



Price leadership and coordination in retail gasoline markets with price cycles [☆]

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ABSTRACT

This study examines the coordination mechanism used by gasoline stations in the midwestern United States where prices exhibit highly cyclical fluctuations known as Edgeworth cycles. Stations in these markets repeatedly coordinate large marketwide price increases following periods of aggressive price undercutting. By studying these periodic price jumps both over time and across cities, I find that a particular retail chain in each city acts as a price leader initiating each price restoration. The leader signals the new price level to competitors by simultaneously jumping prices at all its stations to a single price. Competitors follow quickly with a large majority of stations jumping to the exact same price within a 24 hour period. The characteristics of the leading firms and the nature of observed price coordination suggest that successful price jumps may be facilitated by the existence of a retailer controlling the prices of a significant number of stations in a city. Identifying the important role of these firms in the market contributes to a broader understanding of price leadership and coordination and highlights another potential reason why price cycles exist in some in retail gasoline markets and not others.

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1. Introduction

Economists frequently classify outcomes in many imperfectly competitive markets as being tacitly collusive, suggesting that the interaction of competing firms over time enables them to coordinate prices above statically competitive levels. While countless theoretical models illustrate the existence of collusive price equilibria, almost every model suffers from the fact that multiple, and in some cases infinite, collusive equilibria exist. This often leaves us with very little guidance in understanding how firms in these markets determine the prices at which they will coordinate. Empirical studies of these imperfectly competitive markets frequently identify firms charging prices above statically competitive levels, but are usually unable to provide direct evidence of the mechanism the firms use to reach these price levels.

In this study I examine how price leadership is used to facilitate price coordination in retail gasoline markets. In certain parts of the United States and in a number of other countries, competition between gasoline stations results in highly cyclical price fluctuations. The cycles consist of a period of aggressive price undercutting

followed by a very rapid and universal *relenting* of prices back to more profitable levels. These price cycles tend to follow fairly systematic and predictable patterns and are not explained by changes in wholesale costs. A number of recent empirical studies have documented such cyclical gasoline pricing patterns in the midwestern U.S. (Lewis (2009); Doyle et al. (2010)), Canada (Noel (2007a, 2007b); Eckert (2003); Eckert and West (2004)), and Australia (Wang (2008)). This setting is ideal for an empirical examination of price coordination since relatively detailed station level price data are available and we are able to repeatedly observe stations implementing large market-wide retail price jumps.

Existing research has associated gasoline price cycles with the theoretical concept of an Edgeworth price cycle equilibrium introduced by Maskin and Tirole (1988). Maskin and Tirole model price competition between two homogeneous sellers in an alternating move game with a discrete price grid. An equilibrium arises in which firms take turns undercutting each other's price to steal demand. Eventually margins are so low that one firm jumps the price up to a more profitable level and the undercutting begins again. This equilibrium closely resembles the unusual cyclical price movements observed in certain retail gasoline markets. In a typical city exhibiting cycles in the midwestern U.S., retail prices often fall at an average of a cent per day or more for a week or two and then jump 10 to 20 cents in one day before starting to fall again.

Unfortunately the two firm Maskin and Tirole model abstracts from some of the important details of typical oligopoly markets, including retail gasoline markets. In particular, it does not address coordination problems that might arise in a market with many sellers

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when it is time to restore prices to higher levels to restart the cycle.¹ With two firms it is natural that the second firm will respond to a price increase from the first firm by also raising its price (to just below that of the first firm). However, in markets with many firms it is much less clear how a firm should respond to a price increase by a single competitor. Noel (2008) points out this coordination problem and simulates an equilibrium for a Maskin & Tirole style model with three firms instead of two. He confirms that while cycles can still exist in equilibrium, coordination problems do arise and *false starts* can occur in which one firm attempts to reset the cycle but other firms do not follow. Noel shows that prices in the three firm model tend to remain closer to marginal cost for longer as firms try to coordinate the next price restoration. If additional firms make coordination of price restorations sufficiently difficult, the firms may no longer have the incentive to undercut in the first place and cyclical price equilibria may no longer exist. Wang (2008) also discusses the difficulties of coordinating Edgeworth price cycle restorations and studies evidence from an antitrust case that details how gas stations in Ballarat, Australia actually communicated by telephone to coordinate price increases. Wang analyzes court evidence showing that the number of phone calls between stations jumped dramatically on days when price restorations occurred.

Short of explicit communication between competitors, how can price restorations be coordinated amongst many firms? There is some evidence of specific firms or stations taking on a *price leadership* role during restorations. Noel (2007b) studies daily data from Toronto and finds evidence that brand name stations were more likely to restore prices first. However, Noel suggests that a particular leader does not appear to exist and that any one of several firms may lead a price restoration. Atkinson (2009) uses a unique data set of prices collected every 2 hours for all 26 stations in Guelph, Ontario, and finds evidence that 5 particular stations (representing two different brands) tend to be the stations most likely to jump prices in the first 2 hours of a price restoration.²

In contrast to these previous studies which mostly focus on individual cities, I examine price leadership across 52 different cities representing nearly every cycling gasoline market in the United States. This more comprehensive analysis reveals a large amount of both within and across market price coordination and price leadership. In particular I highlight the important coordinating role played by retailers that own and directly operate a large number of stations in each city. In most cases it appears that a particular firm in each market leads price restorations and is closely followed by all other stations. Often the same firm leads cyclical restorations in many different markets in the region. In each case I find that the *leader* firm is a retail chain that coordinates price restorations citywide by unifying their stations' prices on the day of restoration in order to signal the onset of a restoration and to solidify the new market price level. To further strengthen the signal to competitors in the area, price restorations are frequently initiated by the leader firm simultaneously in a large number of markets within the firm's operating region. There appears to be a high level of awareness and willingness of other sellers to follow these price restorations quickly.

Extremely detailed data allow me to identify specific pricing strategies used to successfully coordinate marketwide price increases even in cities with many competitors spanning fairly large geographical areas. I utilize three different data sources to examine a number of different dimensions of pricing behavior. The first is a nationwide panel of daily average gas prices from 280 U.S. cities which is used

to determine where retail price cycles occur. Consistent with previous studies, I find that price cycles only occur in the Midwest region of the country. Interestingly, most of these cycling cities contain a significant market presence of Speedway or Quik Trip: two large retail gasoline & convenience store chains that operate in the region.

The second data set contains daily station specific prices from 52 cycling markets. I use this to study the timing of stations' price restorations and the prices to which they jump. The findings highlight the importance of price leadership in the coordination of price restorations. Several retailers, most notably Speedway and Quik Trip, are far more likely than competing retailers to jump prices at their stations on the first day of a cyclical price restoration. In addition, stations of these firms almost always jump to an identical price citywide regardless of the price each station was charging prior to the restoration. This citywide unification of prices acts as a signal to competitors. I find that other stations in the city are more likely to restore their prices to the new modal price of the leader firm than to the modal prices of any other brands.

The final data set helps to confirm the brand-wide coordination of prices enacted by these price leading firms. I collect station price information for every Speedway station at three hour intervals throughout the day. During virtually every cyclical restoration that occurs in the 38 cities studied, nearly all Speedway stations within the city jump their prices at exactly the same time and to exactly the same price. Furthermore, Speedway frequently coordinates price restorations in every city throughout its core operating region at exactly the same date and time.

The analysis reveals that price restorations in cycling markets are highly coordinated, with most competitors increasing their prices within a short amount of time and to approximately the same price. Such coordination is not observed in non-cycling markets where even large price increases happen more slowly and less uniformly. The evidence strongly suggests that particular retail chains operating a significant share of stations act as leaders of price restorations in most of the cycling markets, signaling to others when a price restoration will occur and to what level prices should be restored to in their respective markets. This mechanism of price coordination during cyclical restorations has not been studied previously, and reveals the important leadership role of firms operating many retail outlets in a given market. The fact that price cycles are observed almost exclusively in markets where these leader retailers hold a significant market share suggests that the coordination of price restorations might play an important role in the existence of price cycles.

2. Data and market structure

2.1. Data

This study utilizes three different sources of retail gasoline price data. Each of these data sources have their own distinct advantages (and disadvantages). In this section I describe the details of each data set and highlight how they contribute to the understanding of cyclical pricing behavior.

The first data source contains daily city average retail prices from 280 cities nationwide from October 2004 to July 2010. The prices are those reported on the American Automobile Association (AAA) website and are frequently cited in various media outlets. They are based on information from a station price survey collected by the Oil Price Information Service (OPIS). The underlying OPIS pricing information is the same as that contained in the station level data set described in more detail below. However, the city level price data are available for many more locations and for a much longer time period than the station level data.

The second data set provides individual gas station prices collected by OPIS for 165 cities for the two years from July 2008 to July 2010. OPIS reports on their website that these station-specific prices are acquired "through exclusive relationships with credit card companies,

¹ The broader theoretical literature on price leadership also largely restricts attention to models with only two firms. See, for example, Rotemberg and Saloner (1990), Deneckere and Kovenock (1992), and Deneckere et al. (1992).

² It is interesting to note that the ability of stations to respond quickly makes it fairly difficult to definitively identify which stations change price first even when prices are observed every 2 hours.

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