How do Consumers Respond to Gasoline Price Cycles?

David P. Byrne
Department of Economics
University of Melbourne

Gordon W. Leslie
Department of Economics,
Stanford University

Roger Ware
Department of Economics,
Queen's University

In many gasoline markets, retail prices exhibit cycles that involve large, weekly or bi-weekly price jumps, and price undercutting between jumps. The "sawtooth pattern" in retail prices that emerges has attracted the attention of many academics and policymakers seeking to determine the supply-side pricing behavior that generates these patterns.

In contrast to this bulk of supply-side research, there have been virtually no demand-side studies on how gasoline consumers respond to gasoline price cycles. More generally, there is little evidence on whether or how consumers respond to daily fluctuations in gasoline prices. This largely reflects the fact that while daily retail price data is available to researchers, daily data on volumes of fuel sold at the station- or market-level are not. The lack of demand-side research is unfortunate given its relevance for policymakers concerned with consumer welfare and demand-side sources of market power in gasoline markets.

This paper empirically studies how consumers respond to gasoline price cycles. Our analysis uses a new dataset of daily, station-level prices from Ontario, Canada from 2007-2008. The owners of GasBuddy Organization Inc. (GasBuddy), who run the most popular online gasoline price reporting websites in North America, provided us these data. Users of these websites upload stations' prices from their local markets via the internet. The dataset consists of every station-level price report submitted to GasBuddy's websites over the sample period.

The first part of the paper provides new evidence on firms' pricing behavior, and its impact on daily retail price levels and price dispersion in cycling markets. We find stations run by major vertically-integrated brands take on a leadership role in coordinating price jumps. In contrast, we find independent (non-branded) stations do not engage in price leadership. We further find branded retailers not only influence the level of prices when coordinating price jumps, but also price dispersion. In particular, price dispersion across stations within a market collapses after price jumps, and gradually rises during the undercutting phase of the cycle.

In the second part of the paper, we study how consumers respond to these daily fluctuations in price levels and dispersion. Like previous researchers, we do not have access to data on volumes of fuel sold. Instead, we exploit the fact that our data contain every price report submitted to GasBuddy's over the sample period. This allows us to construct a daily, market-specific measure of demand responsiveness in terms of the number of price reports these websites receive from GasBuddy price spotters for a given date and market. This measure essentially assumes consumers are more actively shopping on days when GasBuddy's websites receive more price reports for a given market.

We find price reporting intensity exhibits cycles that move with retail price cycles. In particular, reporting intensity experiences a stark rise just before and during retail price jumps, a period where both price levels and dispersion increases dramatically.

We try to disentangle stockpiling and search-based explanations for these patterns by investigating heterogeneous relationships between reporting intensity, price dispersion, and price changes on days around price jumps. We find a strong positive relationship between reporting intensity and price on days just prior to and during price jumps; however, no such relationship exists on days immediately after a price jump. This can be explained by a model

of stockpiling and demand accumulation: if GasBuddy's price spotters time their purchases and fill their cars' fuel tanks at the bottom of the cycle, then one day after a price jump they will not be actively shopping for fuel, and hence not monitoring price dispersion to make another well-timed fuel purchase. In contrast, a search-based explanation of price reporting alone has a difficult time explaining why reporting intensity and price dispersion has a strong positive relationship on some days of the cycle but not others.

Our analysis also reveals heterogeneous relationships between price reporting and lagged retail price changes that further point to dynamic demand incentives. On most days of the cycle, price reporting is largely unrelated to lagged positive and negative retail price changes. There are, however, two key exceptions: on days when price jumps are initiated, reporting intensity rises when lagged retail prices start to rise, or when lagged price cuts become increasingly small. We document that both small price increases and smaller price cuts during the undercutting phase of the cycle tend to signal a market-wide price jump is about to occur. As such, we see these findings as being consistent with forward-looking consumers who use this information to anticipate price jumps, and stockpile fuel at the bottom of the cycle.

As a final test for distinguishing between stockpiling and search behavior, we examine price reporting in rural markets. These markets are well-suited for testing stockpiling behvaior for two reasons. First, these markets exhibit slow price cycles, with periods of price rigidity following price jumps. Thus, consumers in these markets have strong incentives to time their purchases and stockpile fuel prior to price jumps to avoid paying higher prices in the future. Second, the majority of rural markets have five or fewer stations that tend to be in close proximity to each other. As such, there is little scope for search-based incentives to drive price reporting. Therefore, if stockpiling plays no role in price reporting,

we should not find the jump in reporting intensity around price jumps in rural markets that we found in larger markets with faster cycles. Our findings show this is not the case: price reporting exhibits a large increase when price jumps are initiated in rural markets. The evidence further supports the hypothesis that dynamic demand and stockpiling incentives drive price reporting.

Our results have implications for price transparency policies that provide consumers with web-based information on daily, market-level retail price fluctuations; such policies have recently been considered and enacted by anti-trust authorities and policy makers in Australia and Canada. By providing some of the first "hard" empirical evidence of stockpiling behavior, this paper emphasizes the importance of policies that help consumers make well-timed retail fuel purchases. In this way, these policies can yield consumer welfare gains in gasoline markets, particularly in those with price cycles.