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The relationship between U.S. retail gasoline and crude oil prices during the Great Recession: "Rockets and feathers" or "balloons and rocks" behavior?

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ABSTRACT

Previous studies of the relationship between crude oil and gasoline prices have often found "rockets and feathers" behavior: a scenario where gasoline prices increase more rapidly when crude oil prices rise than they fall when crude oil prices drop. While we find this behavior in times of generally rising crude oil prices, we find the opposite to be true during times of generally falling crude oil prices, a phenomenon we call "balloons and rocks" behavior. This result was obtained by testing for parameter stability in error-correction models which were estimated for periods of significant variability in both crude oil and gasoline prices. The data used to estimate these results is unique in the literature as it is comprised of daily U.S. retail gasoline prices and daily crude oil prices. The sample was taken during the Great Recession, an exceptional period of time that saw both sharp increases and decreases in gasoline and crude oil prices.

1. Introduction

The Great Recession was characterized by extreme volatility in both crude oil and retail gasoline prices with both rising dramatically during the first half of 2008. A confluence of events—rising demand from the emerging economies of India and China, increased speculation in the market for crude oil, and growing political uncertainty in the Middle East—created a perfect storm in the global oil market. Crude oil prices increased from $95.95 per barrel on January 1 to $145.31 per barrel on July 6, a jump exceeding 51%. During the same time period, driven by the higher price of crude, the retail price of unleaded, regular gasoline rose approximately 34% from $3.04 per gallon to $4.09 per gallon.

Then, in the depth of a global recession, the last half of 2008 saw a remarkable plunge in crude oil prices. Between July 7 and December 23 of 2008, the price of crude plummeted from $141.38 to $30.28 per barrel, a drop of more than 78%. Concurrently, the price of regular gasoline fell from its peak of $4.09 to $1.64 per gallon, a decline of almost 60%. Then, between December 24 of 2008 and December 31 of 2009, another significant price swing occurred as the price of crude oil rose almost 141% from $32.94 to $79.35 per barrel. During the same time period, gasoline prices increased more than 60% from $1.64 to $2.64 per gallon. These striking events are presented graphically in Fig. 1.[1]

Precipitous increases in the retail price of gasoline inevitably elicit allegations of price gouging from both the public and the media with complaints that gasoline prices never fall as readily as they increase. Coined the "rockets and feathers" hypothesis, the argument is that an increase in the price of crude will cause the price of gasoline at the pump to rocket upwards, but as the price of crude falls, retail gasoline prices respond like a feather slowly drifting downwards.[2]

Using the error-correction model developed by Engle and Granger (1987), this paper tests for asymmetric price behavior using a unique data set: daily U.S. retail prices between 2008 and 2009. While previous studies have examined semimonthly retail prices or daily wholesale prices, the use of daily retail prices distinguishes this paper as does its results. In their study of asymmetric price responses in the Spanish fuel market, Balaguer and Ripollés (2012) argue that the use of daily retail prices is critically important. The reason being that gas stations can, and often do, change prices daily. So, daily prices provide more detailed information on the responsiveness of retail prices to changes in the price of crude compared to weekly, fortnightly or monthly data.

When the error-correction model is estimated using the entire sample, asymmetric pricing behavior is found. However, Chow tests indicate

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[1] The indexes of both series plotted in Fig. 1 assume the January 1, 2008 observation equals 100.
[2] See Bacon (1991).

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0140-9883/

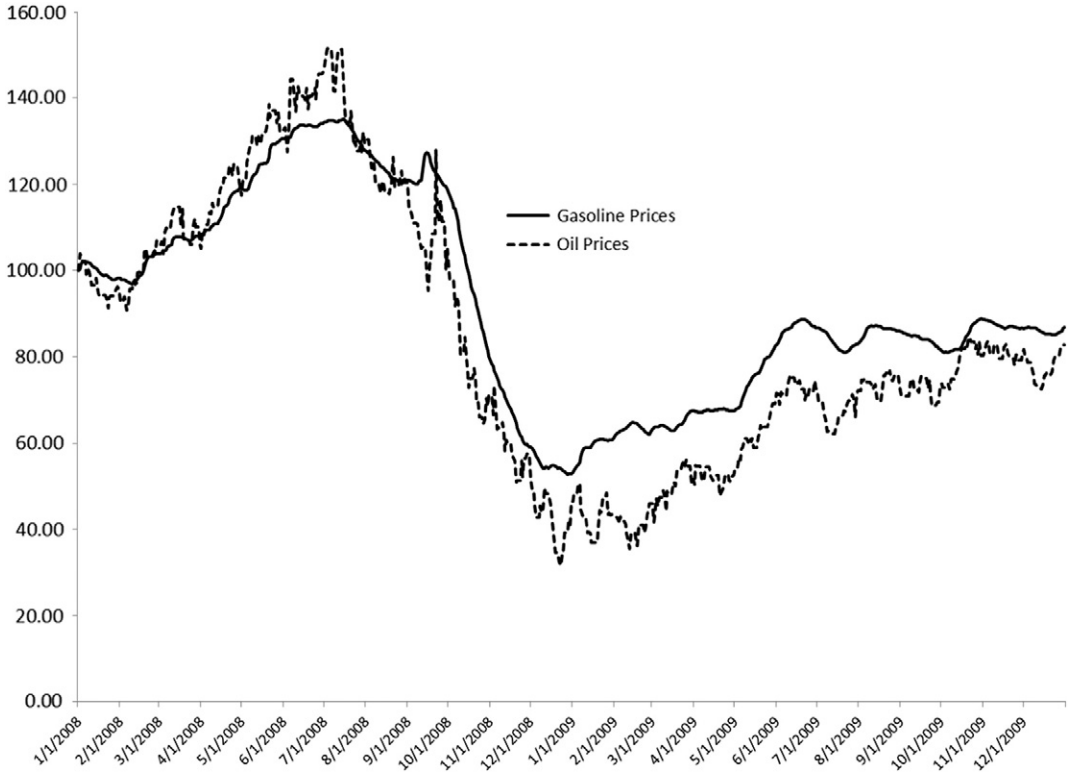

Fig. 1. Indices of daily crude oil and retail gasoline prices (1/1/2008 = 100).

that the regression parameters are unstable when the entire sample of data is used. Consequently, the data was partitioned into three periods reflecting the episodes described above: an initial period of rapidly rising crude oil prices, a period of precipitously falling crude oil prices and a final period of generally rising oil prices. Impulse response functions indicate the presence of asymmetric "rockets and feathers" price behavior during the two periods of increasing crude oil prices. However, during the period of falling prices, a different sort of pricing outcome revealed itself, one perhaps best characterized as "balloons and rocks" behavior. In this situation, gasoline prices plunge as crude oil prices fall, i.e., they drop like a plummeting rock. But if oil prices temporarily increase during such a period, gasoline prices rise slowly, like a balloon gently drifting upward.

Following this introduction, the second section of the paper contains a brief review of the literature. The models reflecting symmetric and asymmetric price behavior are specified in the third section of the paper. The data, estimation results and the outcomes of several statistical tests are discussed in the fourth section of the paper. The behaviors of the various impulse functions are described in the fifth section of the paper while the final section offers some concluding remarks and conjectures about the general relationship between input and output prices.

2. Literature review

Peltzman (2000, p. 493) concludes that an asymmetric response of output prices to changes in input costs is a "stylized fact" for many markets. He analyzes 77 consumer products and 165 producer goods and finds that most of these markets exhibit asymmetric price behavior. In two-thirds of the markets, output prices increase faster than input prices when input prices are rising but fall slower than input prices when input prices are falling.

Given the need for daily transportation and the relative short-run, inelastic demand for gasoline, it is not surprising that volatility in crude oil prices and its relationship to gasoline prices has garnered the attention of both consumers and economists. The preponderance of the past research has found evidence of asymmetric price behavior. This finding persists across several developed countries during different time periods regardless of whether the data frequency is monthly, fortnightly, weekly or daily.[3] The asymmetric price behavior of gasoline and crude oil prices has been attributed to: (1) the existence of market power, (2) the presence of consumer search costs, (3) the varying responses of consumers to changing prices, (4) the variety of inventory management practices in use, (5) the variety of accounting procedures in use, and (6) the presence of adjustment costs.[4]

2.1. Do U.S. gasoline prices exhibit asymmetric behavior?

The two most commonly cited works specific to the U.S. gasoline market are by Borenstein et al. (1997) and Bachmeier and Griffin (2003), differing both in their data sets and their conclusions. Using semimonthly retail data between March 1986 and December 1992, Borenstein et al. (1997) find that retail gasoline prices increase faster when crude prices rise and decrease more slowly when crude prices fall. However, Bachmeier and Griffin (2003) analyze daily data of regional, wholesale prices between 1985 and 1998 and they find no evidence of "rockets and feathers" behavior.[5]

Johnson (2002) analyzes the responsiveness of retail gasoline and diesel prices to changes in wholesale prices in 15 U.S. cities. His sample consists of weekly data between July 1996 and June 1998 and Johnson (2002, p. 33) finds "asymmetric responses, where prices rise faster than they fall." While he notes that the asymmetric behavior of fuel prices is often attributed to oligopolistic fuel retailers, Johnson provides an alternative argument that the "rockets and feathers" behavior can be attributed to search costs. Using monthly, retail data from 47 states

[3] Balaguer and Ripollés (2012, p. 2068) note that "the use of weekly and monthly data has been a habitual practice in empirical research on this issue."

[4] See Brown and Yücel (2000).

[5] Other studies finding asymmetric price behavior in the U.S. gasoline market include Balke et al. (1998); Eltony (1998); Honarvar (2009); Karrenbrock (1991) and Radchenko (2005a, b).