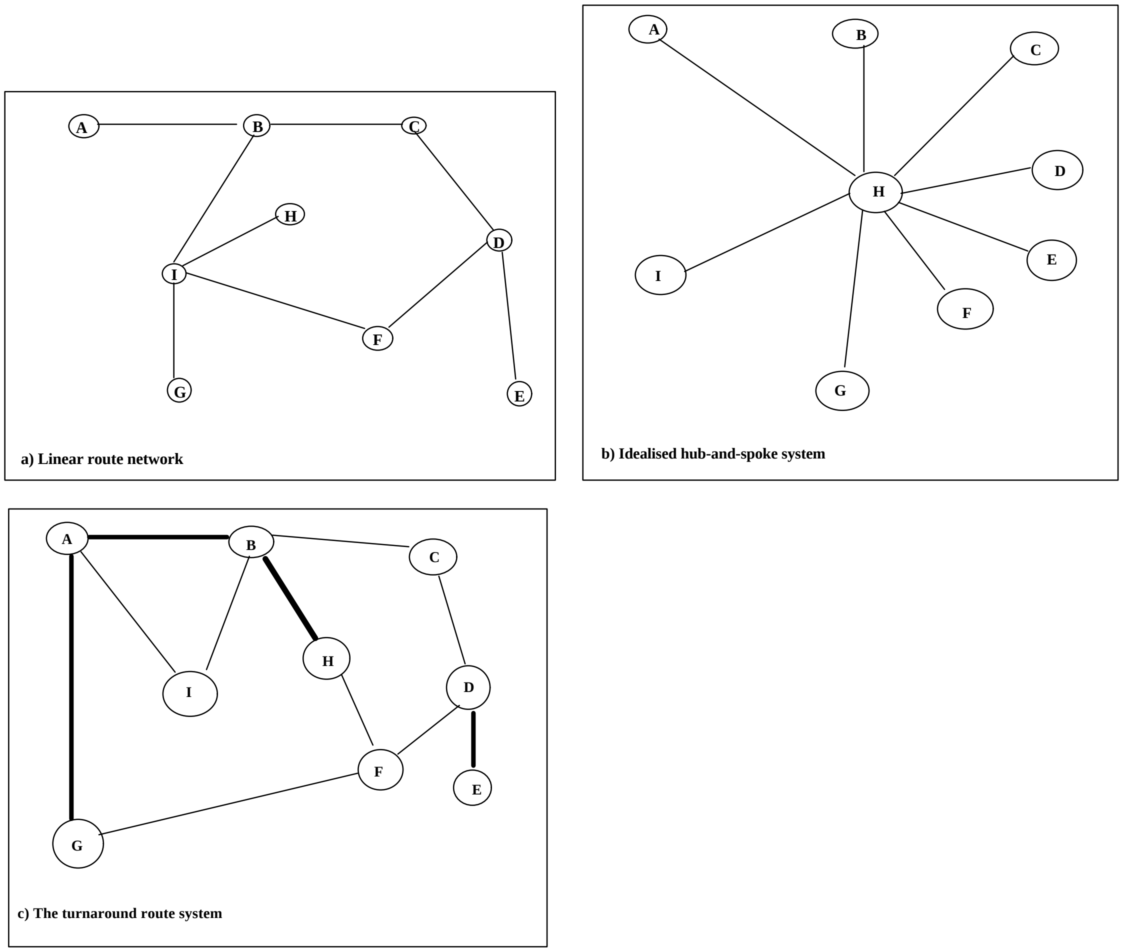

Figure 1. The three generic route systems

In the linear network, the airline makes several stops in order to gather enough passengers. The linear network is usually applicable to thin traffic routes. In international markets, however, the airline is constrained by freedoms of the air and cabotage restrictions as to how many pick-up stops of its choice it can make. The linear network may not confer operating economies because of the stop-start nature of the operations. There is disproportionate travel time inconvenience for the passengers (Sorenson, 1990).

In the hub-and-spoke system airlines build their networks by combining features from non-stop and multi-stop routing patterns. Airlines coordinate schedules of in-bound and out-bound flights. Youssef and Hansen (1994) assert that the use of the hub and spoke system may increase the airline's incentive to expand their international networks through strategic alliances. Denis (1994) asserts that there is a discernible development of the hub-and-spoke system in international aviation. The most efficient means of providing feed for long-haul services is to superimpose them onto short haul routes. All

the principal US carriers have been active in developing Transatlantic links from their major hubs.

The turnaround system (also called the out-and-back system) uses the 'high density approach' where there is little economy to be gained in expanding the geographical scale of links between nodes that have a large demand for interacting with each other (Sorenson, 1990). The system is quite similar to the point to point (linear) network but differs in that the airline concentrates on the dense networks. It is a system that has been exploited successfully by Southwest Airlines in the USA and by Virgin Airlines on the dense competitive North Atlantic route. It is conceivable that one alliance partner may benefit from feed traffic generated in a turnaround segment of its partner by conveying some of the through traffic to its chosen destinations at either end of the segment. A strategic alliance through code sharing for instance may ensure that the traffic from the turnaround segment has access to on-line connections.

Airlines in international aviation may be constrained by bilaterals as to their network structure, but where the bilaterals are liberal, airlines may use a combination of all three (depending on the market), but will tend to emphasise one of them. Airline management will choose partners that may facilitate building of their strategically preferred network pattern as each pattern has its own peculiar economies.

2.13. Scheduled Frequency On The Network

An airline can grow by expanding scheduled frequency on its network (Ghobrial et al., 1992). In international aviation, the scheduled frequency (capacity) that an airline can offer on a route may be subject to bilateral restrictions. There is a direct relationship between frequency on a route and market share. Hansen and Kanafani (1985) demonstrate the S-curve relationship between frequency and market share, where high frequencies translate to higher market share on the route. Consumers prefer more frequent flights and an airline that can provide more frequency can achieve higher traffic levels on the route.

In the past, most international airlines placed emphasis on the number of destinations served, but in many cases demand in these markets could only justify one or two flights per week. Although suitable for leisure travellers, such frequencies are too low for the business travellers. Travel times are also inflated by frequent intermediate stops required to fill up wide bodied aircraft. Yields tend to be poor and costs bloated. Station expenses are spread over a few flights and local marketing expenses are high. The long haul crew is inefficiently used on short hop low load factor tail sectors. The emphasis is now shifting to daily frequencies and long distance non-stop flights between key hubs. Connections can be provided by partner airlines or change-of-gauge equipment to reach the remaining cities (Denis, 1994: 143). For instance, in 1982, 26 points beyond Europe were serviced by Scandinavian Airline Services' (SAS) long haul flights but the number had fallen to eight in 1993. There were, however, 63 weekly departures from Scandinavia in 1993, an increase from 50 in 1982. Twin engine jets have enabled frequent long haul flights on relatively thin routes.

The desire by airlines to extend or re-shape their networks may be achieved through strategic alliances. In the international aviation context, the definition of network may be stretched to include **strategic alliances** between airlines of different nations. In international airline networks, a group of affiliated airlines could offer seamless services to consumers through joint use of computer reservation systems, throughfares and ticketing, automatic baggage transfers, coordinated flight schedules, code sharing of flights, joint marketing, sharing of frequent flier programs, joint purchasing of aircraft and fuel. For all practical purposes, to consumers, it is like using a single airline company (Oum et al., 1993). Strategic alliances, therefore can be viewed as an instrument of increasing both network size (market coverage) and sprucing up network structure (optimal route configuration and connectivity). Alliance partners that assist airline management to shape the network in their most preferred fashion will be preferable.

2.2 MARKETING ECONOMIES

Tretheway (1991) asserts that carrier size advantages come from marketing rather than supply-side economies. Consumers prefer service by one carrier throughout their journey and frequent flier programs build loyalty in consumers especially those travelling further afield. Marketing economies are drivers of strategic alliances and as such should determine partner choice.

2.21. Access To Distribution Channels

Once an international airline has the requisite air service rights to enter a market, their success in gaining market share will largely depend on their marketing strategies and prominent among them are the distribution channels that the airline has access to (Levine, 1987). Travel agents provide an important service to consumers by supplying a range of travel options. On the other hand they act as a distribution channel for airlines. Their role in influencing carrier choice is well recognised and increasingly they are becoming affiliated to airlines through CRSs, joint car hire schemes and frequent flier programs (Nyathi et al., 1993).

From the travel agent's point of view, the airline serving the largest network of international destinations provides a potentially large volume of ticket sales. Thus the advantage of offering incentives to travel agents, combined with frequent flier programs (FFPs) reinforces the advantages of airline size. Airline managers seeking to gain market share on international routes could be expected to seek partners who either have a strategic link with travel agents in those markets or they actually own the travel agents as is the case in the Australian domestic aviation market (see Nyathi et al., 1993 a detailed account of down stream integration in the Australian domestic industry).

2.22. The Market's Image Of A Potential Partner

The market’s image of an airline derives from perceptual, attitudinal and actual operational issues. It involves perceptions and actual records of the airline’s punctuality, fare structures, technical competence, safety and in-flight service (Nyathi et al., 1993). The self image of an airline can be gauged from the marketing communications that it puts out on itself. For instance, Qantas prides itself on its safety record, Lufthansa on its technical efficiency, Swissair on its punctuality, Singapore Airlines on its in-flight service, Japanese Airlines on its friendly staff and good labour relations and British Airways on its global network. Airlines eventually do acquire a distinct image (reputation) and this tends to permeate the *corporate culture and management style*. Some airlines will see each other as 'natural' partners because of compatible self-image and corporate culture or have had a history of cooperation. Airlines which can build positive images for themselves in the minds of the consumers are likely to command customer loyalty. It is to be expected therefore that airline management would want to consider the image that the market holds of the potential partner as an important factor.

2.23. Access To Markets

In a poorly managed strategic alliance, the potential for conflict of interest between partners always exists. A partner who is perceived to be gorging traffic from the other might face retaliatory action and consequently the partnership might collapse (see Pharke, 1993 for a discussion on managing alliance relationships). Airline managers, one would expect, would seek partners that facilitate their operations in chosen markets. For beneficial outcomes, partners should complement rather than compete with each others’ operations (Gallacher, 1994 and Nyathi, 1993).

Complementary scheduling of frequencies on routes are common means of achieving competitive harmony (Forsyth, 1978 on the Two Airline Policy in Australian domestic aviation). To the extent that a potential partner is willing to co-schedule, the more attractive they would be as a partner.

An important source of revenue for international airlines is flow traffic. The benefits of flow traffic to British Airways have been noted by the BTCE (1994: 259), which reports that the alliance gives BA access to the largest volume of traffic by any foreign carrier (in excess of 200 US cities) in the world's largest market. It is a mutually beneficial relationship as USAir has access to BA's international traffic for feed on its domestic network. An alliance partner that would allow reasonably unhindered access to markets or for that matter facilitate access would be a desirable one in the view of airline management.

2.24. Membership Of The Same Computer Reservation System (CRS)

The production and distribution of information are pivotal to any successful operation in a globalising industry (Ohmae, 1992). In the airline industry, CRS have conferred marketing advantages on airlines that own them, not least because of their information gathering role but also because of the revenues that derive from them (Levine 1987). In the US, CRSs processed 80% of all the tickets sold in 1988 compared to 40% before deregulation. With estimates that about half of the leisure travellers and one-fourth of business travellers do not have strong preference for any particular airline, CRS owning airlines can earn tremendous rents (DOT, 1990, 1:12). American Airlines, the owners of Apollo, earned US$ 430 million in booking fees from other carriers, a figure equivalent to 15% of the net income of the entire US domestic industry in 1988 (Transportation Research Board, 1991). In addition to the incremental revenues CRS owning airlines get from their competitors, information from CRSs has been used by carriers to fine tune their yield management strategies. Having access to a CRS allows an airline to continuously observe the booking patterns on their carriers and to device counter-strategies regarding the size of discounts and the number of seats sold (Levine, 1987).

An important development in the CRS sector is that of industry concentration and strategic alliances - thus mirroring the developments in the airline industry. Whilst there are no sizeable economies of scale in airline networks, these are to be found in the CRS or marketing sectors. The economies of scale act as both a barrier to entry as well as a spur to concentration. Interavia (1992: 41) reports that multiple airline owned CRSs such as Galileo are causing industry alignments and thus facilitating strategic alliance formation. In addition, pressure from industry bodies such as IATA, ICAO and the European Union is leading to CRS harmonisation and this in turn leads to airline strategic alliances. Figure 2 adapted from Interavia (1992) depicts the relative ownerships of the proposed Galileo and Covia (Apollo) planned merger. If the merger goes ahead, it will be the largest industry alignment to date and might be a precursor to more widespread cooperation amongst airlines.

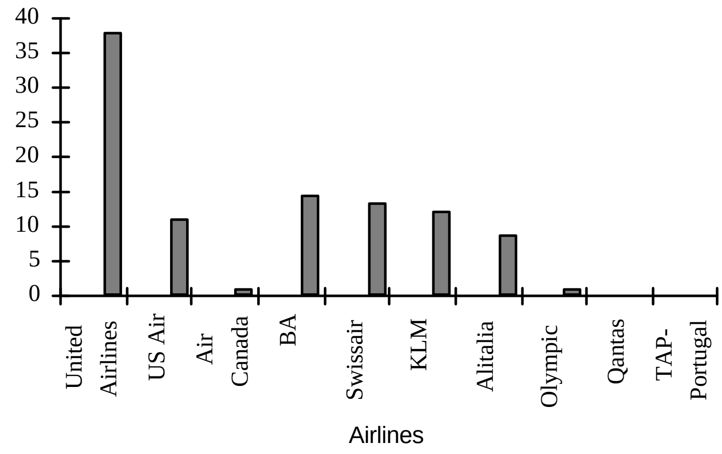

Figure 2. Shareholdings of the proposed Galileo and Covia merger

Bearing in mind that the airlines above also have strategic alliances with other airlines not involved in the CRS merger, those airlines outside both folds could be marginalised. Airline managers, one would expect, would want to choose a partner that has equity in a CRS consortium or is predisposed to offer them the services deriving from CRS ownership. In addition, a potential partner that is in the same CRS with the airline offers some advantages in terms of ease of transacting, code sharing, and schedule (frequency) coordination. There is more transparency in dealings between partners. The advantages to managers of a partner belonging to the same CRS also extend to coordination of Frequent Flier Programs.

2.25. Membership Of The Same Frequent Flier Program (FFP)

Frequent flier programs (FFPs) are marketing inducements used to obtain customer loyalty (Tretheway, 1989). When American Airlines introduced an FFP in 1981, its patronage rose by between 20% - 35%. Tretheway asserts that FFPs have played a role in the consolidation of airlines. They also have a traffic stimulation effect in markets where they are in use.

Besides the US and Europe, the Asia-Pacific airlines have now joined the FFP bandwagon. For instance, Singapore Airlines, Malaysian Airlines, Cathay Pacific and Ansett Airlines have now established a joint venture FFP - called Passages (The Economist Intelligence Unit, 1993). British Airways executives believe that the future will see more FFPs built around airline groupings than now. The Economic Intelligence Unit (1993: 19) quotes a British Airways spokesman as saying;

> In FFP terms, an airline is less well-placed in those market places furthest from its hubs. The only way to respond to competitive activity at the far end of your route structure is to find other ways of attracting people into your program.

FFPs are assisted by the presence of a CRS and the administration costs of an FFP can be less if the airline is able to “piggy-back” it onto an existing CRS system. A CRS based FFP can also be used to differentiate an airline's product from those without a CRS. Joining an existing FFP partnership program has a number of advantages for an airline, among them, lower start-up costs, a larger market, more passengers, and network extension and better configuration. It is also easier for passengers to accumulate points on carriers serving a large number of places because smaller carriers must counter this via more generous payouts. It is to be expected that airline managers would be more predisposed to choose partners who are already in an FFP partnership or are willing to be a member of the same FFP.

2.3 AIRPORT (HUB) ACCESS FACTORS

Besides the bilateral prescriptions on the capacity/frequency an airline is permitted on an international route, there are other constraints that it faces such as availability of airport infrastructure. Partner airlines can trade slots or use the same airport facilities or engage in coordinated scheduling to circumvent the environmental constraints imposed by scarce airport infrastructure.

2.31. Route Circuitry

A strategic alliance can assist an airline to reduce flight circuitry. The flight path that an international airline can take is governed by the freedoms of the air, availability of landing slots and gates at chosen airports, and traffic density on the chosen route. Airline unit costs tend to rise with an increase in the number of stops. Long haul non-stop routes engender lower unit-costs than “pick-up” operations. In addition, circuitous routing increases travel time hence passenger inconvenience.

2.32. Access To Adequate Gates And Slots

There is a widespread lack of access terminal space and gates at airports in the US, Australia, Europe and lately Japan (BTCE, 1994). Airlines are faced with the task of assembling congruent terminal space, gates and slots at airports between city pairs. (Brander et al., 1989 and Bass, 1994: 145). An airline’s portfolio of slots enables it to schedule its frequencies in a competitive manner. Slots are usually the property of the airport authority, but the grandfather rights that airlines have over them mean that they have effective control. Airlines in the US domestic market and the European Union market can exchange slots. There is also a market for leasing them in the US although this option is limited because of scarcity (Transportation Research Board, 1991). Partner airlines are more likely to exchange slots than head-on competitors.

Terminal space and gates are also scarce at airports where some airlines have grandfather rights (see Nyathi et al., 1993 on monopoly rents at airports). Partner airlines are more likely to provide gate space to their partners than competitors (BTCE, 1994).

2.4 FINANCIAL AND OPERATIONAL CONSIDERATIONS

Equity strategic alliances involve more than buying another airline's shares for investment purposes. On the contrary, good financial investment would in fact discourage airlines from investing in other carriers in the interest of diversifying their portfolio (see Lawriwsky, 1993 and Youssef, 1992). Gallacher (1994) asserts that an equity alliance that includes financially weak airlines whose costs are bloated is likely to fail.

Measuring an airline's financial and operational performance is not a straight forward task. Many studies in the past have tried to construct a single, composite profitability/productivity measure to compare airlines. However, due to the diversity found in the nature of carriers' operations, it is very difficult to arrive at a single composite index which can take into account all the operational differences in a way that is meaningful and of use to airline managers (Doganis et al., 1994). The measures that have been used in this study are adapted from the airline management simulation by Smith and Golden (1994). In the in-depth interviews with airline managers, the measures were confirmed as important and widely used in the industry.

2.41. Financial Structure And Performance Of Potential Partner

Before deregulation in the US, the capital structure of airlines comprised almost equal proportions of debt and equity and most of the capital expenditure was financed from internal sources. The trend has been towards higher debt levels. If the operating leases (which are in effect off-balance sheet debt) are taken into account, leverage in the airline industry is far higher than when one first looks at book values. Lawriwsky (1993) urges the examination of operating cashflow coverage ratios to determine the growth of indebtedness of airlines. The capital structure of a company affects its betas and hence its cost of capital. A highly leveraged partner is not a desirable one to management other things considered.

The general problem of financial performance analysis (particularly profit performance) is that ratios and key financial variables examined have different meanings and interpretations for different airlines and periods in the economic cycle (BTCE, 1994). However, within their own subjective criteria, airline managers can use performance ratios that appeal to them when evaluating a potential partner. Good financial performance should make a potential partner more attractive particularly in an equity alliance.

2.42. Number Of Medium To Long Range Aircraft

Aircraft account for the largest portion of an airline's capital investment, particularly if the airline elects to purchase rather than lease its aircraft (BTCE, 1994). De Wit and van Ommeren (1992) attribute the possible development of a hub-and-spoke system in international aviation to improvements in aircraft technology. They assert that the continent wide multi-hub system resulting from deregulation in the US domestic market is being extended to other continents by including intercontinental spoke connections to the domestic hubs. Improvements in aircraft technology have made it possible to eliminate the so-called 90 rule of ICAO, which required a twin engine jet to fly a distance of less than 90 minutes from an airport where it could land in case of engine failure. Since 1985 national aviation administrations eg the FAA (USA) and the CAA (UK) have allowed Extended Range Twin Engine Operations (EROPS or ETOPS) to airlines (see Macrao, 1991). Aircraft such as the B767-200ER, B767-300ER, A310-300, B757, A330, A340 and the new B777 are suited to ETOPS. An advantage is that they can be operated on thinner feeder routes without higher costs per seat kilometre, mainly due to substantial reductions in fuel consumption and the opportunity to match aircraft type to demand.

Wheatcroft and Lipman (1990) give an account of the economies derived from use of large aircraft on long dense routes. Economies of aircraft utilisation in part derive from the right mix of aircraft in the airline's fleet. Large aircraft should be scheduled on long dense routes and smaller aircraft on thinner routes. The down side to different aircraft types lies in the maintenance costs and the need to train pilots for all the different gauges (see Nyathi et al., 1993). Given the cost of acquiring or even leasing aircraft, one would expect airline management to pay attention to the type of aircraft that a potential partner operates. Alliance partners sometimes cross lease aircraft and in some cases carry out joint maintenance. A partner with compatible aircraft therefore confers some economies in maintenance costs and pilot training.

2.43. Fleet Utilisation Rates

Fleet utilisation rates are a measure of how an airline uses its aircraft. Fleet utilisation rates are dependent on aircraft assignment, that is, scheduling, the fleet mix, the network strategy used, labour relations and work rules, and demand. High rates of fleet utilisation are often seen as an indicator of superior fleet planning, a well configured network and crew scheduling.

Smith and Golden (1994) use fleet utilisation as a measure of operating performance. Airline managers keen to judge the operating performance of a potential partner would be expected to give some weight to their fleet utilisation rates. A partner with good utilisation rates may also have some expertise in scheduling or has an optimal fleet mix.

2.44. Cost Per Available Seat Kilometres

The cost structure of an airline depends on input technology, labour costs, route structures and demand. The BTCE (1994) and Doganis et al. (1994) provide some comparative unit cost figures of major airlines world wide. They note that there are measurement and comparability problems arising primarily from the operating and ownership environments of airlines. The profit margins in the airline industry are very thin. It is very important to keep unit costs low in order to be profitable. A partner with high unit costs particularly in an equity alliance may be a liability (Gallacher, 1994). In a marketing alliance, where some tasks are performed by the partner (such baggage handling or manning the gates), the bloated costs may be passed on to the other partner. One would expect airline management therefore to pay attention to the cost structure of a potential partner. A covenant in the BA-USAir strategic alliance specifically addresses the need for the latter to cut costs.

2.45. Average Load Factor Of Potential Partner

The load factor is a measure of airline traffic as proportion of airline capacity. Average load factors are affected by demand in the market, the aircraft in use, and the frequency on the route(s). High load factors are desirable as they *may* translate into higher revenue subject to yield. Airline managers would prefer a partner that has consistently high load factors particularly if they are going into an equity alliance. On the other hand, low load factors may indicate the need for the airline to enter and stimulate the market which may be burdened by high fares or inadequate service frequency.

2.5 OVERALL PREFERRED STRATEGY

The attributes discussed fall under four generic attributes which airline managers can then evaluate. The relative weight given to each generic attribute by management is not known, hence a subject of empirical investigation.

3. SPECIFICATION OF AN ECONOMETRIC MODEL OF PARTNERSHIP CHOICE

If we accept the premise that an individual manager's choice of partners represents an expression of their preference among the available options at the time, then it is possible to model the choices that airline managers would make if presented with alternatives of potential partners with various attributes. Airline management are assumed to evaluate alternative opportunities for strategic alliances within a framework of utility maximisation subject to budgetary, bilateral and legal other constraints. The set of factors considered by management are not all observed and measured by the analyst; hence a number of unobserved influences exist. To ensure that the principle of utility maximisation is adhered to, we have to account for the contribution those influences on partner choice.

Partner choice involves airline management evaluating options (defined as a vector of attributes) from a set of mutually exclusive alternatives and choosing the one which results in securing the maximum utility. Given that a subset of influencing attributes are unobserved, the analyst can only identify the utility maximising alternative up to a probability. The presence of unobserved influences results in a random utility maximisation interpretation of partnership choice.

Formally, we can specify the utility function defining alternative *i* as:

$$U_i = V_i + e_i$$

Where: V_i = an index of the observed influences on utility (usually linear additive in the attributes) and

e_i = an index of the unobserved influences on partner choice with the following properties:

- independently and identically distributed across all alternatives (IID).

- exponentially distributed with an extreme value Type I distribution.

A vector of utility expressions associated with each alternative and with an IID profile for the unobserved effects and an extreme Type I distribution results in a multinomial logit model:

$$P_i = \frac{\exp V_i}{\sum_{j=1}^{J} \exp V_j} \qquad i \neq j: \quad j \in J$$

Where P_i = the probability of choosing alternative *i*, given the set of alternatives J (Hensher and Johnson, 1981).

Specification of the partnership choice model is only part of the definition of the empirical model system. The next task is to design a choice experiment in which the set of generic and elemental attributes are offered to a sample of airline management to evaluate.

4. DATA COLLECTION STRATEGY

There is a dearth of published data on airline strategic alliances. The international aviation industry is generally characterised as oligopolistic. A well known characteristic of oligopolistic competition (where there is no express collusion) is the high value placed on information/data.

4.1. Available Revealed Preference Data

The *Airline Business Journal* (July 1994) provides some data on the current equity alliances, with the names of the alliance partners and their respective equity holdings supplied. There is, however, no data on the motivations behind the alliances nor are the profiles of the partners given. The *Interavia Journal* (April 1993 and April 1994) provides some data on airline profiles but does not address the issue of partner choice nor does it give cross airline equity holdings data. The BTCE (1994) also provides some examples of equity alliances as do many other sources. All the above sources are not amenable to modelling partner choice using revealed preference data. Therefore a need exists to collect primary data from the airlines to enable modelling of the partner choice process.

4.12. Why Use Experimental Data?

In the business strategy and organisational behaviour literatures, Rajagopolan et al. (1993) review the state of practice in data collection on strategic choice. They point out that decompositional methods such as conjoint analysis have not been used in the strategic choice context, and yet they hold so much promise. To this author's knowledge, there is only one study that has used stated preference (SP) techniques to model strategic choice by a firm's managers (see Priem, 1992).

In the absence of useable revealed preference (RP) data, there is strong justification for using SP techniques. Even if the former data were available, Hensher and Bradley (1993), Bradley and Daly (1991) and Hensher (1994) have shown that RP data could be enriched by combining it with SP data. Besides, airline management would be more interested in strategic intensions of the airlines than in the revealed choices of current strategic alliance partners. The information content of the latter whilst useful, is historical and may not necessarily be a pointer to future strategies likely to be adopted by airlines. The next section addresses the design of the SP experiment.

5. A STATED PREFERENCE EXPERIMENT OF PARTNER CHOICE

5.1. Data Type

Stated preference analysis is premised on a controlled experiment, out of which comes a series of survey questions eliciting a response to alternative combinations of levels of attributes. A good experiment has a rich set of attributes and choice contexts together with enough variation in the attribute levels necessary to produce meaningful behavioural responses in the context of strategies under study (Hensher, 1994: 113).

In the transportation context choice data is more commonly used than rating or rank-order data. The behavioural phenomenon of interest is often actual choice although ratings and ranking data may provide a richer source of information just below the most preferred alternative. Choice responses simulate the actual expressions of actions by managers. Airline managers may rank or rate alternative courses of strategic action, but they ultimately have to make a strategic choice. Choice responses also provide the required metric for the multinomial logit model - the estimation models used in this study. The discrete choice responses and the estimation procedures are also consistent with the utility maximisation axiom. The challenge was to offer airline managers realistic and manageable choices from a set of partner profiles that are consistent with strategic considerations in the industry.

5.2. Designing The Stated Choice Experiment

There are seven (7) tasks required to design a choice experiment (Hensher, 1994 and Carson et al., 1994). Although the tasks can be ordered and performed sequentially, there is some simultaneity in decisions about the key parameters (Hague Consulting Group, 1991). In designing the experiment, decisions have to be made about; the relevant attributes, their number and levels, the response metric and presentation; contextual factors or covariates that are included in the experiment that could influence the choice task; the design of the alternative and later choice sets via a statistical experimental design; the design of a survey instrument that translates the statistical design into a comprehendible form which elicits the required information on the choices; the selection of the sample of respondents and administration of the survey and finally; estimation of the stated choice model of strategic alliance partner choice (Hensher, 1994). The steps are discussed in detail below.

5.21. Attributes And Their Levels

The identification of attributes for the partner choice experiment secured through a literature survey of strategic alliances in aviation, in-depth interviews with five airline executives in Australia and a pilot survey with students in the Master of Transport Management degree who were enrolled in the Transport Strategy module (a simulation based course on airline strategic management) at the Institute of Transport Studies, University of Sydney. There was a large number of attributes to begin with (twenty eight), culled down to four generic attributes and sixteen elemental attributes after the interviews and pilot survey.

Important covariates such as size of the airline, its ownership structure, the position of the manager in the respondent airline and the geographical region where the airline is located or intends to compete were left out of the list of attributes (hence design). The objective was to limit the number of attributes to a manageable size. The Hague Consulting Group (1991) note that even if a particular design allows a lot of attributes to be presented, it is advisable to limit the number to avoid confusing respondents. Experience suggests one should aim for an upper limit of 6 or 7 attributes.

The size disparities of the airlines surveyed presented some difficulties as far as selection of the measurement unit for each attribute was concerned. It would have been preferable to have well defined attribute measures such as the actual number of flights in the *scheduled frequency on the network* attribute, or the actual number of *medium to long range aircraft* attribute for instance. However, ordinal scales such as *lower than yours, similar to yours, or higher than yours* for the *scheduled frequency attribute* for instance were used. The difficulty with such ordinal scales is that they might be interpreted differently (subjectively) by responding airline managers. It was, however, decided that the subjectivity problem could be controlled for, using the covariates such as airline size, the potential partner size preferences and data on individual airline characteristics obtained from the *Interavia Journal* (1993) data base.

The number of levels each attribute took was defined by the nature of the metric of each attribute, that is, whether the attribute elicited a binary response (eg Yes, No or Good, Poor) or three levels where there was a possibility of non-linearity (eg low, medium, high) or the nature of the attribute as it is known in the industry. For instance the *geographical scale of the network* attribute could be best described in terms of scope of its geographical coverage such as domestic, regional, or global although it is also possible to measure it terms of the number of nodes and links served (see Reynolds-Feighan, 1992 for a discussion of graph theoretic measures of networks). Discussions with airline managers in Australia confirmed that the measurements used were broadly familiar to them. The overall number of levels for each attribute is also determined by the complexity of the design, which involves consideration of the attribute levels generated, the manner in which they are presented to the respondent, the need to investigate non-linearity and the interaction effects between pairs of attributes.

5.22. Design of Alternatives and Choice Sets

Having determined that the choice option was the preferable way to elicit airline management responses together with the number and level of attributes, the next step was a statistical design of alternatives and choice sets. In the design of alternatives, levels of attributes are combined into a stated choice experiment. As the number of attributes and their levels increase, the number of resulting alternatives also increases, so that the task of assessing all of them may become unwieldy for the respondents. Five possible solutions for reducing the number of options to be presented to the respondent are suggested by the Hague Consulting Group (1991: 33); i) using fractional factorial designs ii) remove those options that are dominated or will dominate other options in the choice set iii) separate the options into blocks so that the full set is completed by groups of respondents, each responding to a different sub-set of options iv) carry out a series of experiments with each individual, offering different attributes, but with one attribute common to all, to enable comparisons; v) define attributes in terms of differences between alternatives, and we might add the sixth;vi) hierarchical and sequential designs after Hensher and Louviere (1983).

The first approach, the fractional factorial design, is the most common solution because it allows the examination of an appreciably larger numbers of attributes and levels, while still using only one experimental design. The approach rests on the assumption that some or all interactions between attributes are not statistically significant and hence will not influence responses adversely. If the interactions are statistically significant, their effects in a fractional factorial design will be carried onto the individual main effects - an effect referred to as confounding main effects with interaction effects (Hague Consulting Group, 1991: 33 and Hensher, 1994: 116). If some or all interaction effects are considered to be insignificant, the opportunity exists to modify the experimental design, such that the number of options is reduced, but the interactions between the attributes do not vary independently from the attributes themselves.

In using fractional factorial designs, specific decisions had to be made regarding treatment of interactions. The fractional design used was the main effects plan, which assumes that individuals process information in a strictly additive way, such that there are no significant interactions between attributes (Louviere, 1988). Hensher (1994) notes that the main effects plan does not in a statistical sense provide a sufficient number of alternatives to be able to detect unobserved but possibly important interaction effects, preventing determination of whether the estimated main effects are statistically biased. Despite potential presence of confounding interactions, Louviere (1988: 40) and the HCG (1991) suggest that main effects explain about 80% of the amount of variance in response data, with two-way interactions accounting for between 3 and 6%, and three way interactions accounting for between 2 to 3%. The elemental attributes under the four generic attributes were combined into alternatives using fractional factorial designs. In the circumstances, it was felt that the main effects design plan used was sufficiently robust to engender a statistically efficient design.

Where there was dominance among the options, the option that dominated others was omitted and those that were dominated by all others were also left out. Removing dominated options allows a limited reduction of options. The problem with removing dominated options is that any respondents choosing randomly will not be identified from their responses whereas if the dominant or dominated options are left in the choice set, the logical or illogical positioning by each respondent provides some indication of the reliability of the response data. More importantly, the orthogonality of the design is reduced. Orthogonality ensures that the attributes presented to respondents are varied independently from one another. The zero-correlation between attributes enables the analyst to undertake tests of the statistical contribution of main effects and interactions. However, although orthogonality is a desirable property, it is not a necessary condition for SP modelling (see Hensher, 1994 and Hensher and Barnard, 1990 for a more detailed discussion).

The computer program SPEED (HCG, 1988) was used to design the alternatives and choice sets which are shown in the attached questionnaire. There were four choice sets; the expected network outcomes, the marketing economies, the airport access factors and financial and operational considerations choice sets. Using the sequential choice set linking strategy the four were combined into one set - the preferred overall strategy choice set.

5.3 COMBINING THE CHOICE SETS

The overall preferred strategy choice set links the four generic attributes in a 3^4 design giving a full factorial of 81. A fractional factorial of 9 was taken from it; one dominated profile was dropped.

There are two possible design strategies for combining choice sets into an overall choice set that links all the attributes to be presented to respondents, the hierarchical design (after Oppewal, Louviere and Timmermans, 1992 and Louviere, 1984) and the sequential design (Hensher, 1991). The first approach jointly estimates the generic and elemental attributes. The basic assumption with the former is that both generic and elemental attributes can be evaluated at the same time and hence joint estimation is possible. The approach is illustrated in Figure 3 below.

Hierarchical choice models can break a large number of attributes into smaller choice experiments by grouping attributes into *logical* subsets based on theory, empirical evidence, or commercial practice. Choice data from separate experiments can be combined into single estimation by logical substitution. The approach, however, has some notable drawbacks. First there is insufficient empirical evidence with the approach to understand its limitations and advantages, and little attention has been given to alternative designs that would be consistent with the model (Carson et al., 1994). In the specific case of this study, one would be hard pressed to find a *logical* link between an elemental attribute describing network type and financial strength of a potential partner. If any link is not so obvious or logical, then why should one expect respondents to treat the linking generic attribute seriously compared to the more logical set of elemental attributes in the choice set - it might well be seen as redundant and this might bring in biases against it in subsequent choice sets. The quality of experimental data is in part dependent on how seriously the respondents treat each attribute - hence realism is an essential feature of choice set designs (Hensher, 1994).

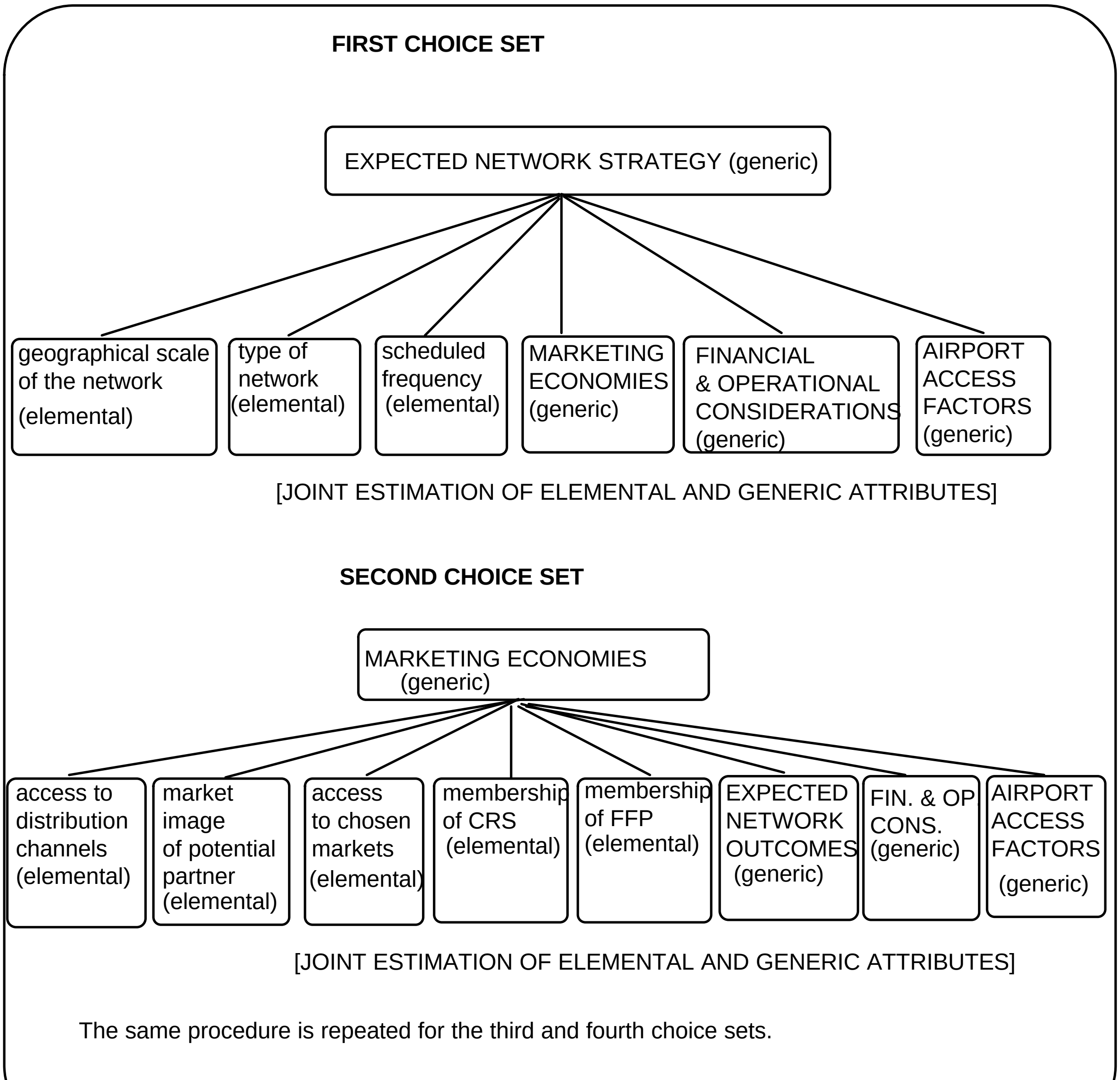

Fig.3: Hierarchical choice sets

The sequential choice set design was used in this study. It is premised on the assumption that individuals evaluate the elemental attributes separately and they can link them with the generic attributes. Kanninen (1993) and Hensher (1991) are exponents of the sequential design. Carson et al. (1994: 362) note that the idea of sequential designs has strong appeal because the approach can be implemented in an efficient manner. In SP experiments individuals are expected to be transitive in their evaluation of options; it is also logical to expect them to evaluate choice sets in a sequential manner.

5.4 SURVEY INSTRUMENT DESIGN, PILOTING AND DEFINING THE

CHOICE TASK

The experiments described above were translated into a self completion questionnaire mailed to 972 airline managers of 243 airlines worldwide. Four managers in each airline (the managing director/manager, the marketing director/manager, the financial director/manager, the operations director/manager) were chosen as respondents.

The first part of the questionnaire asks for information on the respondent's airline, that is ownership structure, legal restrictions on foreign equity and the size of the airline as defined by the number of passengers up lifted and the relative proportions of domestic and international traffic. These are important variables for segmenting the airlines. The managers' accountable areas and the extent of their involvement in the strategic decision making process are probed to confirm whether they indeed are involved in the partner choice process. The second section deals with cross border strategic alliances. Information on current strategic alliances and their types, that is, equity or marketing alliances is sought. Airlines are also required to indicate the types of alliances that they would prefer to enter into. The size of their current partners or their preferences of partner size is sought. The size preference by management seeking equity alliances can also be interpreted as an indicator of the partnership strategy that an airline would like to pursue. That is, do they want to pursue the anchor carrier strategy, or the equal partner strategy or to take up the junior partner role? The third section seeks information on the strategic motives of airlines in entering into alliances. The motives that are frequently mentioned in the literature are presented to the managers who have to rate their respective weights in terms of importance.

The last section, which is the most important in terms of the modelling exercise, is the choice experiment. The SP experiment probed the managers on the attributes they consider to be important in selecting a partner. These have to be put into the context of the regions that the airline wants to compete, hence the airlines are asked to indicate the regions where they have plans for competing in the next five years.

The mail back questionnaire was piloted on 40 students, 12 academic and research staff at the Institute of Transport Studies (University of Sydney), and three airline managers in Australia. There were five students in the course who are already managers in the industry. The students in the Master of Transport Management degree enrolled in the Transport Strategy module whose content is an airline management simulation were specifically asked not only to respond to the questions but to critique the instrument as well. In stated preference experiments the context of questions and the values used in the SP exercise are important considerations. At the pilot stage, a major modification to the questionnaire was the removal of the preface which had been included so as to put the context of the exercise in perspective. The feedback obtained was that the questions were self explanatory and anyone in the airline industry could comprehend their thrust. There was therefore no need for a context setting preface. It was also felt that busy managers are not inclined to read prefaces on surveys.

6. CONCLUSIVE REMARKS

There are considerable difficulties to be encountered in attempts to model alliance partner choice. They emanate primarily from the different contextual settings in which choices may arise. Variables such as airline size, the region the airline is located or those where it wants to compete, the liberalness or otherwise of the bilateral agreement in its markets, ownership structures of the airline or its target partner(s) will all affect partner choice. The task is further complicated by low response rates from airlines (a response rate of 11% was achieved in this study despite sending two reminders). A high number of replications is necessary for realistic results in SP modelling.

In spite some of the problems outlined above, SP methods still provide a practical framework for modelling partner choice.

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