

Asymmetric adjustment of retail energy prices in Europe: Analysis of structural change and exchange rate dynamics

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This paper investigates the roles of structural changes and exchange rates in the relationship between retail energy prices and crude oil costs. Using a dummy variable approach, this paper argues that once the structural change in this relationship is taken into consideration, the empirical results of studies that found evidence in support of asymmetric behavior, which is largely obscured at pump where prices include both tax and duty, no longer hold. Adopting a nonlinear Auto Regressive Distributive Lag (ARDL) framework, this paper also shows that studies that failed to account for the exchange rate as part of the marginal cost of importing oil for countries with a high oil import dependency ratio may be misleading. Specifically, the results indicate that once the exchange rate effect is taken into consideration, the possibility of rent-seeking behavior in the gasoline markets of Italy and Spain disappears, while the rockets and feathers effect in the ex-tax gasoline, diesel, domestic heating oil, and industrial fuel oil markets of France, Germany, Italy, and Spain vanishes. Finally, employing instrumental variables and generalized method of moment estimators, this paper further finds that the results are robust and free from endogeneity issues. *Published by AIP Publishing.* <https://doi.org/10.1063/1.5021052>

I. INTRODUCTION

In the economic development literature, the rockets and feathers effect is a term used to describe the behavior of firms in markets witnessing asymmetric transmission of input costs to product prices in such a manner that allows firms to earn temporary excess profits. More specifically, this term explains that when firms are confronted with rising input costs, they rapidly adjust prices upwards; but when they are faced with decreasing costs, they adjust prices downwards very sluggishly. This represents an important form of market failure and raises serious anti-trust issues that policy makers and governments cannot overlook. In fact, it is typical of markets witnessing practices that are detrimental to consumers' welfare, such as rent-seeking, uncompetitive pricing, collusion, product hoarding, and artificial shortage/scarcity of products, among others. Given the reality of this phenomenon especially in the global retail energy sector, economists across the globe have investigated its prevalence using various methodologies. While some studies found evidence in support of the hypothesized asymmetric response of retail energy prices to changes in crude oil prices, others did not find any evidence of such asymmetry.

The recent tumbling in crude oil prices which started in the last quarter of 2013 has renewed global interest in the asymmetric price transmission from crude oil markets to various retail petroleum product markets. Monthly oil price statistics from the International Energy

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Agency (IEA) indicate that the average cost of imported crude oil in the United States (U.S.) declined from 97.44 U.S. dollars per barrel in October 2013 to 38.76 U.S. dollars per barrel in November 2015 (The IEA provides monthly price statistics for crude oil, gasoline, diesel, domestic heating oil, and industrial fuel oil for selected countries in the global economy at <http://www.iea.org/statistics/topics/pricesandtaxes/>). In fact, the wholesale spot price of Brent crude oil as at close of February 25, 2016, was 32.83 U.S. dollars per barrel (See <https://www.eia.gov/todayinenergy/prices.cfm>). Specifically, given that crude oil is the main input in the production of gasoline, automotive diesel, domestic heating oil, and low sulphur industrial fuel oil, there are global concerns that the prices of these petroleum products at pump may respond asymmetrically to the changes in crude oil prices. Grasso and Manera (2007) provided an authoritative survey of such asymmetry in the retail gasoline markets, especially in the U.S. and the UK.

In the literature, several studies have been conducted to ascertain the presence of the rockets and feathers phenomenon in different economies. Among those who did not find any evidence in support of the phenomenon include Godby *et al.* (2000), Bachmeier and Griffin (2003), and Kristoufek and Lunackova (2014), among others. For example Godby *et al.* (2000) adopted a Threshold Regression model in its error correction form and weekly data for January 1990 to December 1996 and found no evidence in support of the rockets and feathers effect in the Canadian gasoline markets. Bachmeier and Griffin (2003) used daily data for 1985–1998 for the U.S. gasoline market. They also used the standard Engle-Granger two-step estimation procedure as well as the BCG's nonstandard specification and found no evidence of asymmetry in the U.S. wholesale gasoline prices. Also, even though Honarvar (2009) used the error correction modeling (ECM) approach, the results are consistent with those of Bachmeier and Griffin (2003) that there is no evidence of the rockets and feathers effect in the U.S. gasoline market. Quite recently, Kristoufek and Lunackova (2014) re-examined the gasoline markets of Belgium, France, Germany, Italy, the Netherlands, the UK, and the U.S. for evidence of the rockets and feathers effect. They used a new framework of fractional integration, long-term memory, borderline (non-) stationarity as well as the frequently used ECM framework but found no asymmetry in all markets apart from Belgium. However, unlike the studies above that found evidence in favor or against the hypothesized asymmetry, the international comparison of gasoline markets by Galeotti *et al.* (2003) using several econometric frameworks yielded widespread differences in both adjustment speeds and short-run responses of European markets to changes in crude oil prices. (Other studies that have made remarkable contributions towards a more comprehensive understanding of asymmetric adjustment of retail energy prices following changes in crude oil costs are Lewis (2004) that advanced a reference price search model, Johnson (2002), Radchenko (2005), Bettendorf *et al.* (2003), Perdiguero-Garcia (2010), and Chou *et al.* (2013), and the references therein. Perdiguero-Garcia (2010) provides a comprehensive documentation of 48 empirical studies on gasoline market asymmetries for various countries in the global economy.)

In contrast to the studies reviewed above, the empirical works of Bacon (1991), Reilly and Witt (1998), and Grasso and Manera (2007) found evidence in support of the rockets and feathers thesis. For instance, Bacon (1991) used a quadratic quantity adjustment model and data from 1982 to 1989 to examine the UK retail gasoline market for evidence of the rockets and feathers hypothesis. The results are in support of the hypothesized asymmetry. Unlike Bacon (1991) and Manning (1991) used an earlier dataset for the period 1973–1988 and found evidence of asymmetry in the UK retail petrol market although the observed asymmetry is virtually absent after four months. Even though Reilly and Witt (1998) used monthly UK data from 1982 to 1995 and an error correction modeling (ECM) framework to investigate the retail gasoline market, their findings are consistent with those of Bacon (1991) and Manning (1991). Borenstein *et al.* (1997, henceforth BCG) used U.S. data for the period of 1986–1992 and ECMs to analyze price transmission at different points in the distribution chain and found that retail gasoline prices respond more quickly to the increase than to the decrease in crude oil prices. They attributed this asymmetry to production/inventory adjustment lags and market power of some sellers. Grasso and Manera (2007) studied the gasoline markets of France, Germany,