

Does “anti-price gouging” legislation really help gasoline consumers?

Economics at the Pump

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WHEN GASOLINE PRICES CLIMB at the pump, as they inevitably do from time to time, it sparks contention about the industry, pitting drivers against retail station owners, station owners against oil companies, and oil companies against policymakers. The intensity of this backlash from spikes in gasoline prices is remarkable given that many commonly consumed products can change in price radically in a short period of time. One potential explanation for the gasoline reaction is that, unlike other products, drivers process a large volume of gasoline price information on a daily basis, even when they are not considering a purchase. On their way to work and on their way home, consumers see prices prominently posted on large marquees. Another reason why consumers may respond so strongly to changes in gasoline prices is that they know their demands are not responsive to price or, in economists' jargon, are inelastic. Relative to most consumer goods, the quantity of gasoline purchased does not vary appreciably when the price moves.

When consumers bemoan higher gasoline prices, station owners in turn respond that it is not their fault because they often are contractually bound to certain refiners and cannot switch to alternative, lower-priced suppliers. All of this public scrutiny grabs the attention of policymakers, but with so much of the debate driven by charged rhetoric, it is challenging for the policymakers to make prudent, informed decisions — particularly when the structure of the gasoline industry is so complex.

Three issues lie at the heart of this controversy: zone pricing,

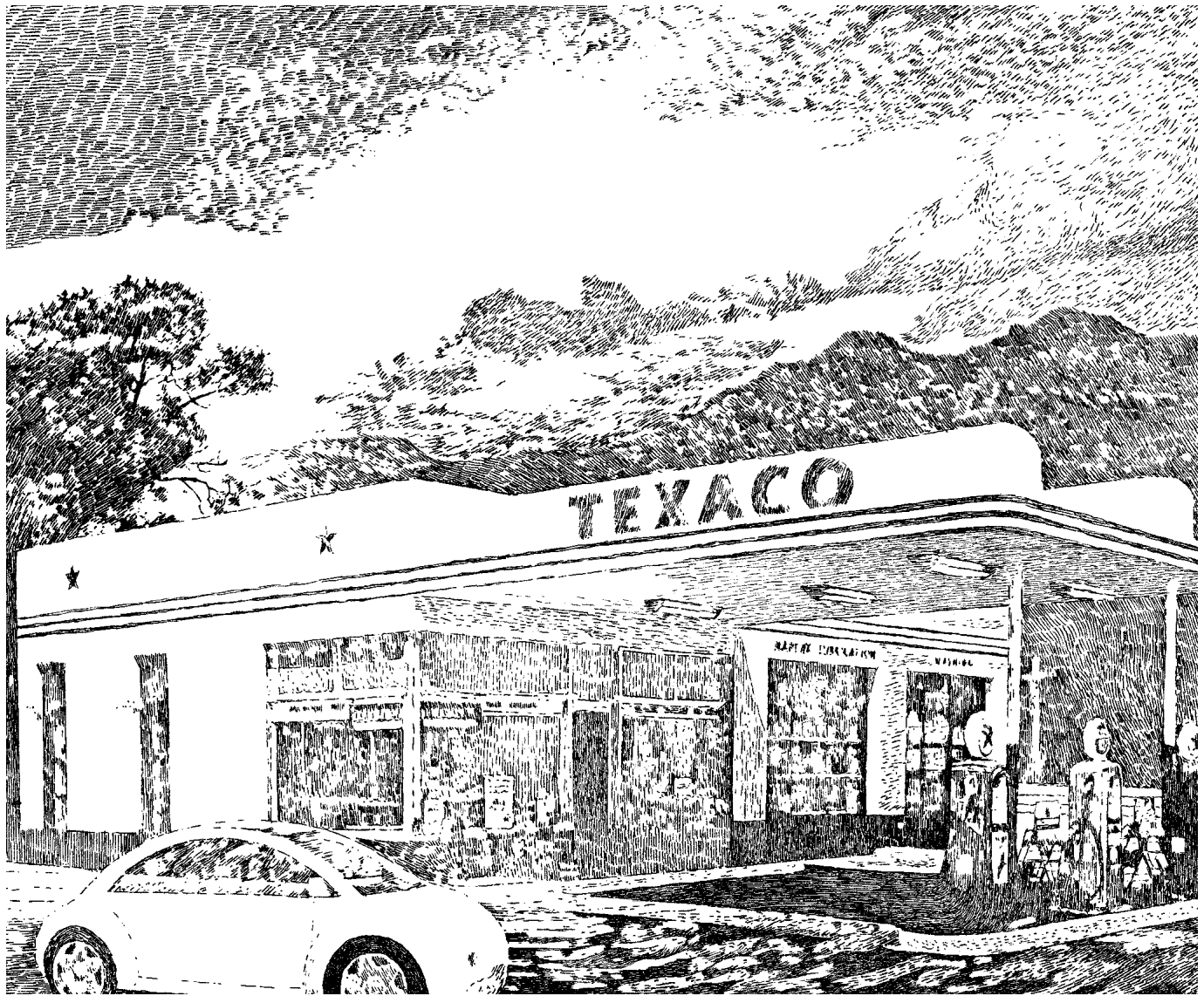
divorcement, and the phenomenon of “rockets and feathers.” Zone pricing — the practice of refiners setting different wholesale prices for retail gasoline stations that operate in different geographic areas or zones — has been a particularly contentious topic in the public policy debate for the past several years. Refiners contend that they employ zone pricing to, as a Chevron (now ChevronTexaco) spokesman told an Arizona state lawmaker, “price our wholesale gasoline to our dealers at prices that will allow them to be competitive.” Of course, what is left unsaid is that in areas with fewer rivals, the refiners' wholesale prices to the station owners are higher. From this observed correlation, state legislators and attorneys general have proposed legislation to ban zone pricing, claiming that, in the words of Connecticut Attorney General Richard Blumenthal, it “only benefits the oil industry, to the detriment of consumers.”

Another controversial issue that is debated in the gasoline industry is divorcement, the legal restriction that refiners and retailers cannot be vertically integrated, i.e., refiners cannot own and operate retail gasoline stations. Maryland was the first state to pass such legislation in 1974, with a handful of other states following suit. A 2000 California Task Force report from Attorney General Bill Lockyer asserts that “the key to enhancing competition at the retail level is to eliminate vertical integration by petroleum companies.” This, however, runs counter to basic economic theory and evidence from field studies. Essentially, divorcement imposes double markups and hence higher retail prices. That is, the refiner's price to the stations includes a markup above the refiner's cost and then the station places another markup on top of that. With vertical integration, the retail station only charges one markup to the final consumer.

Finally, there is the “rockets and feathers” phenomenon, the perception that retail gasoline prices rise faster than they fall in response to cost shocks. Several studies have empirically documented that gasoline prices do indeed rise more rapidly

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than they fall; however, most also suggest that the asymmetry is relatively short-lived. During such episodes, refiners and station owners are often accused of “price gouging,” exercising market power, or engaging in collusion. There are also less pejorative explanations. For example, researchers Jeremy Bulow, Jeffrey Fischer, Jay Creswell, and Christopher Taylor attributed the spring 2000 spike in the Midwest to supply interruptions rather than to collusion. That was undoubtedly the case in Phoenix when a pipeline ruptured in the summer of 2003, leaving many gasoline stations without any gasoline at all. As more and more localities place constraints on gasoline blends and restrict the supply chain, such episodes are likely to occur with increasing frequency.

TESTING As described in our recent working paper, we examined these issues using the tool of experimental economics. Experimental economics is a research method that permits observation of economic behavior under laboratory conditions. The laboratory tests use cash incentives to help us understand how markets perform and why they work the way they do. A laboratory study complements field work by implementing the chief stylized facts of naturally occurring markets

and examining that which cannot be measured with field data.

In the laboratory, we can measure the gains from trade for consumers, retailers, and refiners because we as the experimenter can identify consumer preferences and the costs to retailers and suppliers — information that is not directly observable or readily available in the naturally occurring economy. Holding constant the plethora of potentially confounding effects found in the natural economy, we compare markets in which zone pricing is permitted to arise endogenously to markets in which uniform wholesale pricing is mandated, i.e., zone pricing is prohibited. Such a comparison affords a direct examination of the welfare effects of the proposed legislation on consumers, station owners, and refiners before its implementation in the field. Similarly, we vary the degree of vertical integration to assess the impact of divorcement. Further, in the laboratory we can gather direct evidence about responsiveness of the retail prices to changes in world crude oil prices by imposing the same randomness of shocks in each replication of the market.

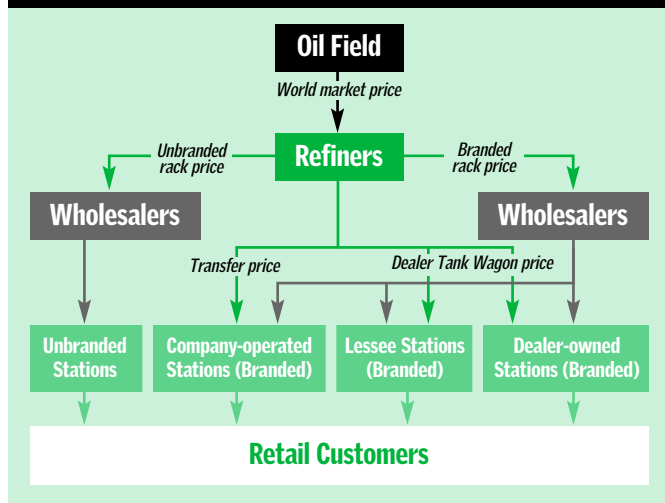
INDUSTRY STRUCTURE

Before discussing our experiment, we need to outline briefly the structure of the gasoline industry, which is also summa-

FIGURE 1

From Well Head to Gas Tank

The structure of the gasoline industry.



rized in Figure 1. The first step in the production and delivery of gasoline is the extraction of crude oil. Crude oil is then traded in a global market, dominated by OPEC, and transported via ocean tankers and pipelines to refineries. At the refinery, the oil is converted into gasoline and other products (e.g., diesel fuel, asphalt, jet fuel). The refiners then pipe the gasoline to various distribution terminals located near most major metropolitan areas.

In the pipeline, gasoline is a pure commodity in that the supplier is indistinguishable. In fact, pipelines carry gasoline from multiple suppliers. At the terminus of the pipe, gasoline is stored in large holding tanks by the various wholesalers operating in the area. At that point, the major oil companies differentiate their gasoline with their brand-specific additives. Unbranded gasoline has no branded additives. The price of gasoline at the holding facilities is referred to as the “rack price.” The gasoline is then shipped by tanker truck to individual retail locations.

At the retail level, a branded station must sell its refiner’s specified brand of gasoline. Some branded stations are company operated, meaning that the refiner owns the retail outlet and sets retail prices. Alternatively, a branded station can be either a lessee-dealer or a dealer-owned station; in those cases, the retail outlet sets the retail price but is still obligated to buy the refiner’s brand of gas.

The price of gasoline delivered to a station is referred to as a Dealer Tank Wagon (DTW) price. In practice, refiners can engage in zone pricing by setting the DTW price to reflect market conditions in very specific geographic locations, possibly as small as a single station.

Under those types of arrangements, the stations can either be supplied directly by the refiner or can purchase gas from a branded “jobber” — an intermediary that delivers gas from the rack to the retail location. Like refiners, jobbers can also set station-specific prices. A fourth category of retailer is the independent station. Independent stations typically sell unbranded gasoline and are free to set their own retail prices. They acquire gas directly from the terminal or via a jobber. While some independent stations are dealer-supplied, most are supplied by jobbers.

EXPERIMENT DESIGN

Our experiment focused exclusively on the direct relationship between the refiner and branded dealers. We specified a laboratory geography that contained two retail areas, corner and center, in a 7 x 7 street-avenue city grid. This geography is depicted in Figure 2. Each oval represents a retail station, and the oval’s shade distinguishes a refiner’s particular brand. The center area is served by four retail stations, whereas there is a single station in each of the four corners of the grid. Those two areas were specified to address the claim of refiners that they use zone pricing to be competitive with their local rivals.

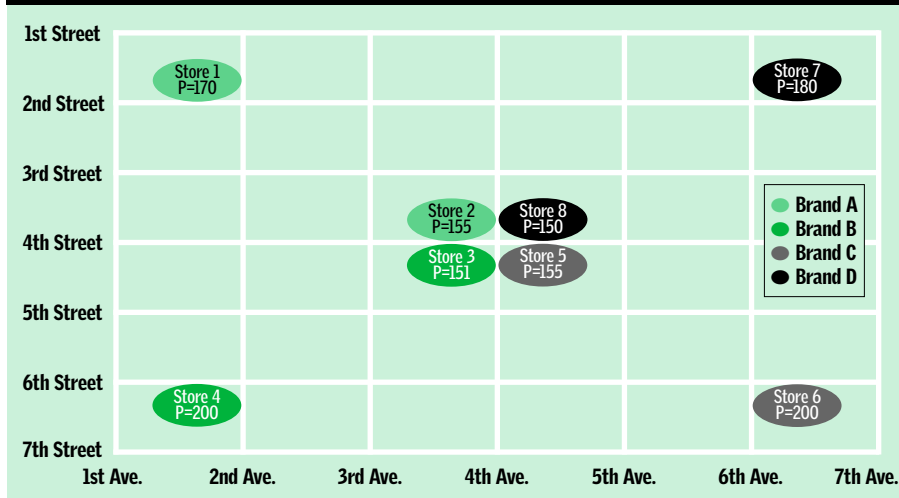
Our basic laboratory gasoline markets consisted of eight subjects: four refiners who each produce branded gasoline and four retailers who each operate a station at two different locations. For example, Refiner A sold his product to a retailer who operated stations at the intersections of 2nd Street and 2nd Avenue and the northwest corner of 4th Street and 4th Avenue.

Each retailer sets station-specific retail prices that could be adjusted at any time during the experiment. Retailers and refiners could observe all current retail prices including those set by rival outlets. However, the current DTW prices were known only by the refiner setting the DTW price and the associated retailer. At the beginning of a session, each refiner set initial DTW prices and station owners purchased an initial invento-

FIGURE 2

Experimental Territory

Locations of retail stations in the experimental model.



ry of 10 units at each station. Refiners could adjust DTW prices at any time. During the course of the experiment, when a retail location stocked out, the retailer completely replenished its inventory of 10 units at the current DTW price.

Every period, a new retail customer entered the market and demanded a single unit of gasoline (a standardized tank). The most that a buyer was willing to pay for a tank of gasoline was 240 experimental dollars. However, for each brand, there was a 20 percent chance that the buyer preferred it to the other three brands and would pay up to 25 more experimental dollars to purchase that brand of gasoline. The remaining 20 percent of buyers did not value any brand-specific additives and hence would pay, at most, 240 experimental dollars. So, for example, if a buyer preferring Brand-A gasoline purchased from a Brand-A station, the most the buyer would pay was 265, but if that same buyer purchased from any other station, the most he would pay was 240.

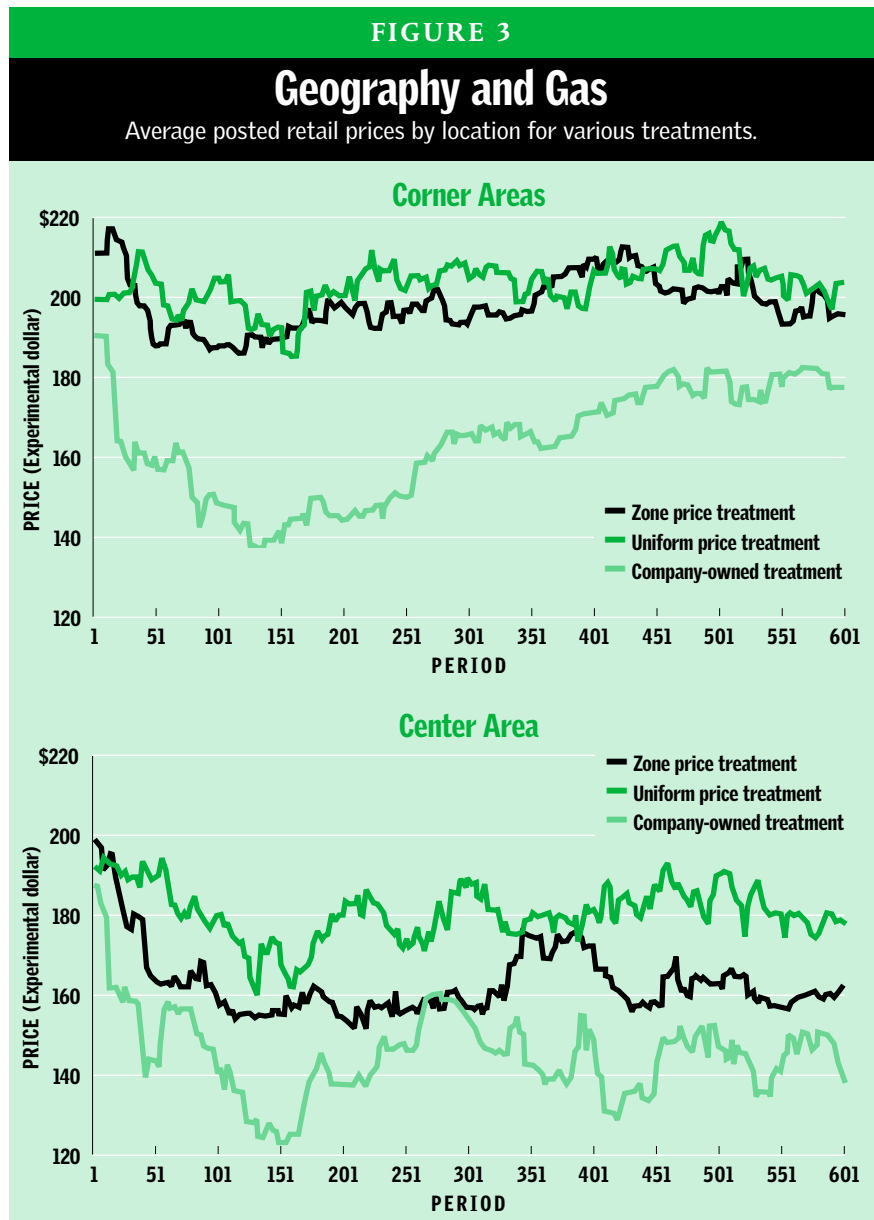
Because we were interested in refiner and station owner behavior, the retail buyers were computer robots that were randomly distributed across the city grid. To purchase from a station, the buyer had to travel to the intersection where the station was located. Each buyer incurred a cost (time, nuisance, etc.) for traveling, which reduced each driver's maximum willingness as the buyer traveled farther away. The parameters were chosen such that no consumer was willing to travel farther than eight blocks to purchase gasoline.

Each buyer had complete information about current retail prices and purchased from the station that yielded the greatest difference between its value net of travel cost and price. A buyer would not purchase gasoline if the price plus travel cost exceeded the value of the gasoline at all retail locations. Every 1.7 seconds when a robot buyer entered the market, all refiners and station owners could observe where the buyer originated and the station at which the buyer purchased the unit. Each session lasted 1,200 periods.

In addition to the DTW price, each retailer also incurred a station operation cost of 10 experimental dollars per unit sold. Hence, a retailer's profit per unit sold equaled the retail price minus the DTW price and the station cost. A refiner's profit per unit sold to a station equaled the DTW price minus the refiner's cost. For the first 600 periods, the cost for each refiner was constant at 100 experimental dollars. In the remaining 600 periods, the refiners' costs followed a random walk to simulate changes in the price of crude oil on the world market. This portion of the experiment was used

to test whether retail prices respond differently to cost increases than to cost decreases. Each refiner experienced the same costs, and each session used the same set of randomly drawn refiner cost realizations.

We considered three experimental treatments. In the Zone Pricing (or baseline) treatment, refiners could set a different DTW for each station. In this treatment, each retailer observed two location-specific wholesale prices but could not shift inventory between locations. (Typically, gasoline stations are contractually prohibited from shifting inventory.) Our Uniform Pricing treatment reflected the setting after the adoption of legislation banning zone pricing. In terms of the design, the Uniform Pricing treatment imposed the restriction that the DTW prices had to be the same for both stations selling the same brand. It is important to note that uniform pricing at the wholesale level does not imply uniform retail prices. We measured the effects of divorcement by comparing the baseline treatment with a Company-owned treatment. In the Company-owned treatment, all of the retail stations



were vertically integrated, which made the DTW price an intra-firm transfer price and not a strategic decision. Integration was operationalized by eliminating the role of the refiner in the Company-owned treatment and automatically setting each station's cost per unit equal to the refiner's cost in the other treatments (plus the station operation cost of 10 experimental dollars).

We conducted a total of 12 laboratory sessions (four in each treatment) using George Mason University undergraduates. Each session lasted, at most, 90 minutes. Given the parameters, our undergraduates could have earned over \$100 per person at the joint profit-maximizing outcome, but the observed level of competition resulted in an average payoff of \$13.25 per subject (plus \$5 for showing up on time).

RESULTS

Most broadly, we concluded that uniform DTW pricing and divorcement harm consumers. This is clearly displayed in Figure 3, which reports the average posted retail prices by location for the first 600 periods. Recall that in those periods the refiner's cost is constant at 100 experimental dollars. In the center area, posted prices are noticeably higher in the Uniform Pricing treatment than in the Zone Pricing treatment. However, there is no impact of mandating uniform DTW prices in the corner areas. Posted prices for both corner and center areas are higher with divorced stations (Zone Pricing treatment) than with vertically integrated stations (Company-owned treatment).

We make the distinction between posted prices (the prices publicly advertised on the large signs) and transaction prices (the prices actually privately paid by consumers who decided to make purchase at a specific station). Data on the former are available in the field, whereas the latter are proprietary. Our specific findings for transaction prices can be summarized as follows:

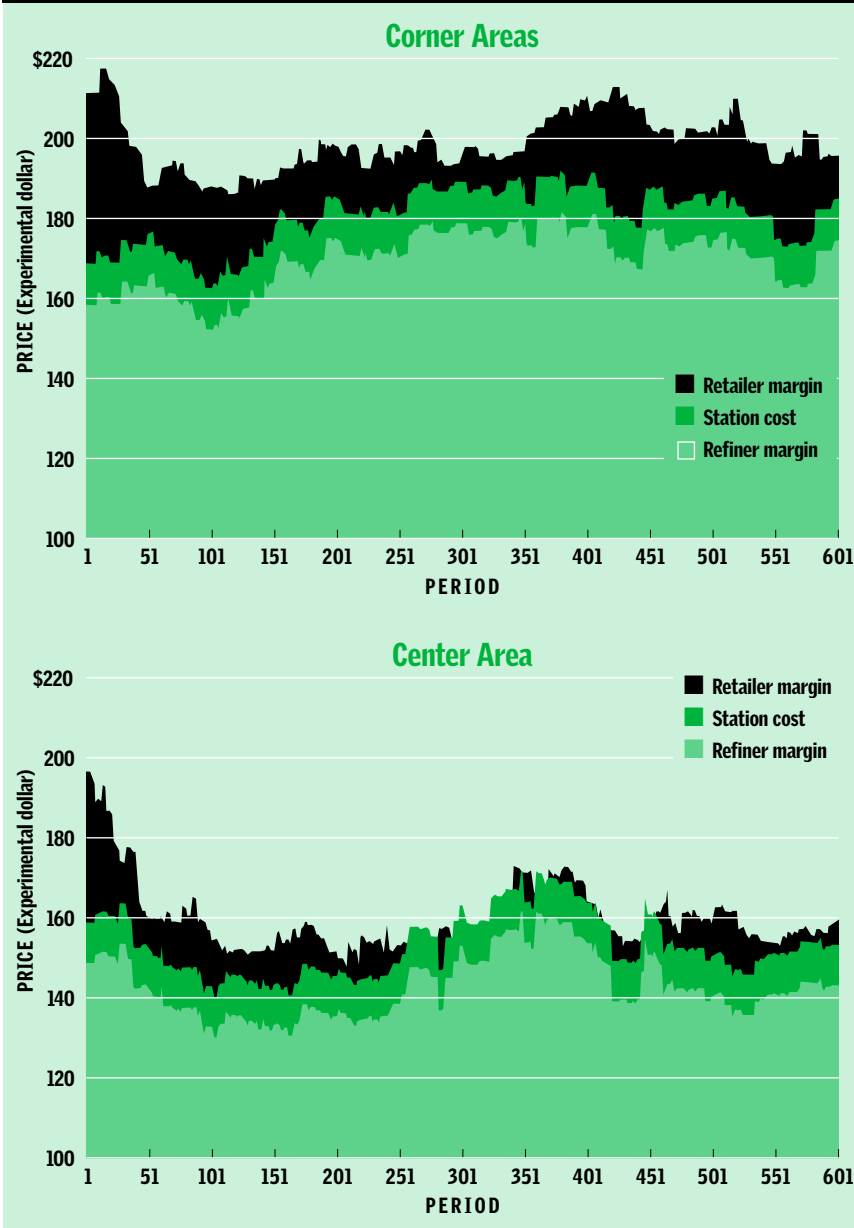
- When zone pricing is banned, consumers in the clustered, center area pay 10.9 percent higher prices than when zone pricing is permitted.
- Consumers in isolated, corner areas pay the same prices with zone pricing as they do when it is prohibited.
- Consumers in the center area and corner areas respectively pay 13.2 percent and 16.5 percent lower prices with company-owned stations than with divorcement. This result affirms those found in previous field studies, lending credence to our other results.

ZONE VS. UNIFORM PRICING Why does uniform wholesale pricing not help the consumers in corner areas but instead harm those in the center area? For one thing, high station prices in the isolated areas are not the result of high refiner DTW prices with zone pricing, but rather the cause. Figure 4 plots the average retailer and refiner profit margins by location. Notice that in early periods when subjects are learning about the competitive pressures in the center and the lack thereof in the corners, retail station margins shrink as DTW prices trend up at corner stations. Over the first 100 periods, corner retail prices are very high. As the refiners recognize that the

FIGURE 4

Dividing the Gains

Profit margins in the zone pricing treatment.



isolated stations are able to charge higher prices and remain competitive, the refiners use zone pricing to capture some of those rents from the corner stations. The center area stands in rather marked contrast. As station prices tumble because of the retail competition, DTW prices also fall as the refiners use zone pricing to be more competitive. Only after station prices stabilized around period 250 did DTW prices start to rise as refiners attempted to capture the retailer profits in the center area.

Station prices in the corner areas were higher because consumers in those areas prefer not to travel long distances to purchase lower-priced gasoline in a more competitive area, and because there is only one local station. The refiners then used zone pricing to capture the station profits at the isolated stations. In the center area with strong station competition, the refiners priced very competitively and, as a result, consumers paid lower prices. The upshot is that refiners captured more profits from the stations with zone pricing, but not to the “detriment of consumers.”

There is a second reason why uniform wholesale pricing did not help consumers in the isolated areas and also harmed consumers in the center area. Uniform DTW pricing ties refiner pricing decisions in isolated corner areas to those in the competitive center area. When refiners were forced to sell at a uniform price, they preferred to set a single price that captured some of the profits of the stations in the corner areas. Figure 5 illustrates this with an example from one market session. The Brand-A refiner was very competitive through period 172, but then raised his DTW price. That, in turn, forced the affiliated station to do the same. That halted the steady decline in the other stations’ center prices. Notice that other refiners did not raise their DTW prices. This illustrates that it only takes one refiner to not just blunt, but end competition at the retail level. In other sessions, the actions of the first refiner eventually induced like responses by the other refiners.

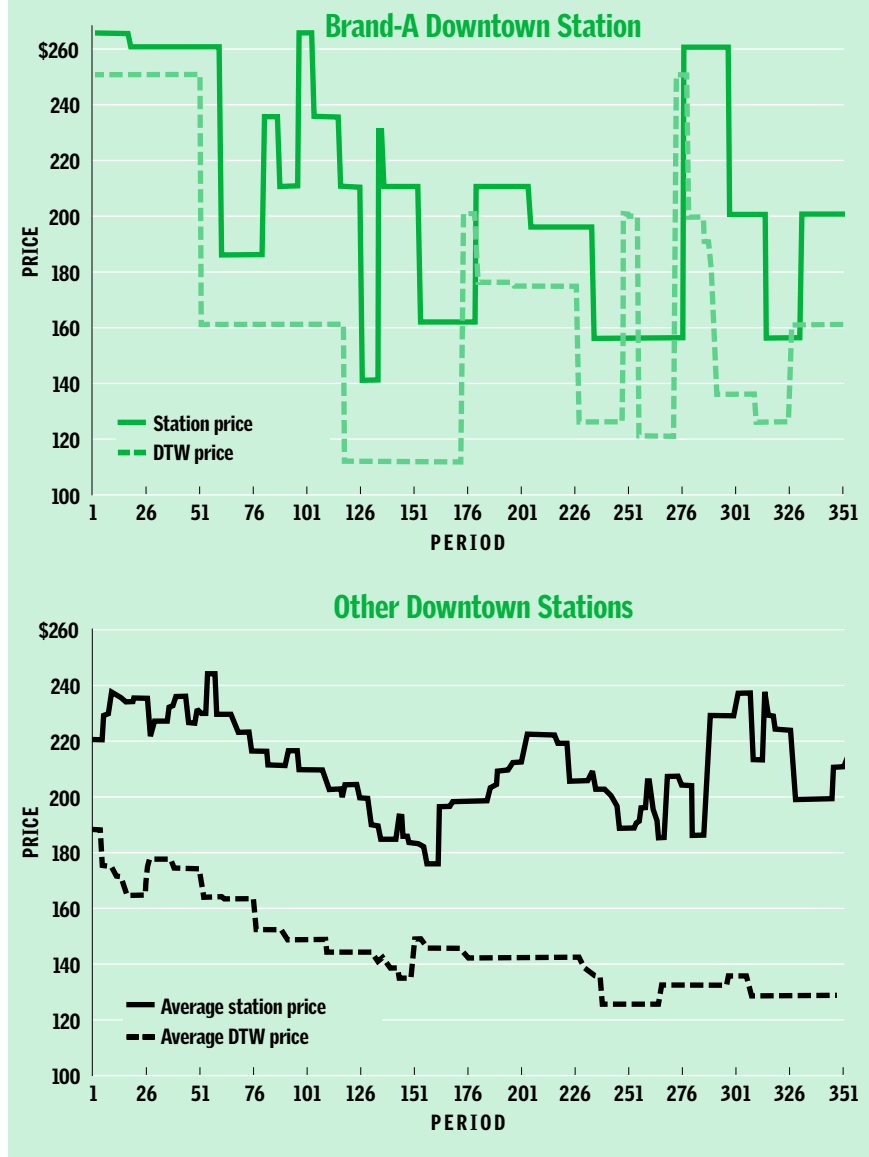
Consumers in the corner areas who paid high retail prices in the Zone Pricing treatment did not see lower prices in the Uniform Pricing treatment because nothing had fundamentally changed at the retail level. In fact, consumers had even less of an incentive to travel to the center area because those prices were higher with uniform pricing. The end result was that uniform pricing stymied competition in the center area and yielded no benefit to consumers in corner areas.

Our observations directly counter the claims that zone pricing harms consumers and that uniform DTW pricing would

FIGURE 5

Quashing Competition Downtown

Examples of why station prices are high in center with uniform DTW prices.



benefit them. Figure 6 reports the distribution of surplus by the three treatments. Consumer surplus is the difference between what consumers were willing to pay and what they actually have to pay. Refiner and station-owner surplus is the profit from selling at prices greater than their costs. In our experiments, banning zone pricing nearly tripled average station owners’ profits. Most of those gains came at the expense of consumers in terms of higher pump prices. Consumers were distinctly best off with vertically integrated firms. As noted previously, this benefit is due to the elimination of the double markup present with divorcement.

ROCKETS AND FEATHERS Finally, we examined the adjustment of retail prices to cost shocks in the last 600 periods of a market session. Figure 7 indicates how much of a cost shock was passed through to the consumers in the retail prices with-

in 10 periods. Station prices in the center area adjusted rather quickly with zone pricing, but still rose faster than they fell (a “rockets and feathers” finding). Some 89 percent of a cost increase was reflected in the price just 10 periods later, but only 38 percent of a cost decrease was passed through in the same amount of time. Recall that 10 periods in the experiment is just 17 seconds of real time. Within 30 periods, most of the price adjustment was complete for both cost increases and decreases when zone pricing was permissible.

Station prices in the corner areas adjusted more slowly than in the center area, but the asymmetry was much small-

CONCLUSION

The results of our experiment suggest that legislation often proposed to reign in “price gouging” will fail to lower retail prices. Policies like divorcement and uniform pricing actually harm consumers rather than help them. The reason is simple: The well-meaning interventions are designed to manipulate market allocations, but they backfire because they cannot account for the complex incentives in an intricate industry. Changing the rules changes the behavior of refiners and station owners, which is why the legislation does not have its intended effect on market outcomes.

The interventions are designed to manipulate market allocations, but they backfire because they cannot account for the incentives of an intricate industry.

er (and statistically insignificant). With company-owned stations, prices rose as fast as they fell in response to changes in station costs, but this response was much slower than with vertical separation.

Perhaps the most stunning result was that banning zone pricing broke down the long-run relationship that captures how station prices adjust to changes in costs. That was true for both center and corner station prices in the Uniform Pricing treatment. The negative implication is that when a refiner’s costs fall, station prices do not necessarily follow in the long-run. That also means that station prices are insulated from increases in costs. However, we have already observed that mandating uniform wholesale prices generates high station prices in the competitive center area.

In the case of zone pricing, two observations of the current gasoline market motivate the policy recommendation of mandating uniform wholesale prices: Some refiners charge higher DTW prices to some stations than to others, and the stations that are charged higher DTW prices charge higher retail prices to consumers. To achieve the goal of lower retail prices, the policy prescription of uniform pricing assumes that lower DTW prices cause lower retail prices, and that uniform DTW prices will be at the level of the lowest current zone prices. The first assumption is only partly true, while the second is wrong.

Lower DTW prices do not necessarily lower retail prices because, as with all markets, two types of factors determine prices — supply and demand. DTW prices are just one variable

FIGURE 6

Who Benefits From Price Regulation?

Distribution of surplus (profits).

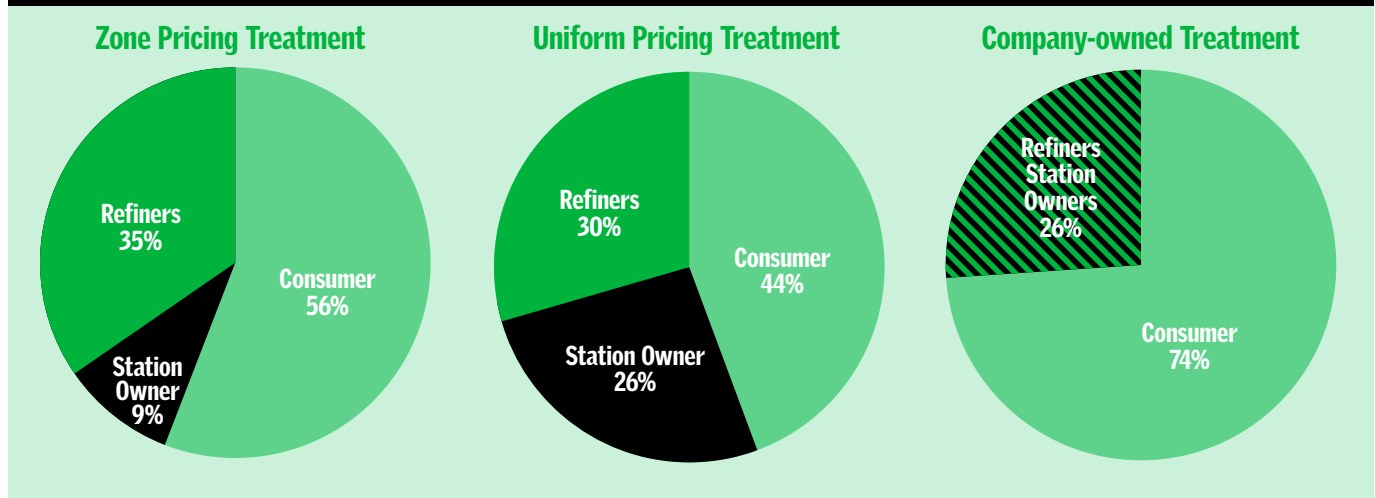
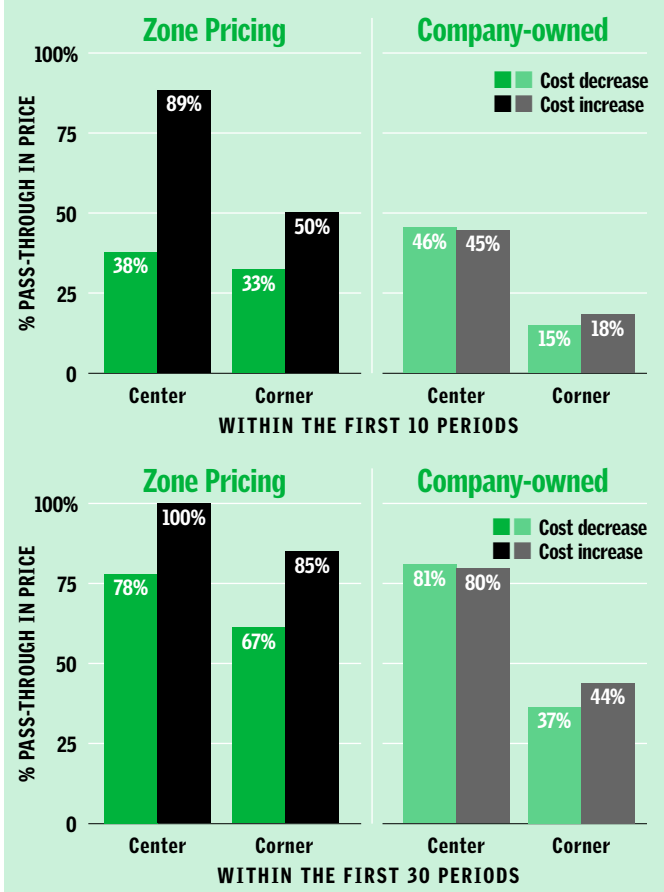


FIGURE 7

What Goes Up...

Pass-through rates for cost changes.



that affects retail prices in balancing supply and demand. On the demand side, prices may be high in some areas because consumers are unwilling to travel elsewhere to buy their gasoline. By remaining local, the consumers are not inducing the stations to compete for their purchases, and if there is little local competition, the retail prices are going to be higher. Hence, because the demand for gasoline is inelastic, lowering the DTW prices for such stations will have little effect in overcoming high retail prices.

The assumption that uniform DTW prices will be at the level of lowest zone prices is incorrect because it ignores the pricing incentives created by tying highly profitable retail stations to less profitable stations. With zone pricing, some stations are more profitable for the refiners than others. Refiners who are compelled to offer the same price to all stations will respond by offering a blend, at best, of the prices offered with zone pricing. This means that stations paying relatively low DTW prices with zone pricing will pay higher DTW prices with uniform pricing, and the higher costs result in higher prices for consumers.

In sum, the impact that DTW prices have on retail prices is asymmetric with respect to the level of retail competition. In competitive areas, the DTW price is a constraining limit on how low prices can go, but in less competitive areas the con-

straint is consumer demand. Hence, mandated uniform wholesale pricing affects the former by raising retail prices, but does not have the intended effect of lowering prices in the latter.

The incentives from mandating divorcement are quite simple. With divorcement, refiners first mark up the price to the stations, and then station owners place an additional markup on the price to the consumers. Refiners that are vertically integrated into the retail market only place one markup on the product. Hence, mandating divorcement increases the prices consumers pay.

Lastly, consistent with field observations, prices respond more quickly to positive cost shocks than to negative shocks in competitive areas under zone pricing. This study demonstrates that “rockets and feathers” price adjustment is not necessarily indicative of collusion or even market power, as is sometimes suggested. Further, the asymmetries are short-lived. Vertical integration, while eliminating the asymmetry, increases the lag time between a cost shock and a change in retail prices. On the other hand, an unintended consequence of uniform pricing is the destruction of the long-term process by which prices adjust to cost shocks. R

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