# Pricing in Retail Gasoline Markets

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*Although fuel costs represent over half of the per mile cost of driving an automobile, vehicle miles traveled are relatively inelastic with respect to changes in gasoline prices. Thus, when there are large increases in gasoline prices as there have been on occasion over the past few years, there have been concerns raised regarding the possibility of anti-competitive behavior on the part of gasoline retailers. The purpose of this paper is to examine price-cost margins for retail gasoline stations in local markets and to determine whether movements in these margins indicate the presence of such behavior.*

*This study uses a unique proprietary data set from an extensive pricing survey that was collected twice weekly for 25 local markets in Oregon. Using a VAR specification, evidence of tacit collusion is tested for and found as indicated by downward price stickiness. Price leadership is observed in several markets, but this behavior is not found to have a significant impact on price-cost margins when compared with markets in which price leadership is not observed. This result supports the hypothesis that price leadership serves to signal price changes in the face of volatile costs in very competitive retail gasoline markets. Other factors, such as whether the firm was a known low-price firm, located in an isolated area, whether the firm was selling unbranded or branded gasoline, and whether the firm was located on an interstate exit, are found to be important and significant determinants of price-cost margins for retail gasoline stations.*

## INTRODUCTION

Although fuel costs represent over half of the per mile cost of driving an automobile, vehicle miles traveled are relatively inelastic with respect to changes in gasoline prices (CBO 2008). Thus, when there are large increases in gasoline prices as there have been on occasion over the past few years, there have been concerns raised regarding the possibility of anti-competitive behavior on the part of gasoline retailers.

When studying the gasoline industry, it is important to distinguish between retail gas stations and the major oil companies. In general, retail outlets are independently owned franchises that purchase wholesale gasoline from a major oil company. The focus of this study is on the retail market.

Increases in retail gasoline prices over the last few years have resulted in public outcry and questions as to whether these higher prices reflect some sort of anti-competitive collusion on the part of retail stations (Associated Press 2005). It is usually suggested that the tendency for retail gas stations to change prices together (often the same day) may mean that firms are setting price as a joint profit-maximizing monopoly. However, as Marvel (1978) observes, a retail gasoline cartel would be nearly impossible to sustain in most of these markets due to the highly informed gasoline consumer. A member of the cartel would be rewarded greatly by deviating from the monopoly price.

In a market where costs are highly volatile and firms may mistakenly interpret cost-based price changes for non-competitive price movements, price wars are a possible result. In this situation some form of tacit collusion may be a way for firms to clearly signal other market participants that a price change is cost based.

When firms tacitly collude, they are usually in a situation where competitors will quickly match price cuts, and thus try to avoid price reductions. Downward price stickiness has been used as an indicator of tacit collusion − although not necessarily market power. For example, Borenstein and Shepard (1996) argue that U.S. retail gas firms engage in tacit collusion as evidenced by the fact that

retail gasoline prices are *sticky* − slow to move in the downward direction, but quick to increase - a finding also consistent with that of Davis and Hamilton (2004).

In an effort to explain the root of sticky retail gasoline prices, several studies have examined the rate at which upstream cost shocks are realized in downstream markets. Borenstein et al. (1997) study the pass-through rates for cost shocks in the crude oil market as they trickle down to the retail gasoline market. They find asymmetry between the speed at which cost increases and decreases pass through nearly every transaction point between crude oil and retail gasoline prices. Prices are observed to respond quite quickly to increases in costs and to respond slower to cost decreases.

The intent of this study is twofold. First we test for a specific form of tacit collusion, price leadership, in individual retail gasoline markets in Oregon. Determinants of price-cost margins for such firms are then examined to see whether price leadership behavior has resulted in the exertion of market power. While the study finds that price leadership behavior is not significantly associated with price-cost margins, other factors, such as whether the firm is a known low-price firm, located in an isolated area, whether the firm was selling unbranded or branded gasoline, and whether the firm was located on an interstate exit, are found to be important and significant determinants of price-margins for retail gasoline stations.

Two things distinguish this paper from the research efforts of others. First, a proprietary data set of individual local retail gasoline markets collected by a multi-station, multi-branded retail gasoline firm operating in Oregon was made available to the researchers. This provides a unique perspective as the firm itself identified the firms it considered to be competitors in each market rather than relying on the researcher to infer which firms were competitors. Second, the empirical part of this analysis is the first to use a VAR specification to test for evidence of downward stickiness of prices and tacit collusion in the form of price leadership in retail gasoline markets.

The model used in this paper follows the sticky pricing literature as gas station managers react to changes in both wholesale gasoline prices and competitors' price-cost margins. Model specification and the test method used for the presence of price leadership are explained in the following section.

## MODEL SPECIFICATION

To motivate a model of tacit collusion and examine the industry in terms of price leadership, it is important to note that in retail gasoline markets, price, costs, and market demand are fairly transparent. Prices are easily monitored because gas stations post prices on large signs easily seen by motorists and rival firms. Cost information is readily available from private data companies that keep track of wholesale prices for all brands of gasoline. Slade (1987, 1992) argues that rival firms know demand for each station implicitly by monitoring the number of cars fueling at each station. While stations are well informed about each other's activities, each retail gas station also enjoys some form of market power based on brand, location, service quality, and amenities (such as car washes or convenience stores) offered in addition to gas (Netz and Taylor 2002, Van Meerbeek 2003, Hastings 2004).

In a price leadership model, one firm takes the role of the price leader, and the other firm(s) takes the role of the price follower(s). It is implicitly agreed that all changes in price will be first made by the price leader and followed by the price follower(s). It is important for all price changes to be instigated by the price leader, or else this could lead to pricing wars in which firms undercut each other until they eventually arrive at zero economic profit Nash equilibrium where price is equal to marginal cost.

The retail gasoline market can be modeled following Slade (1987) where:

1. There are *m* firms in the market, and each firm knows every other firm's costs.
2. Firms set price in each of *n* periods. The number of periods, *n,* is infinite. A discount rate of $\delta<1$ ensures that the discounted value of the sequence of profits over time is finite.
3. Each firm knows the past history of prices for every firm in the market.

4. Each firm implicitly knows the underlying demand for each brand of gasoline for any vector of market prices. This demand is downward sloping, and of functional form:

(1) $D_i(p,g(x))$

Where: $D_i$ = the demand for station *i*'s gasoline.

p = the vector of *m* prices ($p_1, p_2, ..., p_m$, where pi is included as the price of the *i*th station. $p \in [\underline{p}, \overline{p}]$, where $\underline{p}$ represents the vector of non cooperative (competitive) prices and $\overline{p}$ represents the vector of prices that cause Di = 0.

g(x) = function of consumer gasoline preference, assumed to be exogenous.

The inclusion of $\overline{p}$ captures the extremely competitive nature of the gasoline industry across geographically contiguous areas. Because retail gasoline markets are local markets, they have to price in such a way as to keep customers from traveling to another market to buy gasoline. Since retail gas prices are very transparent to the consumer, they will likely travel to a different market to buy gasoline if p =$\overline{p}$. For example, if the *m* firms were to attempt to set p = the monopoly vector of prices, $p_m$, they would run the risk that $p_m = \overline{p}$ and customers would simply refuse to buy gasoline from any station in the market.

Suppose that all firms attempt to maximize their stream of profits by solving the problem:

(2) $\underset{p_i}{Max} \sum_{t=1}^{\infty} \pi_t \delta^t$

(3) $\pi_{t,i} = (p_i - c_i)D_i(p,g(x)) - F_i$

Where:

$\delta$ = Discount rate attached to future profits.

$p_i$ = Price charged by firm *i.*

$c_i$ = Marginal cost of firm *i.*

$F_i$ = Fixed costs of firm *i.*

Because equation (2) is a function of not only station *i*'s price, but all *m* prices in the market, oligopoly theory suggests that firms in a market such as this may be motivated to tacitly collude and to earn a higher profit margin on each gallon of gasoline. To simplify the argument, $\delta$ is assumed to be a value that would make cooperative pricing worthwhile to all firms (Vives 1999).

Given that firms have nearly complete information regarding competitors' prices, costs, and demand for all *m* brands of gasoline, one would expect station managers to take into account past history of rivals, along with their expected future actions. Because station managers expect their competitors to react to their own price changes, they must take these reactions into account before setting their own price.

In this study, current price-cost margins for each firm are modeled based on knowledge of past margins earned by all firms in the market. By modeling margin instead of price, only the non-cost based changes in price are captured since these are the types of changes that are most likely to be interpreted as a change from current pricing behavior. By defining margin as price less marginal cost, equation (3) can be rewritten as:

(4) $\pi_{t,i} = (M_i)D_i(p,g(x)) - F_i$

Where:

$M_i$ = price less marginal cost for firm *i.*

The traditional price leadership model suggests that firms assume the role of price leader and follower(s) through repeated interactions (Vives 1999; Besanko, Dranove, and Shanley 2000). Consider a model of price leadership where the strategic choice variable is price-cost margin. Firms

assume either the role of "margin leader" or "margin follower" based on repeated signaling and previous successful past tacit collusive efforts. Therefore, in a given the market with *m* competitors, each firm has self-selected itself into one of two categories: leaders or followers.

This price leadership can be tested empirically using the following vector autoregression (VAR):

$$(5)\quad M_{i,t} = \alpha_i + \sum_{j=1}^{m} \sum_{k=1}^{3} \theta_{j,k} M_{j,t-k} + \Psi_i INC + \beta_i DEC + \varepsilon$$

$M_{i,t}$ = Margin of firm *i* at time *t*, defined as $p_{i,t} - c_{i,t}$.
INC = Increasing Pacific Northwest Spot Price (Spot). Dummy variable equal to unity if $\text{Spot}_t > \text{Spot}_{t-1} > \text{Spot}_{t-2}$
DEC = Decreasing spot trend. Dummy variable equal to unity if $\text{Spot}_t < \text{Spot}_{t-1} < \text{Spot}_{t-2}$.
$\theta_{j,k}$ = parameter that captures the reaction of firm *i* to margin changes of each of the *m* firms for the *k*th period lag.
$\alpha_i$, $\Psi_i$, and $\beta_i$ are firm specific parameters to be estimated.
$\varepsilon$ is a normal and i.i.d. error term.

Note that changes in the spot price of gasoline are used as a proxy for changes in retail gasoline station costs. Equation (5) is estimated for each of the *m* firms in each market.

To check for behavior compatible with tacit collusion sticky downward pricing is estimated by including dummy variables to signal whether input costs are trending upwards or downwards. If sticky downward pricing is present, the value of $\beta_i$ is expected to be positive. This method of sticky price detection is similar to the approach used in studies such as Borenstein et al. (1997) and Borenstein and Shepard (1996, 2002). Borenstein et al. (1997) and others have suggested that margins may be lower when costs are increasing. If this is the case, $\Psi_i$ should be negative. This would imply that there is implicit price competition stemming from station managers not wanting to be the first one to raise their price. Asplund et al. (2000) found that consumers were especially unreceptive to price increases, suggesting that firms may take a short-run loss (lower margin) to keep their customer base complacent.

The parameter that indicates price leadership behavior is $\theta_{j,k}$. To illustrate the role of $\theta_{j,k}$ in detecting potential collusion or otherwise, consider a simple two firm market and rewrite equation 4 omitting the other relevant regressors and control variables as follows:

$$(4')\quad M_{1,t} = \alpha_1 + \theta_{2,1} M_{2,t-1} + \varepsilon_{1,t}$$
$$M_{2,t} = \alpha_1 + \theta_{1,2} M_{1,t-1} + \varepsilon_{2,t}$$

The signs of $\theta_{2,1}$ and $\theta_{1,2}$ dictate the nature of competition in this market as illustrated by the following cases:

Case 1: $\theta_{2,1} > 0$ and $\theta_{1,2} > 0$ : In this case each firm sets its margin following the lagged margin of the other firm. Thus, it is not possible to identify a market margin leader.
Case 2: $\theta_{2,1} > 0$ and $\theta_{1,2} \leq 0$ : In this case margin changes by firm 2 are matched by firm 1 but not vice versa. This indicates price leadership by firm 2. Similarly, $\theta_{1,2} > 0$ and $\theta_{2,1} \leq 0$ would indicate price leadership by firm 2. Leaders are identified in different markets when estimates of $\theta_{i,j}$ exhibit these patterns and are statistically significant.
Case 3: $\theta_{2,1} \leq 0$ and $\theta_{1,2} \leq 0$ : In this situation there is no apparent strategic interaction between the firms. Here the price setting appears to be driven by reasons other than the margin movement of competitors. This case calls for a separate theoretical treatment of strategic interaction beyond the scope of this paper.

Each system of equations generated by (4) is inspected for price leaders and price followers in each market. If the *i*th firm is taking the role of margin follower, $\theta_{j,k}$ is expected to be positive and significant for the *j*th firm taking the role of margin leader.

## DATA DESCRIPTION

This study uses a unique proprietary set of data on local market level gas prices in a sample of Oregon markets along with regional wholesale gasoline prices. The proprietary dataset was collected by a multi-station, multi-branded retail gasoline firm twice weekly to keep track of its competitors' pricing trends. These data include retail stations in 25 geographic markets that the firm presorted into competitive markets and identified the other firms that it considered to be competitors. This is unique as the firm itself identified the firms it considered to be competitors in each market rather than relying on the researcher to infer which firms were competitors.[1]

These proprietary data were given for use under the condition that individual stations and markets were not to be named explicitly in this paper. Accordingly, individual firms are referred to as "1", "2", "3", etc. and markets as "A", "B", "C", etc.

The pricing survey was collected in each market every Monday and Thursday. Price survey data were collected for the entire study period in some markets (markets D, E, and F) but most markets had data collected for only a part of that time span (Table 1.)

Data on wholesale (spot) prices were obtained from the U.S. Energy Information Administration via special request. The Pacific Northwest spot price represents the average price of large volume wholesale gasoline transactions that took place each day. The Pacific Northwest spot price is used as a proxy for marginal cost for each firm since the cost adjustment period from spot gasoline to wholesale gasoline is nearly instantaneous (Borenstein et al. 1997). In reality, each firm has slightly different wholesale costs, but such cost information is unavailable for all firms. Following informal conversations with industry participants and also for simplicity, it is assumed that the relative markup of each brand (over wholesale) is constant for each period.

Daily margin is calculated by taking the daily price of the *i*'th firm at time *t* and subtracting the spot price at time *t*, along with a constant \$0.464 per gallon to represent per gallon transportation costs and taxes incurred by each firm. The sum of state and federal gasoline tax in Oregon was a constant \$0.424 per gallon for the time period for this study. According to the firm that supplied the pricing data, all stations located within these markets were charged a market rate of \$0.04 per gallon for delivery. Margin is therefore calculated as:

$$M_{i,t} = price_{i,t} - spot_t - 0.464$$

Where:

$M_{i,t}$ = The margin of firm *i* in time *t*.
$price_{i,t}$ = The retail price charged by firm *i* in time *t*.
$spot_t$ = The wholesale price of gasoline in time *t*.
$t$ = Monday and Thursday of each week.

By modeling margin, price changes that are made to keep a constant markup over cost can be distinguished from price changes that represent a higher (lower) margin. This approach is attractive because it lets us consider only price changes that are the most likely to be scrutinized by competing station managers in the markets. If managers are making cost-based changes, rival managers will likely not interpret these as either aggressive actions or signals that a new margin is being earned given the market demand.

**Table 1: Individual Market Data Set Summary**

| Market Code | Observation Starting Date | Observation Ending Date | Number of Observations | Number of Gas Stations |
|---|---|---|---|---|
| A | 11/17/2003 | 7/11/05 | 172 | 5 |
| B | 10/02/2003 | 9/26/05 | 207 | 3 |
| C | 10/02/2003 | 9/26/05 | 207 | 4 |
| D | 2/3/2003 | 9/26/05 | 276 | 4 |
| E | 2/3/2003 | 9/26/05 | 276 | 5 |
| F | 2/3/2003 | 9/26/05 | 276 | 6 |
| G | 2/3/2003 | 9/26/05 | 276 | 4 |
| H | 2/3/2003 | 9/26/05 | 276 | 2 |
| I | 2/3/2003 | 9/26/05 | 276 | 3 |
| J | 2/3/2003 | 7/11/05 | 254 | 4 |
| K | 11/13/2003 | 9/26/05 | 195 | 4 |
| L | 11/13/2003 | 6/13/05 | 165 | 9 |
| M | 4/01/2004 | 9/26/05 | 156 | 5 |
| N | 11/13/2003 | 9/26/05 | 195 | 8 |
| O | 11/13/2003 | 9/26/05 | 195 | 3 |
| P | 11/13/2003 | 9/26/05 | 195 | 4 |
| Q | 10/16/2003 | 9/26/05 | 203 | 7 |
| R | 10/16/2003 | 9/26/05 | 203 | 3 |
| S | 10/16/2003 | 9/26/05 | 203 | 4 |
| T | 10/16/2003 | 7/28/05 | 203 | 6 |
| U | 10/23/2003 | 4/28/05 | 158 | 2 |
| V | 10/23/2003 | 9/26/05 | 201 | 4 |
| W | 10/23/2003 | 9/26/05 | 201 | 2 |
| X | 10/23/2003 | 9/26/05 | 201 | 3 |
| Y | 10/23/2003 | 9/26/05 | 201 | 4 |
| **Total:** | **2/3/2003** | **9/26/05** | **5371** | **108** |

## EMPIRICAL RESULTS

The VAR (4) was estimated for 25 markets, resulting in 108 separate equations. (Results for each of the 25 individual markets available from the authors upon request.) In 24 of the 25 markets, dummy variables were statistically significant at the 5% level with the majority of the parameter estimates significant at the 1% level. The significance of the dummy variable DEC suggests that nearly every market exhibited some form of tacit collusion, as margins appear to be higher when costs are decreasing. Similarly, the significance and size of the estimated coefficient for INC suggests that firms are reluctant to raise price when costs are increasing. While individual markets are not directly comparable due to the different time periods for which data were available, stations generally earned an extra $0.05-$0.06 per gallon when costs were in a decreasing period and $0.04-$0.05 less when costs were in an increasing period.

These findings support the hypothesis that gasoline retailers engage in sticky downward pricing behavior as they earn higher margins in periods when costs are falling and margins are less when

costs are rising. These results are consistent with those of Borenstein et al. (1997), Borenstein and Shepard (1996, 2002), Slade (1987) and others.

Twelve of the 25 markets exhibited evidence consistent with price leadership as summarized in Table 2. No single brand of gas stood out as the margin leader in all markets. In fact, there are several cases of a brand being a margin leader in one market and a margin follower in another market. Consider markets P and B: Brand 7 is the price leader in market P, but in market B, Brand 7 is a follower of Brand 1. This should not come as a surprise as the manager of the station selling Brand 7 in market P is not likely to manage the station selling Brand 7 in market B.

**Table 2: Markets Where Price Leadership Present**

| | |
|---|---|
| **Market A:**<br>Brands Present: 1, 2, 3, 4, 5<br>Leader Brand: Brand 2<br>Followers of Brand 2: 1, 3, 4, 5 | **Market N:**<br>Brands Present: 1, 2, 4, 6, 7a, 7b, 9, 12<br>Leader Brand: 9<br>Followers of Brand 9: 1, 2, 4, 6, 7a, 7b, 12<br>Leader Brand: 7a<br>Followers of Brand 7a: 1, 2, 4, 6, 7b, 9, 12 |
| **Market B:**<br>Brands Present: 1, 4, 7<br>Leader Brand: Brand 1<br>Followers of Brand 1: Brands 4, 7 | **Market P:**<br>Brands Present: 1, 2, 7, 16<br>Leader Brand: 7<br>Followers of Brand 7: 1, 2 |
| **Market F:**<br>Brands Present: 1, 4, 6, 8, 9, 7<br>Leader Brand: 4<br>Followers Brand of 4: 1, 6, 7, 8, 9<br>Leader Brand: 1<br>Followers of Brand 1: 4, 6, 7, 8, 9 | **Market V:**<br>Brands Present: 1, 4a, 4b, 4c<br>Leader Brand: 4a<br>Followers of Brand 4a: 1, 4b, 4c |
| **Market G:**<br>Brands Present: 1, 2, 7, 9<br>Leader Brand: 9<br>Followers of Brand 9: 1, 2, 7 | **Market W:**<br>Brands Present: 1, 7<br>Leader Brand: 7<br>Follower of Brand 7: 1 |
| **Market I:**<br>Brands Present: 1, 2, 7<br>Leader Brand: 1<br>Followers of Brand 1: 2, 7 | **Market X:**<br>Brands Present: 1, 6, 10<br>Leader Brand: 6<br>Followers of Brand 6: 1, 10<br>Leader Brand: 1<br>Followers of Brand 1: 6, 10 |
| **Market K:**<br>Brands Present: 1, 4, 7, 14<br>Leader Brand: 4<br>Followers of Brand 1: 1, 7, 14 | **Market Y:**<br>Brands Present: 1, 2, 4, 7<br>Leader Brand: 1<br>Followers of Brand 1: 2, 4, 7 |

Each market had a margin leader with different characteristics. In some markets, the firm that earned the lowest average margin led the margin changes, while in other markets the firm with the highest average margin led the margin changes. Estimation results suggest that the brand of fuel sold is not important when choosing a margin leader; it seems to be the individual managers who dictate whether or not to establish margin leadership.

While some suggest that tacit collusion is more easily sustained as the number of firms in the market decreases (Vives 1999; Besanko et al. 2000), this does not appear to be supported by the results. There are some markets with relatively few gas stations that do not appear to be exhibiting

a leader-follower pattern, whereas other markets with relatively numerous stations exhibit leader-follower patterns.

Detecting collusive behavior is a useful first step, but policy makers should be more interested in whether or not this collusion leads to higher margins. If collusive behavior results in higher price-cost margins, then it could be classified as anti-competitive, and policymakers may wish to take a closer look to see whether some sort of government intervention might be called for to protect consumers. However, in the retail gasoline market it has been argued that collusion represents a way for market participants to signal cost changes in a volatile industry where price wars are an undesirable but possible outcome. In this second case, margins are not expected to be positively related to collusive behavior; rather the collusion is actually helping organize an essentially competitive market.

An examination of the determinants of price-cost margins is next conducted to see whether stations engaging in price leadership patterns earn a greater margin than stations that do not. Accordingly, a simple regression model is specified with the dependent variable defined as the average margin earned by each station and the independent variables represent station characteristics generally expected to influence price-cost margins.

$$(6) \qquad M_i = \beta_0 + \beta_1 MAV + \beta_2 ISO + \beta_3 F + \beta_4 L + \beta_5 IS + \beta_6 MET + \beta_7 TT + \beta_8 UB + \varepsilon$$

Where:

- $M_i$ = The average margin of the ith station between 4/1/04 and 4/28/05. This date range is consistent for all markets.
- MAV = Dummy equal to one if station is a "maverick" brand, a well-known low-price firm, known as an aggressive pricer. (Eckart and West 2004a, b).
- ISO = Dummy equal to one if the station is located on the Oregon Coast.
- F = Dummy equal to one if the station exhibited a margin follower pattern.
- L = Dummy equal to one if the station exhibited margin leadership patterns.
- IS = Dummy equal to one if the station is located on an interstate exit ramp.
- MET = Dummy equal to one if the station is located in a city with population > 100,000.
- TT = Dummy equal to one if the station sells "top tier" branded gasoline (www.toptier.com).
- UB = Dummy equal to one if the station sells unbranded gasoline.

The regression results reported in Table 3 are consistent with what one would expect to find in the retail gasoline market: firms selling fuel with a perceived lower quality charge a lower margin than do other "major" brands of gasoline. This is indicated by the negative sign on the variable UB. Eckart and West (2004a, b) noticed that a certain "major" brand had a reputation of being the lowest priced gasoline. This firm is included in the regression as MAV for maverick since this particular brand engaged in cutthroat pricing behavior.

The variable TT is used as a quality indicator to test whether or not stations selling gasoline on the "top tier" list earn a greater margin when compared with other brands of gasoline that do not appear on the list. The fact that the coefficient on TT has a low level of significance suggests that this designation has not allowed "top tier" branded stations to earn higher margins.

The variable MET is used to capture two market effects on margins. First, MET captures the higher station density observed in the larger population regions. As station density increases, one would expect market power to decrease because there are more local competitors (Barron et al. 2008). Second, MET captures the additional benefit of lowering one's price because there are more people living in large metropolitan areas so the expected gain from undercutting rivals increases. As expected, MET is negative, suggesting that the average margin earned in large cities is lower than average although the significance of this variable is low.

**Table 3: Average Station Margin Regression Results**

Dependent Variable: $M_i$

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.1682** | 0.0143 | 11.764 | 0.0000 |
| MAV | -0.0845** | 0.0171 | -4.9281 | 0.0000 |
| ISO | 0.0727** | 0.0143 | 5.0584 | 0.0000 |
| F | 0.0064 | 0.0088 | 0.7250 | 0.4701 |
| L | 0.0099 | 0.0121 | 0.8202 | 0.4140 |
| IS | 0.0383* | 0.0167 | 2.2896 | 0.0242 |
| MET | -0.0131 | 0.0089 | -1.4777 | 0.1427 |
| TT | 0.0203 | 0.0124 | 1.6356 | 0.1051 |
| UB | -0.0474** | 0.0156 | -3.0442 | 0.0030 |

* = significant at the 5% level
** = significant at the 1% level

The variable ISO is used to capture the isolated nature of the coastal communities relative to the other cities in this sample. Because of the increased cost incurred by customers wishing to drive to an alternate market to purchase gasoline, one would expect the value of $\overline{P}$ to be larger in these cities, and therefore the average margin earned should be larger in coastal cities. Consistent with theory, the average margin earned by coastal stations is about $0.07 greater than other stations in the sample. As indicated by the positive coefficient on the dummy variable IS, stations located on an interstate highway ramp were also found to have significantly higher margins than firms located elsewhere.

The variables L and F were included to test whether or not firms exhibiting margin leadership or margin follower patterns were able to earn an average margin greater than that earned by firms not exhibiting this type of pricing behavior. Both estimates were statistically insignificant. This supports the hypothesis that the price leadership practiced in retail gas stations in Oregon is not being done in a manner that suggests the exercise of market power. Rather, such behavior seems to be more a form of tacit collusion used to stabilize pricing in a competitive market where costs are volatile.

## CONCLUSION

This paper examines 25 retail gasoline markets in the Willamette Valley region of Oregon using a unique set of proprietary data and time series econometric techniques. Statistically significant evidence is found that firms in these markets are tacitly colluding in the sense they charge higher margins when prices are decreasing and lower margins when prices are increasing. This finding is consistent with previous studies involving tacit collusion and sticky pricing in gasoline markets.

Although evidence of price leadership is found in several markets, the results indicate that participation in this behavior does not significantly impact firm margins. However, other factors, such as whether the firm was a known low-price firm, located in an isolated area, whether the firm was selling unbranded or branded gasoline, and whether the firm was located on an interstate exit, are found to have a significant impact on margins.

Given the results found here for retail gasoline stations, there does not seem to be any pressing need for government intervention to protect consumers from monopoly pricing at the retail level. Indeed, it could be argued that the price leadership and tacit collusion observed in these markets

serve the purpose of sustaining market order and competitive results rather than causing the adverse impacts often associated with collusive behavior.

**Endnotes**

1. The fact that this is not a random sample of Oregon gasoline markets but only those selected as competitive means that we do not *a priori* expect to find evidence of non-competitive behavior. However, there is still the possibility of price leadership that is being exerted in these markets to coordinate price changes in the face of fluctuating costs**.**

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