There will be a large number of business-unit alliances in airlines and aviation activities.

However, there are also tales from the dark side of alliances. In the past six years we have uncovered several pitfalls to be avoided.

- Most financial expectations fail to be realized in the first or even the second year of aviation alliances.
- Most alliances terminate because of competing services and selection of the wrong partner.
- Many alliances end up as acquisitions. It is a good idea to think about this in phase one and not wait until phase two.
- Virtually no alliance meets all its goals.
- It will take twice as long as expected to meet some of the original goals, three times as long to adjust to the new ones, and four times as long to deal with critical issues.
- "Have a good fight with your partner before you sign the deal" is advice from several experienced alliance partners who have developed useful ways to resolve conflicts.

AIRLINE CONSOLIDATION: CONSUMER WELFARE AND POLICY IMPLICATIONS

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An Economic Model of Airline Concentration

While at the University of Pennsylvania, one of the authors (Dong Liu) in collaboration with Elizabeth Bailey developed a model of airline concentration to address several key questions about the impact of airline deregulation on air service and the future of the airline industry.

- Why has the airline industry become increasingly concentrated since deregulation?
- What does this concentration imply for total consumer welfare?
- What are the implications for future public policy?

The central conclusion of the analysis using this model is that the airline industry is unlikely to have a large number of air carriers when it reaches a state of equilibrium. First we will discuss what this concentration means with regard to airline prices and consumer welfare. Later we will examine the implications for future public policy.

The usual approach to these issues is to collect lots of data on prices, service levels, etc. and to analyze past trends. We call this the "data analysis approach." This approach is straight-forward, and it can be quite convincing. But, without an explicit economic model to provide a structure for the empirical analysis, this approach suffers at least two drawbacks.

First, this approach cannot tell whether or not the airline industry is in equilibrium. Without this information, an analysis of past trends tells little about the future of the airline industry. For example, just because the price of air transport is low this year does not mean the price will be low next year. Just because we have five major carriers this year does not mean we will have five next year, or six or four.

Second, this approach cannot tell whether the airlines are oversupplying or undersupplying air transport capacity and whether they are overcharging or undercharging for these services. As a result, many diverse interpretations can be made of the same descriptive data.

The approach that we will describe today is different. We call it compliments the data analysis approach. I call this approach a "radical equilibrium model." Basically, this model simulates rational behavior of airlines on one hand, and passengers on the other. The simulation describes behavior by the airlines and passengers that would be consistent with an equilibrium or stable economic state. The insights from this equilibrium modeling approach complements the data analysis method. We use this model to describe the airline industry's equilibrium states and the corresponding welfare implications. The following is a summary of the major findings. A full technical description of the model is in paper prepared by Elizabeth and Liu.[1]

First we found that under the airlines' hub-and-spoke network structures, only a very small number of major carriers can coexist in equilibrium. In other words, the airline industry will remain concentrated no matter how large the total demand becomes. Later we will show how this small number of airlines in equilibrium varies under different conditions.

Second, we found that, as the industry approaches equilibrium through a series of consolidations and bankruptcies, total consumer welfare increases rather than decreases. This is true even if prices increase along the way. Why? The answer has to do with the travelling public's preference for frequent service — more precisely, frequent, single-carrier services to a

large number of places at low cost. It also has to do with use by major carriers of a capital-intensive hub-and-spoke network to meet such demands.

Since deregulation, investments in hub-and-spoke network systems has become the standard operational procedure for major carriers. If we look closer at this system, we will see that it has two major opposing effects on consumer welfare.

On the one hand, it has significantly improved service by allowing airlines to provide frequent flights to a large number of places — big cities and small cities — at low cost. This service-improving aspect of hub-and-spoke networks has brought great benefits to the flying public. This is the positive, or welfare-increasing effect of hub-and-spoke networks.

On the other hand, the hub-and-spoke network system has negative, or welfare-decreasing effects. Investments in large hub-and-spoke networks investments entail huge fixed costs, thus, allowing only a small number of competitors in equilibrium.

A small number of competitors means potentially high prices, and high prices mean a welfare-decreasing effect on the consumer. The question is, whether the service-increasing effect of a hub-and-spoke network outweighs the price-increasing effect.

We examined this question by establishing two regimes. One may be called a "consumer welfare maximization" regime, where the number of airlines and the services and prices are chosen so that the total consumer welfare is maximized, subject to the constraint that airlines receive market rates of return on investment. The second regime simulates a market where airlines compete freely with one another and where the number of airlines and the equilibrium prices and services are determined under free-market conditions.

The comparison demonstrates that under free competitive equilibrium, the welfare-increasing effect of hub-and-spoke network investments outweighs the corresponding welfare-decreasing (price-increasing) effect. This means that, as the airline industry approaches its equilibrium through consolidation and bankruptcy, consumer welfare increases rather than decreases.

The simulation model allows us to estimate what the airline industry should look like in a state of equilibrium. To do this, the model uses three factors. The first factor is a measure of degree of substitution among airlines. The second factor tracks the airlines, fixed network costs as a percentage of total costs.

The third factor is the overall price elasticity of demand.

TABLE 2 EMPIRICAL ESTIMATES OF THE NUMBER OF AIRLINES IN EQUILIBRIUM

A. Substitution Index (γ/β) = 0.6

Price Elasticity (ε_p)	Network Cost as a % of Total Cost (δ_f)					
	10%	12%	14%	16%	18%	20%
0.8	8.7	7.3	6.3	5.5	5.0	4.5
1.0	7.0	5.9	5.1	4.5	4.0	3.7
1.2	5.9	5.0	4.3	3.8	3.4	3.1
1.4	5.1	4.3	3.7	3.3	3.0	2.7
1.6	4.5	3.8	3.3	2.9	2.6	2.4

B. Substitution Index (γ/β) = 0.8

Price Elasticity (ε_p)	Network Cost as a % of Total Cost (δ_f)					
	10%	12%	14%	16%	18%	20%
0.8	3.9	3.4	3.0	2.7	2.5	2.3
1.0	3.3	2.8	2.5	2.3	2.1	2.0
1.2	2.8	2.5	2.2	2.1	1.9	1.8
1.4	2.5	2.2	2.0	1.9	1.7	1.6
1.6	2.3	2.1	1.9	1.7	1.6	1.5

Detailed Definitions:

γ/β = a measure of the degree of substitution among airlines
δ_f = airline's fixed network cost as a percentage of total cost
ε_p = price elasticity of air travel demand

ϵ_p: typical values: 1.0 to 1.4
based on thirteen air travel demand studies surveyed by Oum, Waters and Yong (JTEP, 1992).

δ_f: typical values: 14% to 18%
based on airline cost studies by Caves, Christensen, and Tretheway (RAND, 1984), and Kumbhakar (SEJ, 1990).

γ/β: typical values: 0.6 to 0.8
based on econometric study of airline entry by Reiss and Spiller (JLE, 1989).

Based on a review of the historical ranges for these three parameters, we constructed a table where the entries in each cell refer to the number of airlines that can coexist in equilibrium. (Table 2) Note that these numbers have not been truncated into integers. This means, for example that there can be 3.8 airlines, which means three major airlines and a small major airline in equilibrium.

Implications for Future Public Policy

Table 3 presents three conceptual examples of the future structure of the airline industry. The first is an industry made up of large domestic hub-and-spoke carriers.

TABLE 3 THREE CONCEPTUAL EXAMPLES

Large domestic hub-and-spoke carriers:

Characteristics:	relatively high substitutability, low price elasticity, and high capital.
Result:	three large carriers at equilibrium.

Non hub-and-spoke carriers (e.g., Southwest):

Characteristics:	lower degree of substitution, higher price elasticity, and lower capital.
Result:	perhaps two more carriers at equilibrium.

International alliances:

Characteristics:	lower degree of substitution, low or medium price elasticity, high capital.
Result:	perhaps four to six mega carriers.

Earlier we described three variables that shape future equilibriums: the degree of substitutability among the airlines, the price elasticity of the market, and the capital intensity of the industry.

The hub-and-spoke market is one with relatively high substitutability. There is no great difference between one hub-and-spoke network and another. The markets are fairly price elastic, and most airlines are high-capital industries. Looking at Table 2 presented earlier and using values that reflect today's market, the implication is that there should be roughly three larger carriers at equilibrium. This is a little scary as there are either five or six carriers today.

The second example in Table 3 is an airline industry made up non- hub-and-spoke carriers, such as Southwest Airlines. These airlines have a lower degree of substitution because they serve nonstop markets, focus on travellers with much higher price elasticity, and are much less capital-intensive. Under these circumstances, one could expect perhaps an additional two carriers at equilibrium, something close to a total of four or five surviving carriers, though these may not be the same ones we have today. One clear implication is that there is an opportunity for more Southwest-type carriers. The elegant thing about the model is that the underlying theory is independent of whatever market one considers and whatever country it is applied to.

Finally, let us examine international markets. These markets have a lower degree of substitution; that is, people tend to exhibit some loyalty to their national airline. These markets show a middle level of price elasticity and consist of relatively high-capital airlines. In this case, the model implies perhaps four to six megacarriers. Again, a number quite different from what you would expect from current U.S. market.

What are the near-term trends? Economists love to talk about equilibriums. They do not always mention that we are never at equilibrium. Nevertheless, if we assume that market forces in the near term will move the industry toward the equilibrium shown by the model, the most obvious conclusion is that the transition to a more concentrated industry has not yet been completed. Mr. Crandall's recent statement that "American Airlines will never buy another airplane," supports this.

A second conclusion is that the transition toward a global industry is obviously just beginning. If one assumes that most of the surviving larger carriers will be global in nature, one would also expect that several of the larger U.S. carriers (especially those that now have extensive international routes) will be among them.

A third conclusion is that we will see tremendous growth of new entrants after a long period when no one came into the business and survived. Most of these new entrants will copy Southwest Airlines. Reno, Kiwi, Continental Lite, and all these other nonhub airlines are chasing that part of the market where, in theory, they should be able to survive.

This analysis has three major policy implications. First, we should encourage competition, but only in the places where carriers are most likely to succeed. That means encouraging the growth of differentiated carriers, ones that serve separate markets where there is a lower degree of substitutability among the airlines — the low cost, non-hub-and-spoke carriers.

Second, we should encourage the large U.S. hub-and-spoke carriers to form the core of global airlines. The analysis implies that in the long term maybe three major U.S. carriers will survive. This is cause for concern since we have five or six now. On the other hand, maybe five or six megacarriers could survive.

The third implication is that we need to track the changes in the industry. It is important to remember that the equilibrium and the underlying economic parameters are always changing. The price elasticity or capital intensity that exists today may not be the same four or five years from now.

In summary, the airline concentration model provides an economic framework that explains the changes that have taken place since deregulation and the development of the hub-and-spoke systems. It offers a more rational way to look at what has happened rather than saying that the airline industry is marginal cost with wings.

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[1] Bailey, Elizabeth E. and Dong Liu, "Airline Consolidation and Consumer Welfare," The Wharton School of the University of Pennsylvania, unpublished paper, 1993.