Dynamic Capacity Adjustments: The Case of Airline Markets

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Once a firm has committed capacity to a market it will adjust prices to ensure it earns as much as possible from that capacity through revenue management techniques. However, in the medium and longer run, firms will adjust capacity by changing the gauge of aircraft and number of flights offered or both. Overall, the objective is to generate a match between supply and demand: if demand exceeds supply, opportunity will be lost, whereas supply in excess of demand may result in a low utilization of resources and increased system inefficiency. Consider for example the busiest market in the US: LAX-SFO. During Q1 of 2013, 7832 flights were performed in this directional market carrying 770,189 passengers. However, given the number of seats on the flights was 1,069,544, the resulting load factor was 72%. Fully utilizing their capacity (implying operating flights at 100% load factors) could have saved 2192 flights! Profit maximization does not necessarily require operating at capacity all the time. However, this underutilization of capacity resources is often a consistent observation in markets. In the LAX-SFO market during Q1 of 2012 the average load-factor was 76% with a similar inefficient use of resources; in effect 1934 “empty” flights. This raises an interesting question about the drivers of firms’ capacity decisions.

The airline industry enjoys a feature not available in many other manufacturing or service industries, its capital equipment (aircraft) used in producing ‘available seat kilometers’, the airline output, are highly mobile. Firms are therefore able to adjust their available capacity in a market, in some cases, rather quickly as they adjust to competitive entry, changing market conditions and to their seasonal schedules. Given the relative ease of introducing changes and shifting capacity within a market or from one market to another, one might expect load factors to be higher. However, at the same time firms may not be able to change the aggregate fleet capacity quickly: once firms made their aggregate capacity decisions—the number of aircraft and the fleet composition—it takes years to make major adjustments and leasing can be used for changes at the margin only.

One can observe that some markets exhibit temporal consistent behavior with respect to load factor performance. In particular, over the years, the load factor is relatively stable and changes only marginally. This is illustrated in the left panel of Figure 1. For example, in the ORD-BWI market the load factor ranges between 73% and 81% -- a fluctuation that could possibly be attributed to changes in demand and or to adjustments in seating capacity. Interestingly though, this figure shows that some markets exhibit consistently high load factors (such as HNL-ANC) whereas other markets suffer from a chronic mismatch between demand and supply and exhibit relatively low load factors (such as JFK-STL). We note that HNL-ANC and PHL-PHX are both heavily leisure markets whereas the other three markets exhibited in Figure 1a are mixed business/leisure and connecting markets. Inspection of the right panel of Figure 1, (b) reveals a dramatically different picture—in the markets illustrated the realized load factors fluctuate significantly from one year to the next and is rarely above 0.8. For example, in the PHL-HOU market the seating
and frequency capacity went through a major correction between 2010 and 2011 as the number of flights was reduced from 151 to 90.

These diverse observations about markets and the match, or mismatch, between supply and demand raises several important questions. First, we seek to explore how firms, at the aggregate market level, adjust capacity allocation over time in dynamic markets. Namely, as demand is realized during the quarter and firms’ plan their capacity allocation for the next year, are firms more likely to increase capacity in markets that are more competitive or more concentrated? Do they increase capacity in lucrative markets (high RASK) or are there other factors that influence firms’ decision making? Do markets with LCCs adjust differently given their homogeneous fleets and capacity changes are made via frequency not aircraft gauge?

We further explore the link between transacted airfares, load factors and frequencies. Higher load factors might be associated with higher transacted fares indicating strong demand or it could be market power. Based on the revenue management mechanisms developed by airlines, if realized demand falls short of the predicted booking path, lower fare classes will reopen, or will remain open, indicating that transacted fares are lower when load factors are lower. At the same time with higher load factors, firms are generally utilizing their resources more efficiently resulting with a lower unit cost which could be reflected with a lower unit price to consumers. Additionally, an argument could be made that firms might be adjusting their fares to generate demand. Specifically, airlines could reduce the fares associated with the fare classes to stimulate demand and fill their planes. Either way, the direction of the relationship between transacted airfares and load factors is not a-priori clear. Another aspect that influences this relationship is the frequency of flights. The literature has argued and demonstrated that demand and supply in the airline markets seems to be driven by frequency of operations. That is, passengers—especially business travelers—are more sensitive to schedules delay and hence are willing to pay a premium for more frequency, which then leads airlines to compete over the frequency of flights they offer in the various markets.
Literature review

We briefly review some of the pertinent literature. Peeters et al. (2005) show that frequency in a market is a major factor in the competitive environment between airlines as high yield passengers are willing to pay for relieving the schedule delay. While Button and Drexler (2005) found weak evidence for the presence of S-curve competition, Wei and Hansen (2005) found evidence for such competition in duopoly markets. The implications are important; when firms are engaged in S-curve competition, they will elect smaller aircrafts and offer more frequency. Indeed, Brueckner and Zhang (2001) show such competition between airlines results with market capacity beyond the social optimum. Givoni and Rietveld (2009) using 2003 data empirically study a cross-section of airlines’ choice of seating capacity, revealing that distance, market size, and concentration positively affect aircraft size. They report an elasticity of 0.75 for frequency elasticity from the literature. Their own model provides estimates of almost the same coefficients (0.34 to 0.37) for the impact of market size, market concentration and route distance in explaining average aircraft size. They also find that the presence of LCCs diverts the competition from frequency-focused to price-focused resulting with aircraft with higher seating capacity likely from densification rather than change of gauge.

Pai (2010) looks at total flight frequency on a route. He estimates two regressions using OLS and 2SLS and includes a frequency and an aircraft size (seats per departure) equation. He finds that route and airport characteristics influence choice of frequency and size. Similar to Pai (2010), Pitfield et al. (2010) examine the size versus frequency question on North Atlantic routes. They are focused on total frequency rather than the distribution of flights over the day. They estimate a 3-equation model for passengers, frequency and aircraft size (seats). They find market size drives frequency more than gauge of aircraft. This outcome would be affected by the restriction of data to essentially long haul routes flown by wide body aircraft where there is not much variability across numbers of seats. Richard (2003) examines models of mergers where consumer welfare is affected not only by price but also by frequencies and convenience of departure times. He uses monthly US data (T100) on aggregate flights in a market. He finds that even with mergers and an increase in market concentration that there will be an increase in flights or the flight schedule will be more convenient. He finds post merger, flight frequency tends to increase in smaller markets.

Data

We collected data covering the first quarter of each of the years between 2008 and 2013. Data was gathered from a variety of sources. Based on T100 form the DOT, we have derived the available number of Seats in each market, which was then used to generate the competition index HHI and LCCShare. This source also permitted the calculation of the LoadFactor in each market. From BEA, we have collected population and income per capita for each MSA. We then calculated the average population (AvgPop) and average income per capita (AvgPerCap) for each market based on the origin and destination MSAs. Using DB1B we assembled the average fare transacted in each market for non-stop flights. This measure was normalized to capture the distance travelled. Lastly, the Leisure and Business market dummies were adopted from Gerardi and Shapiro (2009). A market is defined as leisure if either of the airports is a leisure destination based on the MSA’s accommodation earnings to total non-farm earnings ratio, and business is defined as any market connecting the largest 30 MSAs.
Analysis and Preliminary Results
We first analyze the link between load factors and transacted fares. Our analysis reveals that load factors are negatively associated with transacted fares. This is an important result as it resolves the opposing predictions offered by economic intuition and by the operational intuition. Specifically, the negative relationship suggests that an increase in load factors is primarily driven by lower fares offered by airlines rather than by higher demand realizations.

Carrying out panel estimations we find that Revenue per Available Seat Kilometer, RASK, is driven, among others by the supply of seats into markets: the more seats are offered by airlines, the lower the RASK. This result is intuitive and one could speculate whether airlines in their capacity decisions seek to increase the supply of seats, or flights, into lucrative markets with high RASK or whether RASK is not a factor in their capacity decisions. Surprisingly, we do not find evidence to support a link between RASK and airlines’ capacity decisions. How do they adjust their supply into markets then? Overall, we find that airlines have consistently reduced their supply into markets between 2009 and 2013. Yet, several important insights emerge: Airlines have sought to increase capacity into markets with high load factors. This is surprising, as we have noticed earlier that high load factors are associated with lower transacted fares. Additionally, there is evidence for intensification and concentration around hubs and into more competitive markets, especially where LCCs are present.

References