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Note

Weekend effect in airfare pricing

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A B S T R A C T

Internet traffic during weekends is lighter than at weekdays, allowing airlines to adopt a distinctive pricing policy during the weekend. By analyzing the daily airfares for 1000 US domestic routes, this study tests whether a weekend effect exists in the level and dispersion of airfares. It finds a strong weekend effect for airfare dispersion, but not for price level. This suggests that different arrival timing of online consumers during the weekdays motivate airlines to adopt a distinctive pricing mechanism during weekends, by offering occasional discounts while maintaining the same fare level on average.

1. Introduction

Could airlines be posting consistently different airfares across the days of the week, in particular on weekends versus weekdays? If they are, why would they adopt such a pricing mechanism? Airlines have already adopted advanced inter-temporal pricing mechanisms by changing daily airfares. Several studies report that airfares tend to increase as the departure date approaches, which can be explained by the airlines' strategy of discriminating the early arriving, price-sensitive leisure passengers from the late-arriving business passengers. Airline pricing mechanisms, which are often based on the expected marginal seat revenue method, consider the expected arrival rates of different types of passengers (such as business and leisure) as well as the remaining seat capacity prior to departure. The prices and availability of different seats for various flights are updated using the complex pricing mechanisms, and thus we can observe different pricing patterns on weekdays and weekends.

This study illustrates that airlines exercise weekday- and weekend-dependent pricing mechanisms. As airlines expect different types of consumers during the weekends (namely, a larger composition of leisure passengers), they adjust their pricing strategies to exploit the consumers' demand pattern.[1] By analyzing the lowest daily airfares for multiple travel dates on 1000 US domestic origin-destination pairs, this study finds evidence for within-week variation of airfares. In particular, airfares exhibit a strong weekend effect—airfare dispersion (across fare histories) is much larger for weekends (including Fridays) than weekdays (Mondays–Thursdays). This weekend effect is likely driven by the different types of consumers who purchase tickets on different days of week.[2] Encountering different types of consumers, airlines occasionally offer lower fares during the weekend, while balancing off with higher fares, to maintain the same average fare as during the weekdays.

2. Hypothesis

An increasingly large proportion of airline tickets are sold online, but this cyberspace 'sales desk' poses a double-edged benefit for airlines. The Internet emerges as a channel through which airlines can reach a greater number of consumers while maintaining smaller online sales forces. It also fosters competition by giving consumers easy access to a large number of flight options including airfare sites providing instantaneous comparisons of prices, and travel times and dates. It also offers airlines travel service portals at a low search cost, and significant cost savings with direct interaction with consumers (by eliminating broker fees to travel agencies) and ready access to consumers' activities and choices. Understanding consumers' preferences and behaviors enables airlines to set airfares according to consumers' demand pattern.

Internet traffic in general varies across the days of the week. Internet traffic data from several e-business intelligence services

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[1] As the Internet matures, it increasingly becomes the primary selling channel of airline tickets; according to Johnson (2007), 44% of passengers book their flights online.

[2] The day-of-the-week effect occurs in finance and online auctions. For example, in the financial markets, Berument and Kiymaz (2001) show that volatility in stock price is greatest on Friday, because investors take into account the potential bad news to be delivered over the weekend. In online auctions, Lucking-Reiley et al. (2007) find that auctions ending during the weekend achieve 7% higher revenues than weekday-ending auctions, and Dewan and Hsu (2004) find that auctions ending during the weekend have a higher probability of sale.

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(WebSideStory.com and Onestat.com) reveal that the size of Friday–Sunday traffic is lower than weekday traffic by 10–20%. A similar pattern is observed for air travel shopping. Usage statistics of a few travel websites (Expedia.com, Travelocity.com, and usairways.com) by several providers (google.com/trends and alexa.com) suggest that fewer consumers search for flights on weekends.

Such Internet shopping patterns arise because most business-driven shopping occurs during weekdays. This enables airlines to employ day-dependent price discrimination. If the type of consumers differs on weekdays and weekends, then airlines can use this knowledge to adjust prices accordingly. However, prices posted during the weekend cannot be consistently lower than the prices available in the weekdays, since such a pricing strategy would shift many shoppers from weekdays to weekends. To compensate for the reduced demand on weekends, airlines can exercise an "inter-fare history high–low pricing strategy".[3] To capture the demand from price-sensitive leisure consumers who outnumber their business counterparts during weekend Internet shopping, airlines offer discounts on some weekends while posting higher fares on other weekends, so as to maintain similar fares, on average, to weekday fares. Thus, we have the following hypothesis.

While the average price dispersion during weekends (Friday–Sunday) is larger than during weekdays, the average price during the weekends is similar to that of the weekdays.

Two equations are used to compare the signs and significance levels of the coefficients of weekend dummy variables.

$$\begin{aligned}\text{AVG\_PRICE}_{\text{TIME}} = {} & \beta_0 + \beta_1\text{TIME} + \beta_2\text{TIME}^2 + \beta_3\text{MONDAY} \\ & + \beta_4\text{TUESDAY} + \beta_5\text{WEDNESDAY} \\ & + \beta_6\text{FRIDAY} + \beta_7\text{WEEKEND}, \qquad (1)\end{aligned}$$

$$\begin{aligned}\text{AVG\_PRICE\_DISPERSION}_{\text{TIME}} = {} & \alpha_0 + \alpha_1\text{TIME} + \alpha_2\text{TIME}^2 \\ & + \alpha_3\text{MONDAY} + \alpha_4\text{TUESDAY} \\ & + \alpha_5\text{WEDNESDAY} + \alpha_6\text{FRIDAY} \\ & + \alpha_7\text{WEEKEND}, \qquad (2)\end{aligned}$$

where TIME is the number of days prior to the departure date, TIME^2 is the square of TIME, and the other variables are dummies of different weekdays (WEEKEND is a dummy for Saturdays and Sundays).

3. Data

Data from Farecast.com's website for 1000 randomly selected origin–destination (O–D) pairs is used for analysis. For each O–D pair, we collected the lowest daily airfares across all airlines, starting from 90 days out for the itineraries departing on each Wednesday between February 27, 2008 and April 2, 2008, and returning 7 days later. In sum, six fare histories spanning 90 days prior to departure were gathered for each O–D pair, resulting in approximately 540,000 observations of daily airfares.

The dotted line in Fig. 1 shows the average price progression of all O–D pairs in our sample (i.e., across 6000 fare histories). The average fare gradually decreases up to about 2–3 weeks prior to departure, followed by a rapid increase until the day before the flight. As Fig. 1 shows there is very little periodic fluctuation in the average price level.

We construct the price dispersion measure across fare histories on a given O–D pair, based on the power divergence statistic (PDS) (Read and Cressie, 1988), which calculates the distribution divergence level by comparing expected and observed frequencies. Using our six sets of daily airfares, the PDS values for 90 days are calculated for each O–D pair as follows (Mantin and Koo, in press):

$$\text{PDS}_{r,t} = \frac{2}{\lambda(\lambda+1)}\sum_{i=1}^{6} f_{r,t}^{i}\left[\left(\frac{f_{r,t}^{i}}{g_{r,t}}\right)^{\lambda} - 1\right],$$

where $f_{r,t}^{i}$ is the observed airfare on history i at t days out, $g_{r,t}$ is the average fare across the six fare histories at t days out $(=\sum_{i=1}^{6} f_{r,t}^{i}/6)$, and λ is the family parameter. We set λ equal to 2/3, which, according to Read and Cressie (1998), is a compromise between the Pearson's χ^2 statistic $(\lambda = 1)$ and the log-likelihood ratio statistic G^2 $(\lambda = 0)$.

The progression of the average price dispersion is illustrated by the solid line in Fig. 1. Its pattern substantially differs from the average price; the average price dispersion (average PDS) steadily increases over time with strong periodic fluctuations.

4. Analysis

The results for equations (1) and (2) are summarized in Table 1. Both the average price and average price dispersion increase as the departure date approaches; the rate of these increases also increases over time. Pels and Rietveld (2004), among others, have found that the average price level increases near departure are driven by the changing demand patterns.

Table 1 confirms that while the average price across the O–D pairs does not exhibit any significant day-of-the-week effect, the average price dispersion does reveal such an effect on Fridays–Sundays. While airlines maintain an average price during the weekend that is fairly consistent with weekday fares (Monday–Thursday), as none of the days exhibit any significance, the price dispersion is significant from Friday–Sunday across all fares and airlines, as FRIDAY and WEEKEND are significant in the estimation of equation (2).

We also notice that the size of the weekend effect is quite significant; while the overall average PDS is about 0.1, Friday–Sunday's PDS is approximately 15% higher. Table 1 shows that airlines exercise day-of-week price discrimination to capitalize on the leisure passengers looking for lower fares on weekends. With

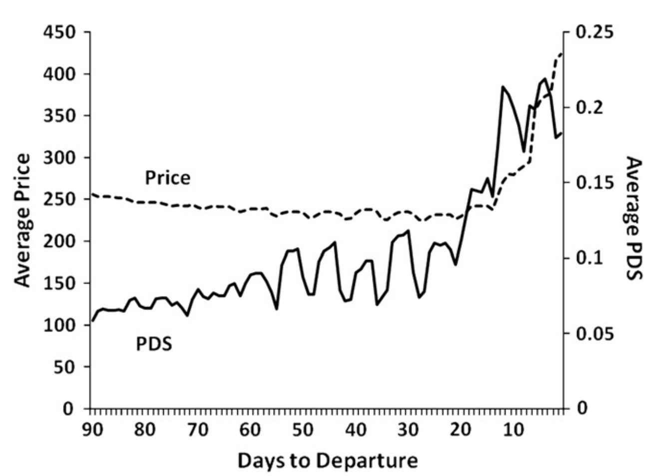

Fig. 1. Average daily airfare and price dispersion across all origin–destination pairs. (Source: Mantin and Koo, in press).

[3] For a discussion on the airline industry's inter-temporal high-low pricing (often adopted by full-service carriers) versus every-day-low-fare pricing strategies (commonly adopted by low-cost carriers) see Sin et al. (2007) and Mantin and Koo (in press).

Table 1
Estimation results.

	Equation (1): AVG_Price	Equation (2): AVG_Price_Dispersion
TIME	−4.56[b]	−0.0038[b]
$TIME^2$	0.04[b]	0.000027[b]
MONDAY	8.38	0.01
TUESDAY	7.91	0.0014
WEDNESDAY	−3.46	−0.0008
FRIDAY	3.64	0.014[a]
WEEKEND	5.99	0.015[b]
Constant	335.67[b]	0.19[b]
R-squared	0.64	0.85

[a] Significant at 5%.
[b] Significant at 1%.

Table 1A
Logit specification results.

	PDS
Scheduled departures (k)	0.17
Distance (k)	−0.439[a]
Population (m)	0.02
Income per Capita	0.036
Boardings (m)	0.124[a]
Enplanements (m)	−29.862[a]
Herfindahl–Hirschman index	0.416
Constant	−3.299[a]

[a] Significant at 1%.

a smaller number of potential consumers during weekends, possibly due to the lack of presence of business consumers, airlines may offer them lower fares. Such fares during the weekend will motivate other consumers to wait for the weekend deals. To counteract consumers' strategic waiting, the airlines maintain the average price offered during the weekend at the same level available during other weekdays. Thus, while the price level is kept at the same level, the price dispersion on Friday–Sunday is much higher than other weekdays.

We conducted additional analysis on the route level. This analysis, which is provided in Appendix, suggests that routes with thinner markets (in terms of enplanements), connecting to larger hubs (in terms of boardings), and of shorter distance, are more likely to reflect a significant weekend effect in price dispersion (as measured by the PDS).

5. Conclusions

Several data sources reveal that traffic on the Internet, as well as on travel-related websites, is lower on Fridays–Sundays. This phenomenon is likely due to lower activity from business passengers. With different types of consumers buying tickets on different days of the week, airlines can exercise day-of-the-week price discrimination practices. For example, with more price-sensitive consumers searching websites for lower fares on weekends, airlines are motivated to post slightly lower fares during these days.

The analyses of time-series data of the average price and dispersion across six fare histories of 1000 domestic routes reveal that the price dispersion is significant and greatest on Friday–Sunday, while the corresponding average price exhibits no such effects. This confirms that the price dispersion on weekends is driven by greater price differentials, with the Friday–Sunday's price dispersion is approximately 15% higher than during the weekdays.

Appendix

We also estimate Model 1 on the route level to characterize O–D pairs that are more likely to exhibit significant weekend effects in price dispersion. The dependent variable equals one if the coefficient of the WEEKEND variable is significant, and zero otherwise. The absence of significance for the WEEKEND variable for a particular route does not affirm that the weekend effect is absent; however, we cannot reject the null hypothesis that the coefficient of WEEKEND is zero.

Additional variables are used to explain more of the importance of the weekend effect. *Scheduled departures* is the planned direct departures between the origin and destination pairs (in thousands) (from the US Department of Transportation's DB1B database). *Distance* (in thousands of kilometers) is the distance between the origin and destination airports. *Population* is the average population of the two metropolitan areas (MAs) and *Income per capita* reflects the average income per capita in these two MAs, both of which are from the US Department of Commerce's Bureau of Economic Analysis (BEA). *Boardings* is the average boardings (in millions) at the origin and destination airports. *Enplanements* refer to the number of passengers who traveled between the airports (retrieved from the US Department of Transportation) and the Herfindahl–Hirschman index estimates the competitive market environment based on various enplanements (i.e., by accounting for each airline's market share on the route).

Logit results are provided in Table 1A and reveals that O–D pairs of shorter distances and with fewer passengers, as well as O–D pairs connecting larger airports, are more likely to account for the significance of the weekend effect. The negative sign of distance implies that passengers are more likely to substitute short-distance air routes for other travel modes. The presence of potential leisure passengers, who would otherwise not take a flight but use different modes of transportation, is targeted in another way during the weekend, by offering occasional discounts. The finding that smaller markets between hubs are significant in accounting for the existence of the weekend effect, suggests that larger airports attract a greater variety of business and leisure passengers, and that the thinner markets offer airlines the potential of relatively easier segmentation.

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