

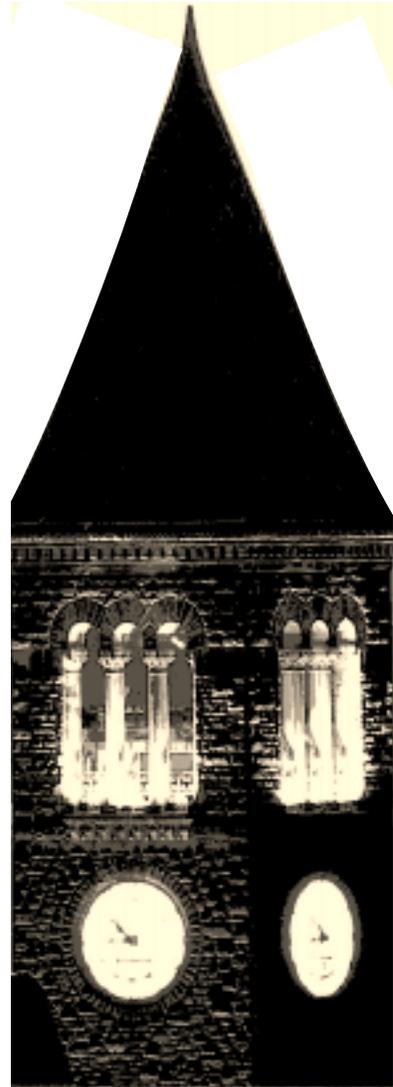
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The Influence of Gasoline-price Fluctuations on U.S. Lodging Demand:

**A Study of Branded Hotels
from 1988 through 2000**

by Linda Canina, Ph.D.,
Kate Walsh, Ph.D., and
Cathy A.ENZ, Ph.D.



The Center for Hospitality Research
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CHR Reports

is produced for the benefit of the hospitality industry by
the Center for Hospitality Research at Cornell University

Cathy A. Enz, Executive Director

Glenn Withiam, Director of Publications Services

Price \$50.00

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A 13-year analysis of the relationship between gasoline prices and lodging demand found that a 1-percent increase in gasoline prices results in a drop of rooms demand of 1.74 percent. The study, which is based on brand-name hotels in the United States, was done at The Center for Hospitality Research.

The researchers examined monthly room-night data from 1988 through 2000 from the Smith Travel Research database. The researchers also factored gross domestic product into their analysis and included a trend factor as an additional control. All room rates were adjusted to year-2000 dollars using the consumer-price index (CPI).

Examining the effects of gasoline-price increases on various lodging segments, the researchers determined that the effects of rising gasoline prices fall most heavily on midscale and economy hotels, with a lesser effect on upscale properties. For example, a 1-percent increase in gas prices would reduce annual economy-hotel demand by 2.89 percent. Midscale properties with F&B would see a demand reduction of 4.12

percent and limited-service midscale properties would have a reduction of 2.89 percent with every 1-percent increase in gasoline prices.

The combined effects of hotel location and market segment clarify the effect of gasoline-price increases on hotels operating in various segments in different locations. The effects of gasoline-price changes are magnified in hotels located along highways—that is, those that depend chiefly on automobile access.

The most gasoline-price-sensitive group comprises midscale and economy hotels located in highway and suburban locations. The following demonstrates that effect. A 1-percent increase in gasoline prices reduces demand for full-service midscale urban hotels by a little over 2 percent, but for highway properties in the same segment, the loss is nearly 4 percent.

Ironically, gasoline-price increases are associated with an increase in demand for resorts in mid- to upscale segments, but resorts in the economy segment see a reduction in demand.

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Hospitality managers and analysts have long believed that rising gasoline prices diminish lodging demand in the United States. This view is based largely on the connection between the automobile and American travel activity for all purposes. From the free-ways filled with commuters to the traditional summer vacation with the kids, the car is a key feature of the life and habits of U.S. residents. Indeed, by 1990 the U.S. was responsible for one-third of the world's oil consumption, and transportation consumed two-thirds of the U.S.'s total oil use.¹ Thus, it is no wonder that changes in gasoline prices are headline news, or that gasoline-price fluctuations play a central role in U.S. economic planning.

Because Americans rely heavily on their automobiles for

¹ A. Gately, "The U.S. Demand for Highway Travel and Motor Fuel," *The Energy Journal*, Vol. 11 (1990), pp. 59-73.

travel, we argue that gasoline-consumption patterns almost certainly have a profound effect on travel choices, and that those travel choices, in turn, undoubtedly affect lodging demand. The connection between consumption patterns and gasoline-price changes, however, is not clear or direct. If travelers do, in fact, curtail their travel plans in response to gasoline-price increases, the question becomes what is the resultant effect on lodging demand. The following is the focus of our study: To what extent do gasoline-price changes influence lodging demand? We are particularly interested in knowing how sensitive travelers are to changes in gasoline prices and which lodging segments are the most susceptible to gasoline-price fluctuations.

This report examines the relationship between gasoline prices and lodging demand in the United States. Using monthly property-level rooms-sold data

for brand-name (chain) hotels from 1988 through 2000, we investigated how overall lodging demand is affected by gasoline prices, controlling for general economic conditions. In addition, we also examined how gasoline prices affect hotels by location and market segment.

Study Approach

As a first step, we examined the relationship between gasoline prices and overall industry demand during those 13 years to estimate the magnitude of the effect of gasoline-price fluctuations on rooms demand. Since the availability of alternative forms of travel is a factor that almost certainly mediates the effects of gasoline-price fluctuations on lodging demand in certain sectors or locations, we then examined the effect of gasoline-price changes on lodging demand for hotels in four different categories: urban, suburban, highway, and resort.

Microeconomic theory predicts that the cross-price elasticity of demand for an item will decrease as the availability and number of alternatives increase. The cross-price elasticity of demand measures the sensitivity of demand for one good to a change in price of another good. In our case, if the price of the alternatives (to automobile travel) remains reasonably constant, an increase in the price of gasoline

should not cause demand for lodging to fluctuate significantly, to the extent that alternative forms of transportation exist. In other words, rather than curtail their travel if gasoline has become expensive, travelers may seek out motorcoaches, trains, or airplanes, which may not change their fares in direct relationship with fuel-price changes.

The cross-price elasticity of demand varies according to a hotel's location. Some properties are accessible only by automobile—indeed, were developed

In Appreciation to Smith Travel Research



This *CHR Report* is made possible through an alliance between The Center for Hospitality Research and Smith Travel Research. Through this alliance with STR, the data are available for the use of The Center for Hospitality Research under non-disclosure and confidentiality agreements that carefully guide the scope and nature of data reporting. The authors acknowledge the support of both Smith Travel Research and the CHR.

because of automobile travel—while others can be reached by some combination of train, automobile, taxicab, airline, bus, or even ship. We argue that gasoline-price changes will have a smaller effect on lodging demand for lodging segments that are served by several modes of travel than it will on hotels in exclusively automobile-related locations. Specifically, we expect

Lodging demand for highway hotels will be influenced by gasoline-price changes to a greater degree than hotels that can be reached by a number of transportation methods.

that lodging demand on highways and in suburban locations will be influenced by gasoline-price changes to a greater degree than, say, urban hotels, which can be reached by a number of transportation methods.

In addition, we expect that sensitivity to gasoline-price changes will affect rooms demand depending on travelers' price sensitivity, which is defined in terms of hotels' price segments. Accordingly, we categorized the hotel data by market segment, dividing the hotels into the categories of upper upscale, upscale, midscale with F&B, midscale limited service (i.e., without F&B), and economy.

This follows from the assumption that low-income groups frequent the low-price properties, while high-end properties attract high-income guests.

Economic theory suggests that the demand for an item should decline as price increases, for two reasons. First, as the relative price of a good increases, consumers substitute a relatively less-expensive good for the more-expensive one. Second, a price increase reduces real income, resulting in a downward shift in demand for all goods—a phenomenon known as the income effect. The income effect does not fall equally on travelers at all income levels, however. The key factor in the income effect is the percentage of income that is absorbed by the cost of a particular item. As the percentage of total income spent on the item increases, a price change in that item will have a larger income effect. Thus, the income effect predicts that the effects of gasoline-price increases on lodging demand will vary by travelers' income level. The effect of gasoline-price changes on lodging demand should be less pronounced at high income levels because any increased cost represents a smaller portion of income than for those in low income brackets. Along this line, we expect that lodging demand for hotels in low-price segments will be more sensitive to gasoline-

price fluctuations than will lodging demand for hotels in high-price segments.

Aggregating the effects of the availability of alternative transportation modes with the income effect, we expected that gasoline-price changes will most profoundly shape lodging demand for hotels in low-price segments in locations for which few transportation alternatives exist. To test this notion, we analyzed the relationship for each of the five market segments by each of the four location categories. We believed that customers who frequent low-price hotels will be the most sensitive to the price of gasoline, and, consequently, that this effect will be particularly pronounced in hotels along highways and in suburban locations. Our final analysis, then, combined the income effect with the availability of transportation alternatives (or lack thereof). We expected that lodging demand for hotels in economy and midscale hotels in highway and suburban locations would be the most sensitive to gasoline-price fluctuations.

The Model

The dependent variable in this analysis, property-level hotel-rooms sold, was obtained from Smith Travel Research (STR), an independent research organization that tracks performance of all major North American lodg-

ing chains. STR's hotel-rooms-sold data are comprehensive, capturing over 98 percent of the nation's brand-hotel inventory, and thus are fully representative of the entire U.S. lodging population for brand-name (chain) hotels. The key independent variable in the analysis was gasoline prices. Data for that variable were obtained from the Bureau of Economic Analysis in the form of the annual averages of monthly gasoline prices by state.

Even though our objective was simply to measure the relationship between gasoline prices and hotel-rooms sold, we included two other independent variables to ensure that the equation's gasoline-price coefficient was measuring only the relationship between gasoline prices and lodging demand. To control for general economic conditions, the equation included both gross domestic product (GDP), which was obtained from the U.S. Bureau of Economic Analysis, and a measure of consumer demographics, in the form of a trend variable. The GDP figure captured the influence of general economic prosperity on lodging demand, while the purpose of a trend variable is to control for systematic effects that change over time that are not picked up by the other independent variables (e.g., the population is increasing over time, the percentage of aged people in the

population is increasing over time). All dollar-denominated variables were converted to 2000 real dollars using the consumer-price index (CPI), obtained from the U.S. Bureau of Labor Statistics.

The regression model below tests the effect of gasoline prices on lodging demand and takes into consideration the general economic conditions as measured by GDP, as well as the trend variable. We used several forms of the following equation:

$$\ln(\text{ROOMS SOLD})_{t,s}^{l,m} = \alpha^{l,m} + \beta_1^{l,m} \text{TREND}_t + \beta_2^{l,m} \ln(\text{GDP})_t + \beta_3^{l,m} \ln(\text{GAS PRICE})_{t,s}$$

where:

l denotes location (i. e., urban, suburban, highway, and resort);

m denotes the market segment (i.e., upper upscale, upscale, midscale with food and beverage, midscale limited service, and economy);

t denotes the years 1988 through 2000;

s denotes the states 1 through 50;

$\ln(\text{ROOMS SOLD})_{t,s}^{l,m}$ is the natural log of the sum of rooms sold across properties in year *t*, in state *s*, by location *l*, and by market segment *m*;

*TREND*_{*t*} is a trend variable taking a value of 1 in 1988 and thereafter increasing by 1 for each year *t*;

$\ln(\text{GDP})_t$ is the natural log of gross domestic product in constant 2000 dollars in year *t*; and

$\ln(\text{GAS PRICE})_{t,s}$ is the natural log of the average monthly gasoline price in year *t* for state *s* in constant 2000 dollars.

The dependent variable in this model is the natural log (ln) of rooms sold. The independent variables are the natural log (ln) of gasoline prices, the natural log (ln) of GDP, and the trend variable. The continuous variables were transformed to natural logs (lns) so that their coefficients could be interpreted as the percentage change in rooms sold for a 1-percent change in the price of gasoline.

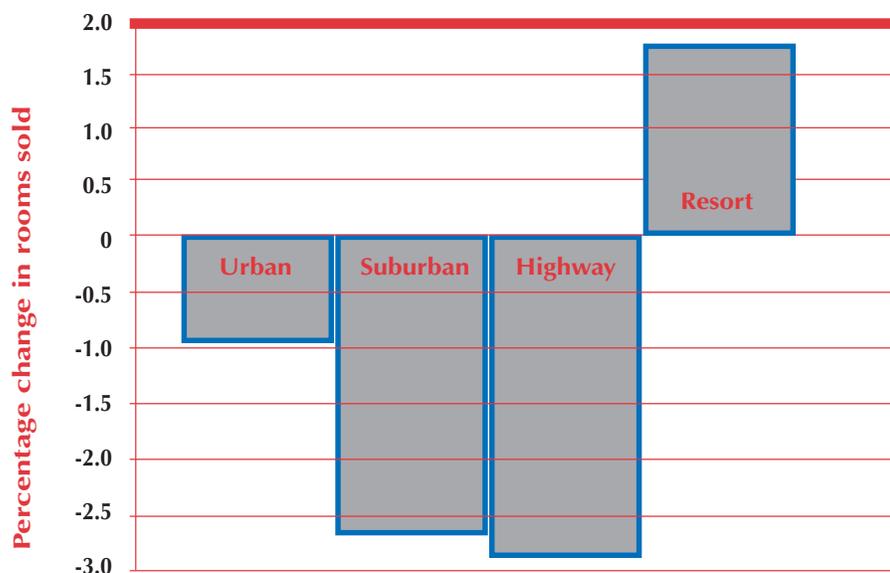
Results:

Costly Price Increases

We found that lodging demand does, indeed, diminish as gasoline prices increase. Our regression analysis found that a 1-percent increase in gasoline prices yields a 1.74-percent decrease in lodging demand. This result is consistent with the microeconomic principle that there is an inverse relationship between the quantity demanded of a good and its cost. Since gasoline is an element in the cost of travel, lodging demand declines as gasoline prices increase. To translate this finding into concrete terms, a one-cent in-

EXHIBIT 1

Effect of a 1-percent gasoline-price change on rooms sold, by location



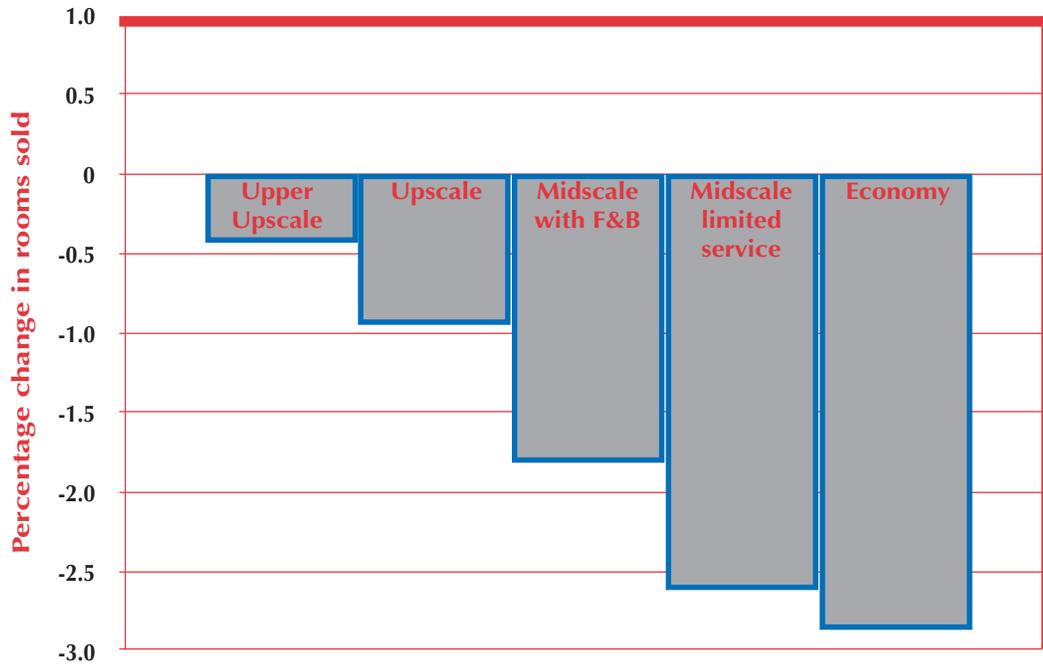
crease in the price of gasoline in year 2000 would have translated into a lodging-demand decline of about nine million room-nights for that year. This result confirms our expectation that gasoline is a core component of lodging demand. As we would expect, the cost of gasoline directly affects the cost of travel, which in turn affects the demand for lodging. Because the U.S. lodging industry is so large, a small-sounding 1.74-percent decrease in rooms sold creates a substantial effect when stated in room-nights.

Hurting highway hotels. The data presented in Exhibit 1 show that lodging demand for hotels in highway and suburban locations

is more sensitive to gasoline-prices than is lodging demand for hotels in urban and resort destinations. We found the strongest relationship between gasoline prices and lodging demand in highway locations, followed closely by hotels in suburban locations. On the other hand, the weakest relationship was found in urban locations. A 1-percent increase in gasoline prices results in a 2.89-percent decrease in lodging demand for highway hotels and a 2.70-percent decrease for suburban hotels. But that same 1-percent gasoline-price increase was associated with only a .91-percent decrease in demand for urban hotels.

EXHIBIT 2

Effect of 1-percent gasoline-price increase on rooms sold, by market segment



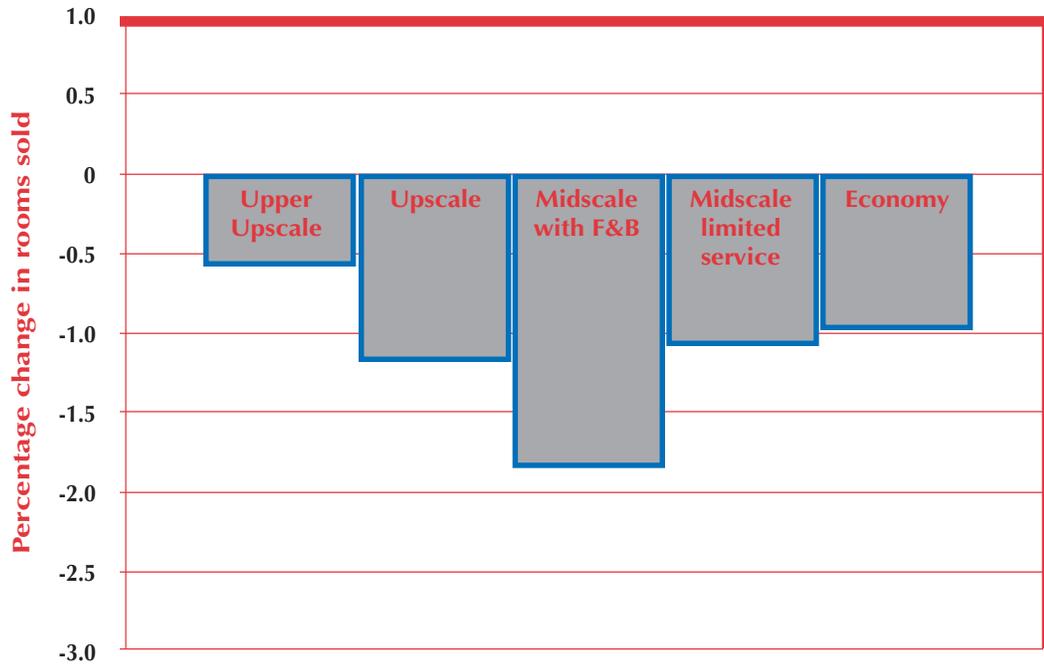
Not harmed. An unexpected result was the positive and significant relationship found between gasoline prices and demand in resort locations. Resort hotels saw *increases* in rooms sold when gasoline prices rose. Our data showed that a 1-percent increase in gasoline prices was associated with an increase of 1.85 percent in lodging demand for resorts, or approximately 700,000 annual room nights in 2000. This was a counterintuitive finding that merits further exploration in subsequent studies, but the core finding is that resort

demand is not depressed by increasing gasoline prices.

Segments are key. Our analysis also found that lodging demand for hotels in low-price segments is more sensitive to gasoline-price fluctuations than lodging demand for hotels in high-price segments. The magnitude of the coefficients, presented in Exhibit 2, indicates that the strongest effect of gasoline prices on lodging demand was found in the economy segment, while the weakest effect was found for hotels in the upscale segment. The volume of rooms

EXHIBIT 3

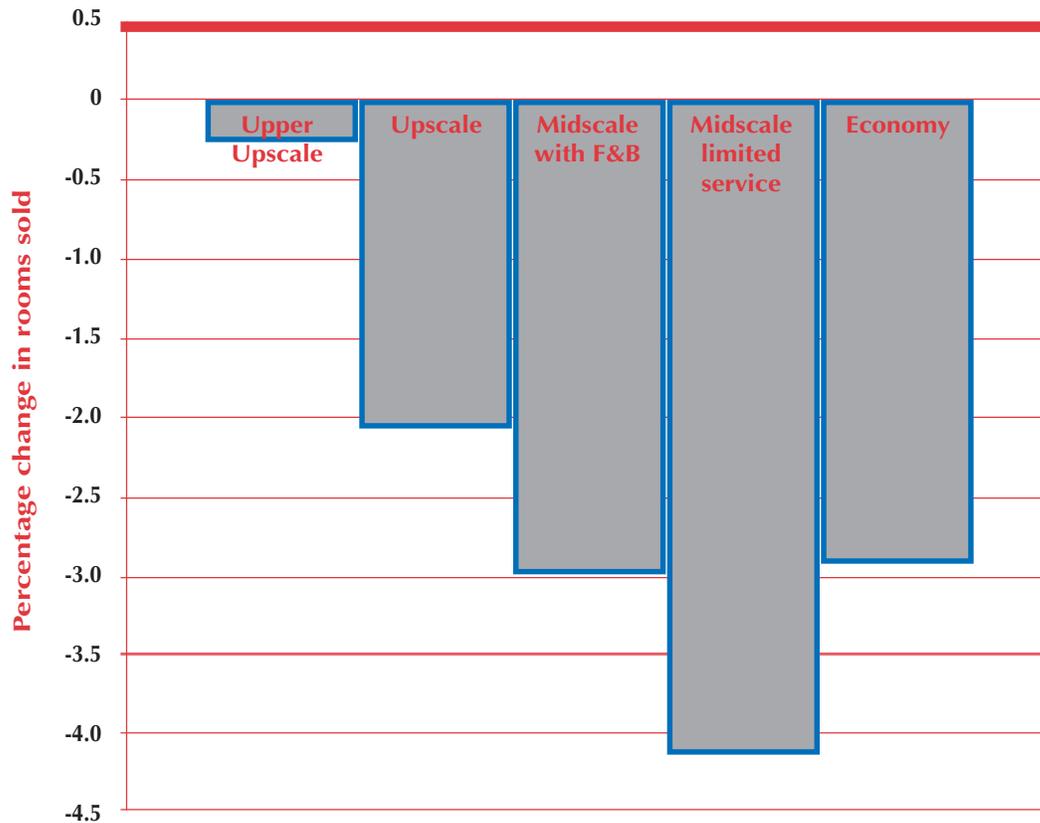
Effect of 1-percent gasoline-price increase on rooms sold for urban hotels, by segment



sold in the upper-upscale market showed a negative but not significant relationship to changes in gasoline prices, while the negative effects found on all other segments were statistically significant ($p < .001$). Thus, the -2.80 coefficient for hotels in the economy segment suggests that a 1-percent increase in gasoline prices reduces lodging demand for economy hotels by 2.80 percent or approximately three million room-nights annually in 2000, while the $-.98$ coefficient for hotels in upscale markets suggests that a 1-percent increase

in gas prices reduces lodging demand for upscale hotels by .98 percent, or approximately 800,000 room-nights in 2000.

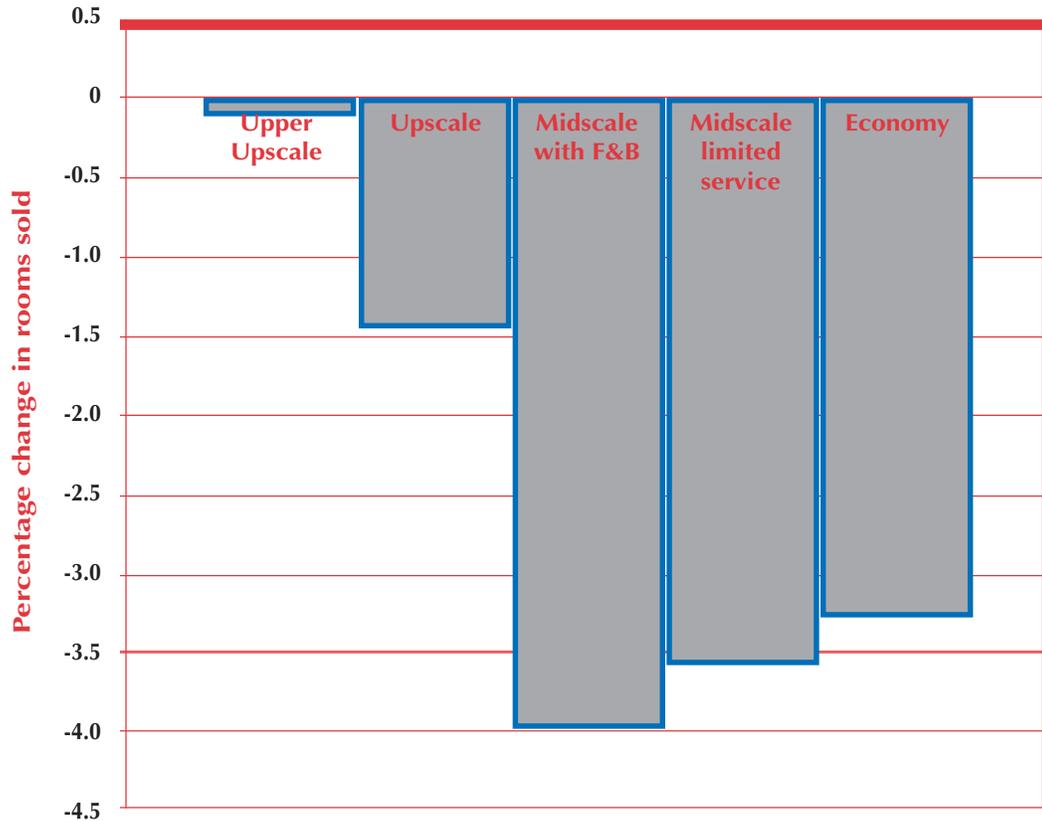
The magnitude of the effect on rooms sold as gasoline prices increase expands as ADRs decline, that is from upscale to midscale to economy. This pattern of negative, significant coefficients clearly reveals that consumers of low-price lodging products reduce their consumption when gasoline prices increase, supporting our expectations regarding the income effect on economy-market hotels.

EXHIBIT 4*Effect of 1-percent gasoline-price increase on rooms sold for suburban hotels, by segment*

Combined effects. The results of the combined effects of gasoline prices with hotel location and market segment, are shown on this and the adjacent pages in Exhibits 3, 4, 5, and 6. We found that lodging demand for economy and midscale hotels in highway and suburban locations is the most sensitive to gasoline-price fluctuations. Hotels that saw the greatest sensitivity to changes in gasoline prices were along highways and in suburban locations in economy and midscale segments, both with

and without food and beverage facilities. Interestingly, the largest decreases in rooms sold occurred in midscale hotels, in both suburban and highway locations, rather than among economy hotels.

A 1-percent increase in gasoline prices reduces lodging demand for these segments in suburban locations as follows: for economy properties, 2.89 percent; for midscale hotels with F&B, 2.98 percent; and for limited-service midscale hotels, 4.12 percent (see Exhibit 4). For a

EXHIBIT 5*Effect of gasoline-price changes on rooms sold for highway hotels, by segment*

one-cent increase in (year 2000) gas prices, this result translates into an approximate annual average loss in rooms sold for the year 2000 of 1,278,276, 919,646; and 1,777,570, respectively.

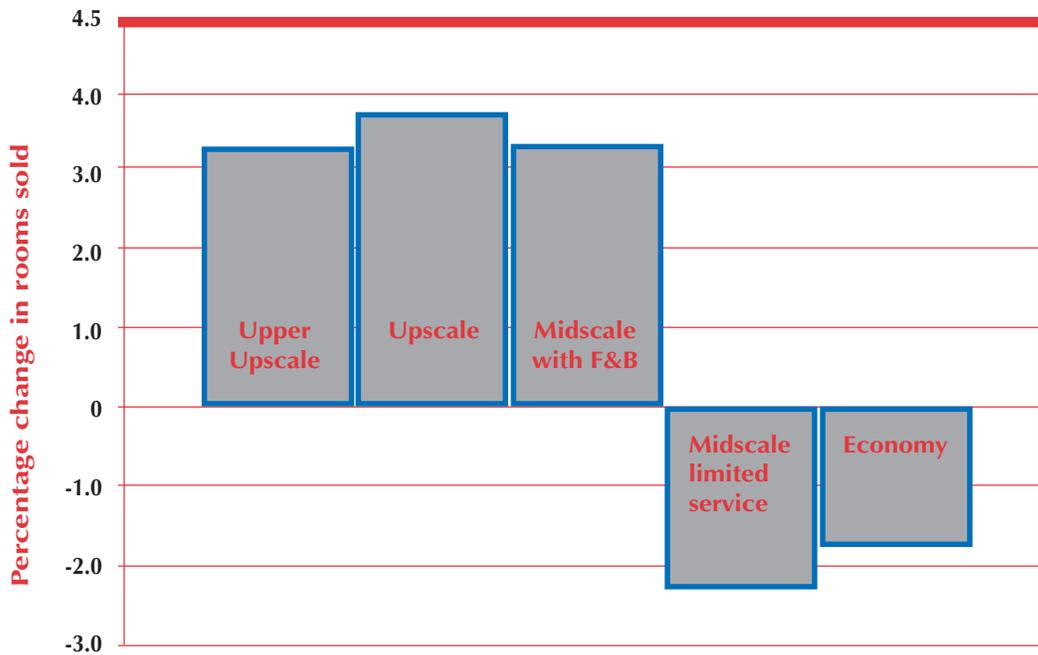
For midmarket properties in highway locations, that same 1-percent increase in gasoline prices reduced lodging demand for full-service properties by 3.97 percent, and for limited-service properties by 3.58 percent (see Exhibit 5). The relationship for highway economy hotels is a reduction of 3.35 percent in

demand. For a one-cent increase in gasoline prices, that would mean an approximate annual average room-night loss of 1,460,182 for full-service hotels, 1,596,569 for limited-service hotels, and 1,651,465 for economy hotels (in year-2000 terms).

Resort hotels (whether upper upscale, upscale, or midscale) constituted the only hotel segment to experience statistically significant, positive room-demand changes when gas prices increased. However, we must point out that low-end resorts did

EXHIBIT 6

Effect of 1-percent gasoline-price increase on rooms sold for resort hotels, by segment



not experience that lift and were hurt by gasoline-price rises (see Exhibit 6). While the strongest relationships were found in upscale hotels, the size of the coefficients was noteworthy. For example, a 1-percent increase in gasoline prices actually results in 3.67-percent increase in demand for upscale resort locations, or approximately 227,302 annual room-nights in the year 2000. Other top-market properties did not experience the same demand boost as that found for resorts. The results were not significant for upper-upscale hotels in the other locations.

Implications for the Hospitality Industry

Our results indicate that gasoline prices do, in fact, make a difference in lodging demand. In general, when gasoline prices rise, U.S. lodging demand declines. We now know the magnitude of this relationship on a percentage basis—a 1-percent increase in gasoline prices results in a 1.74-percent decrease in lodging demand. We also found that demand for low-end hotel brands is more sensitive to shifting gasoline prices than is demand for high-price brands.

These findings support the notion that travelers who stay in economy and midscale hotels may consider gasoline price to be a key factor in their travel decisions and will likely curtail their travel activity if their overall travel costs increase—in this case, the cost of automobile travel.

The effects of gasoline-price changes are magnified in hotels located along highways and outside of major metropolitan locations—in short, those that depend on automobile access. These results provide tentative support for our expectation that the presence of few transportation alternatives augments changes in rooms sold when gasoline prices change. In contrast, the demand base for urban hotels is less price sensitive to gasoline-price fluctuations, possibly due to the fact that consumers in these locations rely on public transportation such as taxis, subways, or shuttles.

Finally, lodging demand's price sensitivity to gasoline-price fluctuations increases with hotels' distance from urban locations (that is, in suburban and highway locations), as well as when hotels fall into low-end market segments. As we expected, the most gasoline-price susceptible group comprises midscale and economy hotels located in highway and suburban locations. The susceptibility of those properties to gasoline-price changes is dramatic.

An interesting finding of our study is the positive relationship found between gasoline prices and lodging demand for resort hotels in the upper-upscale, upscale, and full-service midscale segments. While purely speculative, our theory is that price-conscious travelers respond to rising gasoline prices by shifting their travels to resort-type destinations to minimize transportation costs, since they can use alternative means of transportation (air, rail, or motorcoach) to get to the resorts. Moreover, when gasoline prices rise, travelers who are at a resort on convention or group business may extend their trip as a family vacation (rather than take a separate trip). This might explain why upper-upscale resorts demonstrate a weak, albeit positive, relationship between gas prices and lodging demand when compared with upscale and full-service midscale resorts. Whatever the explanation, this unanticipated positive relationship bears further investigation and represents a point from which to extend our research.

Implications for Hospitality Practice

Our study demonstrates the substantial effect that rising gas prices have on lodging demand. As such, it can help decision makers predict approximate

changes to their occupancy and income levels when gas prices shift. By increasing their sensitivity to this economic signal, decision makers can become more precise in forecasting their demand. In addition, we demonstrate the effect of gas prices on the industry to make more substantial our speculation about possible effects. Hoteliers may consider sharing these results with others in the travel industry to help anticipate and strategically plan for the full array of costs of travel. Efforts to control transportation costs will directly influence lodging demand, as this study shows.

At the same time, our findings suggest that not all lodging

Our study demonstrates the substantial effect that rising gas prices have on lodging demand.

operators need to worry that jumps in gasoline prices will hurt their demand levels. The quick assumption that rising gasoline prices will affect summer travel plans, for example, holds true only for specific segments in specific locations—that is, for those hotels in locations dominated by automotive travel. Thus, a practical way in which to build on our findings may be to exam-

ine the seasonal effects of gasoline-price fluctuations on lodging demand for certain markets.

Our study has the benefit of being based on data from the entire U.S. lodging industry over a 13-year interval, a period in which the gasoline prices exhibited both sharp spikes and drops. These data are not subject to a particular year or season of gasoline prices, but instead our results present the pattern of the relationship between gasoline prices and lodging demand over an extended time, in various locations and among several market segments. As a consequence, we offer a picture of hospitality-industry demand that is more than a snapshot in time—one that captures both dramatic and subtle shifts in gasoline prices. In addition, because our sample is comprehensive and captures over 98-percent of U.S. brand-name hotels, these findings can be applied generally to the industry (in aggregate). As a result, we are able to determine in real dollars the concrete effects that gasoline-price increases have on the hospitality industry.

While this study shows a causal link between gasoline-price fluctuations and lodging demand, an important limitation is that we were not able to obtain specific data to connect consumer-spending variables (such as consumers' income levels or

purpose of travel) with the overall effect. Regrettably, this information is unavailable because hotels generally do not link consumer profiles with demand patterns. Obtaining consumer information of that type would enable us to better understand income effects, for example, or to determine whether the clientele for resorts represents a specific niche market in terms of income levels or purpose of business.

As the hospitality industry becomes more sophisticated in capturing and managing data, a fruitful area in which to extend this research would be to bridge the literatures on the economic effects of gasoline-price shifts, hospitality-customer demographics, and lodging demand. One area for future exploration is the development and testing of causal models that examine hospitality-demand patterns in response to economic shifts and includes customers' demographic and business-mix profiles. Such work could extend the contribution of this study by exploring the effect of gasoline prices on travel decisions for both leisure and business travelers.

References

- C.A. Dahl and T. Sterner, "Analyzing Gasoline-demand Elasticities: A Survey," *Energy Economics*, Vol. 13 (1991), pp. 203-210.
- A. Gately, "The U.S. Demand for Highway Travel and Motor Fuel," *The Energy Journal*, Vol. 11 (1990), pp. 59-73.
- L.A. Greening, T.J. Hann, J.P. Formby, and D.C. Cheng, "Use of Region, Life-cycle, and Role Variables in the Short-run Estimation of the Demand for Gasoline and Miles Traveled," *Applied Economics*, Vol. 27 (1995), pp. 643-656.
- H.A. Kayser, "Gasoline Demand and Car Choice: Estimating Gasoline Demand using Household Information," *Energy Economics*, Vol. 22, pp. 331-348.
- R.R. Palakurthi and S.J. Parks, "The Effect of Selected Socio-demographic Factors on Lodging Demand in the USA," *International Journal of Contemporary Hospitality Management*, Vol. 12 (2000), pp. 135-142.
- R. Schmalensee and T.M. Stoker, "Household Gasoline Demand in the United States," *Econometrica*, Vol. 67 (1999), pp. 645-662.
- A. Zuber, "QSR Pumps up Summer Promos to Compete with Gas Prices," *Nation's Restaurant News*, Vol. 6, May 28, 2001, pp. 49-52.

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