The past 20 years has seen huge efforts by airlines directed at predicting and improving passenger yields. The nature of freight yields is different, but can be explained by rational economics. David Blond of MergeGlobal explains how changes in freight yields have been modelled.

The nature of freight yields

How are prices set for airfreight? This question has plagued the industry since the end of the enforced rates set by IATA 20 years ago. Since then airfreight has grown by sometimes double-digit figures. Price certainly matters in defining products that can be shipped by air. Freight yields have consistently fallen as new capacity has met the increased volume of freight demand.

In a perfect economic world markets set prices. But markets, we must remember, are not privy, even in an age of instantaneous communications, to perfect information. For most products sold today in the world there is no free interchange between buyers and sellers. Perhaps the closest we can come to perfect markets are the auction marts that are springing up on the Internet. This is where both buyers and sellers bid freely for products from surplus computers to art curios. So far, at least, sales of space on aircraft are not subject to the same daily give and take, nor is the information on rate formation quite so public.

Price formation

The price of airfreight transport services is set usually through a give and take between buyers of services (mainly freight forwarders) and sellers of services (primarily the large airlines and dedicated freight carriers). Neither the buyer nor seller has full information.

Negotiated contract rates between buyers and sellers tend to be the rule, not the exception. Take-or-lose contracts are rare. Most major forwarders have multiple paths for shipping cargo. Even the airfreight spot market rate is set without the full knowledge of the price being charged elsewhere for similar services. Unlike most commodity markets there is no open auction, no central exchange, no clearing house and the available supply (capacity) and the demand (freight) varies from market to market on a daily, even hourly, basis. This is primarily because forwarders may wait until the last moment to commit a load to a carrier.

A further complication in the setting of prices for airfreight is the importance of free or nearly free space for shipping products by air. About 52% of the traffic is carried within the belly space of passenger flights worldwide. Belly capacity offers an even higher proportion on some well-travelled passenger routes, such as the North Atlantic where the share is 70% or more.

For most airlines the freight revenue carried in these spaces is considered to flow directly to the bottom line. Pricing decisions by these carriers may not therefore be optimised for maximising revenues, and indeed are more likely to be opportunistic.

Opportunistic pricing makes forecasting difficult. Like the marginal passenger who may pay less than the full, allocated cost of operating the seat on the flight, the belly operator may not charge the fully allocated cost of owning and operating the aircraft.

Despite these issues, our research has shown that market rate differentials between equally distance markets follow the laws of economics. There are economic factors that can help explain why some rates are high and others low on a per kilometre basis.

The facts, as known

In an ideal world where there is full information and where shippers and carriers can move capacity to meet changing demand a uniform rate would be charged.

Capacity adjusts to demand and so there would be just enough capacity to meet demand in each market. Unused capacity in the other regions would flow to the region with the highest demand. Rates in this region would be driven down because of the supply of extra capacity. The withdrawal of capacity from the declining regions would be sufficient to hold yields constant.

Since carriers would not wish to operate at a loss in this perfect world they should set the rate close to their operating costs. The market would thus drive rates down to as close to the operating margins of the major carriers and drive out of business those who could not reach these operational efficiencies.

Airfreight rates are not, however, set purely by the market. Carriers and freight forwarders cannot ignore the market, but they are probably also incapable of fully observing it as well. Most airfreight tariffs are negotiated between forwarders and carriers on a contract basis. Between these two competing forces in the market there is a natural give and take.

In general, however, most shippers are not as price-sensitive as economists tend to believe. They do not adjust relationships with airlines when prices are reasonably close. The term economists use to describe this is 'stickiness'. Contracts create stickiness, the contracts acting as *de facto* ceilings, but there is more involved than that.

Competitive price setting takes place on two levels at the same time:

1. The interplay between buyers and sellers.
2. The interplay among sellers and among buyers.

Freight carried in the belly space of passenger aircraft is charged opportunistically and it makes a direct contribution to the bottom line. The marginal costs of belly freight are just the administration and marginal fuel. Passenger aircraft belly space tends to provide a much higher proportion of freight capacity on trans-Atlantic sectors than it does on longer-range trans-Pacific routes.

Since forwarders make deals with more than one carrier for each market served there is competition between contracts. The forwarder has a complete view of the market and may thus be able to ensure that it always achieves the 'best offered rate' despite the forwarder's contract rate. The forwarder can then direct traffic to more than one carrier, pitting one against the other. In a business where carriers themselves often view filling belly space at any price as more important than filling belly space at the right price, this strategy often can work well.

Forwarders themselves compete with each other for business. They must then be mindful of their competitive position within the market served. If they have a negotiated contract rate that is too high *vis-à-vis* their competitors then they will lose business. Their competition for business also drives rates and impacts the rates that other carriers can competitively offer.

Finally, carriers compete with one another to maximise volume. Within geographically close markets – such as in Western Europe or in the United States – the ability to gather cargo by land routes before moving to international air routes means that carriers can offer discounts on service for delayed delivery. Air France gathers traffic in Germany and Lufthansa collects freight in France, but it takes longer to get the minimal volume required for a flight. This competition for cargo also increases the competitive forces in the marketplace.

How are rates set?

In most markets there is a difference between spot rates and contract rates. Contract rates reflect the price that freight forwarders negotiate with the major carriers on behalf of their customers. One assumption that is probably true is that there are few secrets in this market and the other shippers often mimic what one shipper receives from an airline. The opposite is that carriers themselves will set rates that are similar. In this case it is likely that there is some form of market leadership, with the dominant carrier in each major market setting the highest rate.

This is because this airline can muster the most capacity and meet most of the shipper's needs. Shippers tend not to adjust relationships with airlines when prices are reasonably close. This stickiness, as described earlier, suggests there is some flexibility within a reasonable variance of yield to stay with a customer airline to earn a reasonable profit. If this is the case then the dominant carrier and the dominant shipper can both collectively set the rate in the market. This rule may break down in a market such as Europe or even in the continental market within the US, where trucking can draw off traffic. Lower rates out of Toronto, for example, may draw traffic out of Chicago and Detroit.

Since there is no formal market mechanism for setting rates, those rates as we have observed tend to cluster around a certain range (adjusted for distance). Forwarders tend to know what they pay per kilometre in one market and likely will refuse to pay significantly more or less without reason. Of course if distance is shorter we expect carriers to baulk at charging less than their fixed and marginal costs for hauling the freight. Fixed prices per kilometre are higher the shorter the leg is.

If we assume there is a fixed price for handling and administration of $0.15 per kilo irrespective of distance then this cost alone would be $150 per tonne. An airline would have to cover this if the trip were 1,000 or 10,000 kilometres. The fixed cost is therefore 15 cents per tonne-kilometre on the short trip and 1.5 cents per tonne-kilometre on the longer trip. Add to this the marginal cost of fuel, which increases with distance, and it is easy to get an impression of how a belly operator might set the minimum cost of handling freight.

Buyers and sellers

Market power and the price set depends on the relative position of forwarders and carriers in each geographic market served.

Interestingly when there are few buyers and few sellers competing for business then prices will likely be higher. This is explained by the fact that there is little competition in the market and that all players find the situation easy to cope with.

Similarly, when there are many buyers and few sellers then prices will also be higher than normal. This is explained by the unwillingness of sellers to withdraw service from a market, because they are in a position with low levels of competition.

It is likely that the power of the buyer is greater than that of the seller in this scenario. Buyers will have true market power, since they are in a position to offer each airline supplier sufficient volumes of business to get away with volume discounts to their customers. Thus rates have tended to be skewed to lower rates. It is not true for smaller forwarders who must pay mainly spot-market rates.

Cargo carriers which enjoy the position of setting their own rates can ignore directional imbalance, capacity utilisation and distance travelled, unlike operators which depend on freight forwarders.

Spot rates should always be higher than the best-negotiated rate except in a declining market. In a market depressed by steep declines in demand or over capacity (excess supply), the balance of power shifts. In this case spot prices may drop below contract rates. In today's world where there is significant oversupply, the trend will be down.

Explaining rate formation

A statistical model relies on data and observations to explain how rates are formed. Unfortunately there is not always a long time series of observations to measure relative changes over time in a single market.

Therefore in our statistical model we observe the inter-market rate formation mechanism. This can be used, however, as a proxy for the changes that are likely to be observed over time. In our data sample we have organised our rate data into inter-regional market pairs. There are 18 regions or 324 regional bilateral pairs. We have observations (as of October 1998) on about half of these.

In most cases traffic is based on a direct routing between one region and another. This is the case when there is direct service, in which case even indirect routing must conform to the market price of the direct service offering. In some markets – notably markets such as Africa to Asia or even North America to Africa – the route is through some other market. Observing the appropriate rate then may be more complex and this is more likely the case when there is more than one routing possible.

A statistical model is designed to do two things. First, it predicts the movement of rates over time. Second, it fills in the missing rates for city-pairs where there is no information available. A statistical model best handles both of these tasks. The reason is that when rate data is viewed one factor at a time it often produces no discernable trends. A multi-factor regression model allows for these statistical patterns to be sorted into their relative importance and collectively to explain the actual pattern. From this we can discern the approximate impact of each factor on the rate charged and the change in the rate likely to be observed.

Factors in rate formation

Five factors help determine how rates adjust when market conditions change. Unlike our factual model, this model depends on economic factors alone that influence the rate that either the buyer accepts or the carrier charges. These factors are:

- Belly capacity share of a route – the proportion of belly capacity to main deck freighters.
- Directional imbalance – how balanced is the flow between inbound traffic and outbound traffic.
- Utilisation of capacity – the direct observation of demand relative to available capacity.
- Importance of market – how important is the market as measured by its share of total airfreight to all markets.
- Distance travelled.

The multi-factor regression model that we developed used data covering 150 standardised average airfreight rates. From a statistical point of view this data set proved to be quite robust with good statistical properties. Equations could be derived that had the correct signs and where the coefficients estimated were statistically significant (different from zero). Coefficients represent point elasticities; measuring the percentage change in the rate against the percentage change in each of the factors separately. Using this analysis we can come to following conclusions.

Belly capacity

If a route is served by a very high share of belly lift then we should expect rates to be lower than when there is a mix of belly and freighter.

While belly operators often use their profits to cross-subsidise, on average markets with a higher freight share tend to have higher rates (and thus belly profits on these routes are themselves higher). For each 1% increase in belly share for a route we can expect the charged rate to be about 0.06 of 1% lower, or 0.0006% less.

This adjustment is almost unobservable. The important point is that it confirms our belief that routes with a greater concentration of belly freight tend to be lower yield routes for main-deck cargo carriers.

Directional imbalance

For nearly every market there is often a significant directional imbalance with one leg greater in volume than the other leg. Like supply and demand, a directional imbalance implies that one side of the equation is out of sync with the other. More capacity is available in one direction than in the other. This is because freight only travels in one direction, and does not return as with passengers. Rates need to be cut to fill this space, since there is a direct linkage between rates and air penetration.

The statistical model reflects the "effect of directional imbalance on average across all routes" on rates charged. Comparing the balance in the route between inbound and outbound traffic (50% would be perfectly in balance) with the new balance shows the average percentage growth expected.

For each 1% of balance change we can expect just a 0.3 of 1% increase in the rate charged for the growing leg of the voyage and a minus 0.3 of 1% decline in the declining leg of the trip.

For example, if the directional imbalance shifts from 50/50 to 51/49 and if the starting average rate per ton per kilometre is 25 cents then the rate earned on the increasing leg would increase to 25.2 cents. The rate on the decreasing leg would decline to 24.8 cents.

The five main factors that influence yields are proportion of belly capacity on a route, directional imbalance, utilisation of capacity, market importance and distance between markets. The economic rules which govern how these factors influence yields can only be followed when markets are stable. Sellers tend to lose rationality during times of crisis; they over-react and yields tumble.

Capacity utilisation

Capacity utilisation represents the degree to which capacity on either the inbound or outbound legs are being utilised. We have reduced the problem to looking at capacity utilisation on major trade lanes, since there is often limited direct flow from smaller regional pairs. We expect that when there is excess capacity there will be lower rates and when capacity is tight then rates will be higher.

Our statistical data bears this out. If capacity utilisation increases from 70% to 80%, or a 14% increase in capacity utilisation is experienced, this induces about a 2% increase. That is, a 25 cents rate would increase to 25.5 cents. A 1% increase in capacity utilisation on a route adds about 0.0014% to the rate charged.

Market importance

The importance of a market surprisingly has a major influence on rates charged. Like passenger carriers competing for the large-volume markets, freight carriers also compete. Less important markets have higher prices, because there is less competition, than in more important ones.

Take a market that currently accounts for about 3% of the world's airfreight and that loses share to just 2.5% – a decline of about 17%. Our estimated impact of this adjustment would be to add 17% x 0.17 (the coefficient) to the rate charged, or an increase of about 3%. The statistical model suggests that for each 1% adjustment down in this factor adds about 0.17 of 1% to the rate shippers pay.

Distance between markets

Not surprisingly the shorter the route the higher the average charge. As we explained this is due to the allocation of the fixed costs across a shorter distance. Since most pricing is distance-based then the average distance corrected rate needs to be adjusted up. For each 1% increase in kilometres we can expect that the rate will be 0.6 of 1% less.

Over-reaction to crises

The Asian collapse may be a good example to show the difference between the 'model' and the real world. In the real world companies react to crises. In fact, they tend to over-react, letting prices drop well below market clearing rates.

In a model, based on the collective information obtained from the sample of all rates and the factors that explain rate formation, the changes are more modest. Thus, if traffic were to fall – as it did by 20% into Asia on the westbound leg out of the United States – the directional imbalance is driven down by about 25%. Utilisation declines by about 22% (assuming there was no adjustment in capacity). With the westbound leg now smaller, the importance of this route to world airfreight must also decline – falling by about 22%. Using the coefficients in the model the cumulative impact is about -7%.

Rates, however, over-react to this small adjustment in rate per kilometre by multiples of four to five times and a decline in westbound airfreight rates of 25–30% was observed.

Despite this problem, models are helpful during most normal periods when operators face only marginal changes in volume and where econometric or statistical relationships should be more accurate measures.

Such statistical models are also helpful in determining the direction of change and in establishing a pattern for adjustment in rates across markets that is linked to the demand for airfreight and capacity on routes.

The MergeGlobal Route Specific Rate model helps us understand the dynamics of rate formation and measure future revenues by route for cargo carriers. It is one step towards a fuller and more complete understanding of the dynamics of the global airfreight industry. Linked as it is into the MergeGlobal models determining airfreight penetration by product by route, it forms a chain that ensures our forecasts of global airfreight volume are as accurate and as realistic as any available at any price.

Summary

What drives price formation? It is clear that market economics play a leading role and that (at least from the sample of cross-market rates we have collected) there are 'economic' effects that are critical to explaining price formation. This economic model of price formation assumes, however, rational behaviour and a full understanding of relative differences between markets.

In the MGI Rates Model the factors that influence price formation include:

- Belly share
- Directional balance;
- Capacity utilisation;
- Market importance; and
- Distance between markets.

In a stable and moderately changing market these five factors can explain much of the variance in cargo rates. But in an unstable market – one where price formation mechanisms are often weakened by crisis and confusion - rates tend to overshoot.

But as we know from working in the airfreight industry such rationality may be in short supply. When crisis comes and demand falls dramatically, rates crumble as sellers try to fill empty belly space. Only as capacity is withdrawn and market demand returns does price rationality return. Once normality returns then the rational model sketched in the statistical part replaces the irrationality of market reaction to crisis and change. AC