

Retail Gasoline Markets

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Economists have long been interested in the functioning of retail gasoline markets and for numerous reasons. From a purely industrial organization perspective, it is an interesting market to study because it allows us to observe competitive interdependence (or some would argue a lack thereof in some cases) and optimal best response behavior by competitive and oligopolistic firms in almost real time. Gasoline is more homogenous than most consumer products, prices are highly visible, and price information spreads through a marketplace quickly, allowing firms to observe and react quickly to other competing firms, and allowing economists to study this competitive interaction up close. From a social welfare perspective, gasoline markets are important because gasoline consumers tend to be highly inelastic and at the mercy of unexpected price increases in the short run. Since gasoline purchases constitute a significant monthly expense for many consumers, the welfare effects of gasoline price changes can be large, making it important to ensure a competitive market upstream and down. From a taxation perspective, and almost paradoxically, governments depend on that low elasticity of gasoline to charge relatively high gasoline taxes and secure a stream of revenue knowing that drivers will keep buying. That stream has recently been disrupted by higher mileage and electric vehicles, shrinking gasoline tax revenues, and making them even more regressive than they already were. From a political perspective, the retail gasoline industry is an important election-year villain for some politicians, who exploit consumers' lack of understanding of the frequent gasoline price movements to stir suspicion, promise a crackdown, and score political points. From an antitrust perspective, it is of course important to ensure that gasoline retailers in any given area are not colluding (as has happened in rare cases), but at the same time, to bring a more balanced reasoning to situations where collusion accusations are abound but built on misinformation.

There are many prominent themes in the gasoline literature. One interesting and well-studied aspect of retail gasoline pricing is the so-called “rockets and feathers” phenomenon – where prices tend to rise more quickly after a cost increase than they fall after a cost decrease. Many papers have established this phenomenon exists in different areas at different times (Bacon (1991), Borenstein, Cameron, and Gilbert (1997), Godby et al. (2000), Galeotti et al. (2003), Chesnes (2012), and Cook and Fosten (2019) to name a few), though it is not universal.

A common presumption is that rockets and feathers imposes a cost on consumers, but this is not necessarily the case. Balmaceda and Soruco (2008) calculate the consumer cost from a pair of 1 cent price changes – one increase and one decrease – to be 2.3 cents per gallon, assuming that retailers could still feasibly make a profit if prices fell as fast as they rose. There is no reason why this must be, though. Lewis (2011) and Lewis and Marvel (2011) present models in which consumers search more intensely when prices are rising and less intensely when they are falling, which naturally leads to different rates of increase and decrease, similar to a standard price

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discrimination model with two groups of consumers – a more elastic group and a less elastic group. The twist is that the two groups are actually the same people, just at different times. This implies that rockets and feathers is likely just efficient competitive dynamic pricing - retailers make little to nothing on the way up when consumers are elastic, and earn enough to cover the cost of doing business on the way down when consumers are less elastic. Related search models that produce rockets and feathers effects include Yang and Ye (2008), Tappata (2009), and Cabral and Fishman (2012).

Another fascinating gasoline price phenomenon in many markets in the U.S., Canada, Australia, Norway, Germany and elsewhere is that of Edgeworth Cycles (Noel (2002), Eckert (2002), Noel (2007a)). In an Edgeworth Cycle, retailers undercut one another's prices by small amounts each day (or every hour in some cases) until gasoline prices fall close to marginal costs. At that point, one retailer raises its price by a large amount, often 10 or 20% and often at a similar time of day or similar day of the week (Noel (2018a)). Other retailers follow in quick succession, and almost immediately undercutting resumes again. Cycles are most often weekly in nature in the U.S. (Lewis (2009), Doyle, Muehlegger, and Samphantharak (2010), Lewis (2012), Lewis and Noel (2011), Zimmerman, Yun, and Taylor (2013)), weekly in Norway (Foros and Steen (2013)), daily or weekly in Canada (Eckert and West (2004), Atkinson, Eckert, and West (2014), and Noel (2018b)), as much as three-times-a-day in Germany (Siekman (2017), Haucap et al. (2017)), and between one and three weeks in Australia (Wang (2009b), Noel (2018), Byrne and de Roos (2019)). The time series of prices on a graph appear as a distinctive sawtooth pattern, with sharp increases and gradual decreases in a highly parallel fashion, even absent changes in underlying costs.

The basic theory underlying Edgeworth Cycles is from Maskin and Tirole (1988), and they are the natural consequence of firms selling almost-homogenous goods in a dynamic game with Markov strategies. Eckert (2003) extends the model to asymmetric firms and Noel (2008) extends the model along to cases of stochastic marginal costs, capacity constraints, product differentiation, and other kinds of asymmetric equilibria. The retail gasoline price cycles observed in many countries closely match the predictions of these models (Eckert (2003), Noel (2007a), Noel (2007b), and Atkinson (2009) and Atkinson, Eckert, and West (2009), Wang (2009b), Bloch and Wills-Johnson (2010)), though a few papers hold reservations on technical points (de Roos and Katayama (2013), Foros and Steen (2013), and de Haas (2019)). It is a different mechanism than that which produces rockets and feathers (as cycles do not depend on cost shocks), but Edgeworth Cycles can still create a perceived rockets and feathers effect (Eckert (2002), Noel (2009)) when cost changes shock the timing of the cycles. The two distinct effects are often commingled (Asane-Otoo and Dannermann (2022)).

The interesting policy question here is whether the presence of cycles is good or bad for prices and welfare. In cross-sectional analyses, Noel (2002) and Doyle et al. (2010) find lower prices and margins in cities where there are cycles. In natural experiments, Zimmerman et al. (2013) Noel (2015) find that prices actually fall when cycles start up or rise when cycles shut off, all providing evidence of a competitive cycle. Noel (2012) and Noel and Chu (2015) show that

consumers do even better than average price comparisons would suggest because consumers can and do time their purchases to periods of low prices near the cycle troughs. Lewis (2009) and Lewis and Noel (2011) show an additional benefit - that the persistent undercutting within cycle enables markets with cycles to recover more quickly after negative supply shocks than markets without.

Putting aside any particular dynamic pricing patterns, other studies focus on various aspects of pricing. A common theme relates to the effects of station type and density. Barron, Umbeck and Taylor (2004) find lower prices with greater station density, Sen (2005) finds lower prices with more independent stations, and Cooper and Jones (2007) and Houde (2012) find that consumers with longer commutes have more choices and pay less.

Barron, Umbeck and Taylor (2004), Lewis (2008), and Chandra and Tappata (2011) all show that more densely located stations (acting as a proxy for lower search costs) leads to lower gasoline price dispersion, consistent with the many similar studies done for other industries. Noel (2018b) is a rare example of a study that looks at the search-price-dispersion causal relationship in the opposite direction – using a rare exogenous shock to price dispersion to show that higher gasoline price dispersion leads to greater consumer search. Noel and Qiang (2019, 2023) show that gasoline price signboards have highly significant effects on price dispersion.

Hughes, Knittel, and Sperling (2008) and Lin and Prince (2013) are a few of the studies that estimate aggregate gasoline price elasticities and show they are low - lower in the short run than the long run, and potentially getting lower in the short run. Station-level gasoline elasticities are more difficult to estimate, but Wang (2009a) and Barron, Umbeck, and Waddell (2008) are notable exceptions which show high short run elasticities in the range of -3 to -6.

Other papers look at the incidence of excise taxes into retail prices (Manuszak and Moul (2009), Doyle and Samphantharak (2008), Barron, Hunt Blanchard, and Umbeck (2004), Li, Linn and Muehlegger (2014), and Ahundjanov and Noel (2021), to name a few.) Results tend to be mixed, with some papers showing complete passthrough of taxes and others showing passthrough that is short of complete.

Other papers perform case studies of specific competitive issues within retail gasoline. In terms of potential collusive activity within specific markets, Clark and Houde (2013) examine the functioning of a cartel in Quebec, Canada, Wang (2008) studies an alleged cartel in a small Australian city, and Silveira et al. (2022) examines a gasoline cartel in Brazil.

Merger retrospectives are also common. Taylor and Hosken (2007) examine the Marathon-Ashland joint venture, Simpson and Taylor (2008) examine the Marathon-Ashland-Ultramar merger, Silvia and Taylor (2010) examine several refinery mergers in the northeast, and Hosken, Silvia, and Taylor (2011) examine several refinery mergers in California, and find each case no ill effects from these past mergers.

Other papers evaluate specific laws or policy changes on gasoline prices. Sales-below-cost (SBC) laws are essentially minimum margin laws, in which retail gasoline stations are prohibited from pricing either below cost, or below some positive minimum-margin price. Wisconsin, for example, requires at least a 6% margin over cost or 9.18% margin over posted

rack, whichever is greater (Noel (2016)). Anderson and Johnson (1999) and Brannon (2003) show that these laws tend to increase gasoline prices, while Skidmore, Peltier, and Alm (2005) and Carranza, Clark and Houde (2013) argue that these laws modestly lower prices in some areas instead.

Price gouging laws prohibit stations from charging “excessive” or “unreasonable” prices (or similarly vague language) during declared emergencies, though in reality they prohibit stations from charging prices that reflect what gasoline is actually worth at those times, leading to further supply issues (Noel (2016)). Following Hurricane’s Katrina and Rita, the FTC investigated instances of price gouging, as that term was defined by Congress, and noted that in all but one case the pricing was higher but consistent with local market conditions.

In a relic from days gone by, New Jersey and some counties in Oregon still prohibit self-serve at the pumps on purported safety grounds. Johnson and Romeo (2000) and Melo (2024) examine these bans and find them to only increase retail prices. Taking a longer term perspective, Basker, Foster, and Klimek (2015) find substantial cost savings when full serve was replaced by self-serve across the U.S.

As an example of another policy study, Noel and Roach (2016) quantify the debacle of the Australian ethanol rollout on gasoline prices in Australia, where consumers ended up flocking to a very expensive ethanol-free alternative, increasing their gasoline costs and undoing the expected benefit of the policy.

The retail gasoline industry has been marked with significant market structure change over the past twenty years. In the U.S. in particular, stations have become much larger and much fewer in number. Whereas “branded” traditionally meant a station that carried a refiner’s brand name and “unbranded” was one that did not, in the U.S. today the most popular gasoline brands are not refiner brands at all. Many of these non-refiner brands are very large, and many are supermarket and hypermarket chains. Zimmerman (2012) shows that supermarket and hypermarket entry into gasoline has led to lower prices and margins in the U.S. Similarly, Wang (2010) argues that supermarket-refiner relationships lead to lower gasoline prices in Australia. The transformation of the retail gasoline industry continues.

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