



The economic significance of gasoline wholesale price volatility to retailers



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ABSTRACT

We show that gasoline retailer profits heavily depend on the direction of wholesale cost movements. Using a unique, firm-level, proprietary sample of 121 U.S. gasoline retailers collectively operating over 4500 stores, we find that it tends to be only in months when wholesale prices are declining that retailers make meaningfully positive profits, and that in spite of the low profits earned when wholesale prices are increasing, over the entire wholesale price cycle, volatility is preferred by retailers to relatively stable wholesale prices. We are the first to our knowledge to link asymmetric price responses directly to firm profits and characterize the economic significance of asymmetric pricing in the retail gasoline industry. Our findings may have important implications for the scores of other industries where asymmetric retail-to-wholesale price responses are found.

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1. Introduction

Crude oil prices are notoriously volatile. In the last few years, crude prices have experienced a historic pattern of what we call *directional volatility*, where prices are volatile in one direction (up or down) for a prolonged period of time (generally four months or more). The standard for directional crude price volatility was the mid-1970's through mid-1980's, which consisted of the first and second oil price shocks and the subsequent price declines. Real prices in that time shot up from their historical mean of \$25 per barrel, in 2008 dollars, and peaked at over \$105 per barrel before falling back near the historical mean. Recently, though, the standard for directional volatility has changed. Real prices climbed over 475% from \$23 in December 2001 to an inflation-adjusted record of \$133 in June 2008 before plunging faster than they rose. Fig. 1 displays the real price of West Texas Intermediate (WTI) crude oil, a customary crude benchmark, from 1960 through 2008.

Crude price volatility is important in part because researchers have identified that retail gasoline prices respond asymmetrically to shocks in wholesale prices, which are largely determined by movements in crude oil prices. They show retail prices increase quickly in response to increases in wholesale prices but only fall gradually when wholesale prices decline. A direct implication of the general finding is that retail gasoline margins are smaller when wholesale prices are moving up than when they are moving down. While much has been said about asymmetric retail-to-wholesale price adjustments, little has been said about its economic significance. How do asymmetric price adjustments impact overall profitability? Do firms have higher profitability when prices are volatile or when prices are stable?

Our paper uses a unique, firm-level, proprietary dataset of gasoline retailers' prices and costs to confirm that retail margins are smaller when wholesale prices are rising. We then relate asymmetric responses of margins to profitability. We show for the first time that the asymmetric response is sufficiently large that it is primarily only in periods when wholesale prices are falling that retailers make meaningfully positive accounting profits. In periods when wholesale prices are rising and margins are tight, retailers more or less break even.

Second, we explore retailers' preferences for wholesale price volatility. Since retailers' profits are meaningfully impacted by the direction of

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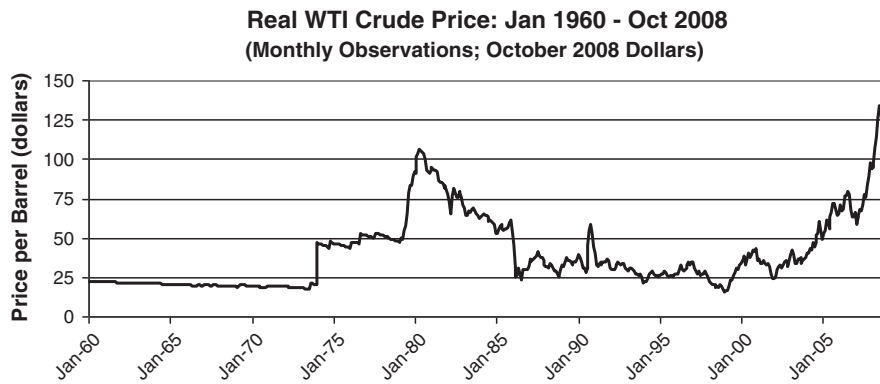


Fig. 1. Recent years have experienced historic directional crude price volatility.

wholesale price volatility, we ask if retailers prefer volatility to stability. We conclude that volatile wholesale prices are preferred. Our data show that retailers make more than enough in periods of declining wholesale prices to offset the lack of profits when prices are rising so that average profits over the entire price cycle are greater than if wholesale prices remained relatively stable.

These findings highlight retailers' need for relatively symmetric wholesale price volatility over a reasonable period of time. If wholesale prices persist directionally upwards for extended periods of time, some retailers might not be able to survive until prices mean revert. We observe some evidence of this in the retail gasoline industry as a result of the recent historic directional movements of crude prices.

The rest of the paper is organized as follows. Section 2 discusses the large existing literature on asymmetric wholesale to retail price fluctuations and where our findings fit in; Section 3 describes the dataset and key variables used in this paper; Section 4 contains our estimation procedure, presents our results, and elaborates on the economic significance of our findings; and Section 5 concludes with a discussion of the generalizability of our findings to other industries where asymmetric responses have been observed.

2. Literature

There is a large literature addressing asymmetric responses of output prices to fluctuations in input costs. Colloquially, the literature is referred to “Rockets and Feathers” and is based on the observation that retail prices appear to rise like rockets when wholesale prices increase and fall like feathers when wholesale prices drop. Bacon (1991) used the rockets and feathers terminology in the title of his paper on observations in the U.K. retail gasoline market. Others have followed since with use of the phrase in their titles, including Galeotti et al. (2003), Tappata (2006), and Verlinda (2008). Existing literature tends to address two general questions: do asymmetric responses exist, and if so, why?

The answer to the question of existence of asymmetric price responses seems clear. Empirical evidence is plentiful documenting and suggesting existence in some markets for some input–output price relationships. Asymmetries are found in the U.S. retail gasoline market, the U.K., Canada, the Philippines, and other geographic markets. As a non-comprehensive list see Duffy-Deno (1996), Borenstein et al. (1997), Akarca and Andrianacos (1998), Balke et al. (1998), Chen et al. (2005), Radchenko (2005), and Abosedra and Radchenko (2006) using US datasets; Bacon (1991) in the UK; Godby et al. (2000) in Canada; and Salas (2002) in the Philippines.

Some exceptions are present. Karrenbrock (1991) for instance examined this issue earlier and concluded that retail prices responded symmetrically to wholesale prices for premium and unleaded regular gasoline but asymmetrically for leaded regular gasoline. Bermingham and O'Brien (2011) explore asymmetries in the U.K. and Irish gasoline

and diesel markets from 1994 to 2009 and find no evidence of the rockets and feathers hypothesis. Shin (1994) also finds no evidence of asymmetry using monthly U.S. prices from 1986 to 1992. Despite counterexamples such as these, the empirical evidence seems to point toward the existence of asymmetries at least in some markets.

Beyond downstream gas markets, asymmetries are found in a variety of other industries. Peltzman (2000) studied over 200 industries and found price asymmetries in over two-thirds of them. Asymmetries were found for both producer goods and consumer goods. He found few common denominators across markets that systematically explain the asymmetries. Examples of others who have found asymmetric responses in non-gasoline markets are Neumark and Sharp (1992) and Jackson (1997) in bank deposit rates; Goodwin and Holt (1999) in the US beef industry; and Goodwin and Harper (2000) in the US pork sector.

Geweke (2004) provides a helpful review of some of the academic work done in the retail gasoline literature to that date. He surveys eighteen papers and compares and contrasts the datasets used and econometric models employed. Asymmetric pricing is rich in other industries too, especially agriculture. Meyer and von Cramon-Taubadel (2004) contains a survey of forty papers. Eighty percent of the papers cover asymmetries found in agriculture and ten percent of the papers describe the asymmetries found in gasoline markets. Frey and Manera (2007) provide one of the most comprehensive reviews discussing seventy papers. Half are focused on the agricultural industry and half on gas markets.

The term “asymmetry” used in the literature often takes on different meanings depending on the study. Some papers in the literature focus on identifying asymmetries in *magnitude* while others focus on identifying asymmetries in *speed* of adjustment. Asymmetries in magnitude refer to downstream prices rising more for a given-sized upward shock in upstream prices than downstream prices would fall given a similarly sized downward shock in upstream prices. If asymmetries in magnitude are large enough, the impact on firm profits could be economically significant. Asymmetries in speed refer to downstream prices responding more quickly to an upward cost shock than to a downward cost shock of the same size, even though the ultimate magnitude of the adjustment might be the same. If the asymmetry in speed persists sufficiently long, the impact on firm profits could also be economically significant. Meyer and von Cramon-Taubadel (2004) provide a helpful visual explanation of the difference between magnitude and speed (Figure 1, pp 584). Asymmetries in speed and magnitude of course can exist simultaneously and work together.

The frequency of data used is a choice researchers make and is often motivated by data availability and constraints. We use monthly data in our study since that is the frequency at which most private firms close their books and create financial statements. Of note, asymmetries can be found at all frequencies in the literature for some markets. Karrenbrock (1991) and Akarca and Andrianacos (1998) for instance find asymmetries with monthly datasets; Borenstein et al. (1997) find

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