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Asymmetric pass through of oil prices to gasoline prices: Evidence from a new country sample

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ABSTRACT

This paper investigates the asymmetric pass-through of oil prices to gasoline prices under the non-linear autoregressive distributed lags (NARDL) model. The analysis adds to the unsettled discussion of whether retail gasoline prices respond asymmetrically to oil prices and it is carried out for the US, the UK, Spain, Italy and Greece, spanning the period January 2009 to July 2016. These countries have been selected on the basis that fuel markets are differentiated by the structure of retail markets (oligopolistic behavior, production lags and market competition), which depends on extraction, refinery and distribution. The analysis considers markets that differ in terms of their structure. Both short- and long-run non-linearity are tested by deriving both the positive and negative partial sum decompositions of the dependent variable. In addition, it was feasible to quantify the responses to positive and negative oil price shocks from the asymmetric dynamic multipliers. The findings indicate that oil and gasoline prices provide mixed evidence of an asymmetric behavior. Short-run asymmetry is found in the Italian market, while in the Spanish market there is evidence of both short- and long-run asymmetry. The remaining cases (Greece, U.K., U.S.) illustrate a symmetric pass-through scheme of oil to retail gasoline prices.

1. Introduction

The relationship between oil and gasoline prices has been the subject of investigation over the last three decades, igniting a controversy across researchers. Understanding the transmission mechanism of positive and negative crude oil shocks to both the wholesale and retail gasoline prices is of paramount importance for a country's energy policy making, the optimal energy risk hedging, and the portfolio risk management, in general. The movement of these energy commodities' prices can affect not only the consumption and production expenditures, but also future investment decisions.

However, these economic variables can behave in a non-linear manner, causing a corresponding non-linear interaction with each other, which cannot be a simple and historically stable relationship. Moreover, there is a widely held belief that there is inconsistency in the pass-through procedure from upstream to downstream prices (Bacon, 1991; Atil et al., 2014). Specifically, many studies highlight that gasoline prices react asymmetrically to oil price changes (Radchenko, 2005; Grasso and Manera, 2007; Blair and Rezek, 2008; Meyler, 2009; Honarvar, 2009; Radchenko and Shapiro, 2011; Atil et al., 2014; among others), that is to say oil firms and individual retailers respond faster to oil price increases than decreases. For instance, when refiners or retailers experience a decline in their input costs, they will do not rush to decrease accordingly wholesale or retail prices, since they can take advantage of the additional profits they can make. This situation cannot last indefinitely and is kept on as long as the demand has not been altered. Some competitors, however, will realize that by reducing these prices they can enjoy greater profits from the larger quantities they can sell. Eventually, all will be forced to adjust the price level to its new equilibrium position. By contrast, economic agents increase their prices as soon as they can in order to maintain their regular profit margins and not to experience any losses. This asymmetric price adjustment is known as the 'rockets and feathers' effect, because prices rise like a rocket, but fall like a feather, a concept first introduced by Bacon (1991). Although the economic theory suggests no prevalent inclinations for output prices to respond differently to input cost increases and decreases, several studies have been undertaken and generated similar results (Borenstein et al., 1997; Bachmeier and Griffin, 2003; Galeotti et al., 2003; Chen et al., 2005; Grasso and Manera, 2007; Al-Gudhea et al., 2007; Blair and Rezek, 2008; Meyler, 2009; Honarvar, 2009; Remer, 2015; Polemis and Tsionas, 2016). The majority of these studies used the Error Correction Modelling (ECM) approach to assess the

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presence of potential asymmetric effects. For instance, Borenstein et al. (1997) examine the short-run dynamic asymmetric responses of US gasoline market to crude oil price changes by implementing a non-standard asymmetric ECM and, thus, they confirm the common belief of asymmetry.

The presence of any asymmetries dictating the pass-through mechanism from oil to gasoline prices could be primarily attributed to the presence of structural distortions that seem to hamper the level of the effective competition in the fuel sector. This is a serious issue which the regulatory authorities have to intensely check provided that such asymmetries could reflect a behavior of potential exercise of market power by the refineries. In that sense, these authorities in order to protect consumers from welfare loses need to take a number of measures, such as the strengthening of the role of the wholesalers and the elimination of certain barriers to entry in the oil market, i.e. thus enhancing oil imports, the thorough investigation of any potential merging activity in the fuel industry, since certain merging results lead to market concentration without enhancing economies of scale, by further opening the market to new entrants, such as hypermarkets or big stores, and by removing certain legal or technical barriers for the establishment of new filling stations. Furthermore, the presence of asymmetric behavior can be attributed to a blend of several reasons. To begin with, the market power of several locally active gasoline stations can affect both the adjustment speed of the prices and the consumer search behavior. Moreover, another reason that justifies the asymmetric pricing scheme is the negative relationship between inventory levels and fuel prices. When oil prices increase (decrease) and, subsequently, oil supply declines (rises), the level of gasoline inventories is reduced (increased), leading to higher (lower) values of retail gasoline prices (Borenstein and Shephard, 2002). Finally, imperfect competition, collusive behaviors among firms, the size of the market and accounting practices could all cause retail prices to respond in a dissimilar pattern to input cost changes (Brown and Yucel, 2000). In a more recent paper, Suvankulov et al. (2012) explore the role of price regulations on potential asymmetries and on relative price convergence in the case of the Canadian retail gasoline market. Their analysis makes use of monthly data over the period 2000–2010 on retail gasoline prices in 60 Canadian cities. Their goal is to investigate (i) whether the retail gasoline market in Canada has experienced a relative price convergence to the mean, given the increased economic integration across Canadian provinces, and (ii) whether the introduction of price regulation mechanisms in the regions of New Brunswick and Nova Scotia in July 2006 had any impact on the price dynamics in these provinces. Through a non-linear panel unit root test their findings document that Canadian retail gasoline markets are well integrated across locales; however, the share of converging cities reveals a significant decline since July of 2006. The impact of price regulation on price convergence, however, is mixed; the results indicate that since the enactment of the regulation across all New Brunswick cities included in the dataset, gasoline prices converge to the national mean. In contrast, in the wake of price regulation in Nova Scotia, all cities of the province are non-convergent to the mean with increased volatility.

Little effort has been dedicated to the presence of non-linear cointegration analysis, since the long-run relationship between the non-stationary regressors is usually introduced as a symmetric one. However, the latter could also be asymmetric or non-linear. Additionally, most researchers implement the two step Engle-Granger methodology for the modelling of the short-run asymmetry which is not as much as efficient as the single-step Error Correction Model estimation, provided that the errors of the first regression (i.e., residual series estimation) are carried to the second estimation (i.e., a unit root test). Finally, the two-step methodology presumes that the number of the cointegrating relationships is known a priori. Based on the above discussion, the goal of this paper is to investigate the asymmetric pass-through of oil prices to gasoline prices for a panel of countries, i.e. Greece, Italy, Spain, the U.K. and the U.S. The selection of this particular sample is based on the following discussion: According to Serletis and Ricardo (2004), Al-Gudhea et al. (2007) and Grasso and Manera (2007), the potential asymmetric behavior of pass-through of oil to gasoline prices is potentially due to the fact that fuel markets across countries are differentiated by the structure of retail markets (i.e., oligopolistic behavior, inventory levels, production lags, and market competition structures), which depends on extraction, refinery and distribution. To this end, the analysis considers markets that differ significantly in terms of market structure. According to Nowakowski and Karasiewicz (2016), fuel markets in continental Europe do exhibit differentiated degrees of competition, though such competition is lower versus the US and the UK corresponding markets. Therefore, it would be substantially interesting to consider a differentiated panel of countries whose fuel markets differ significantly in terms of their competition level. Moreover, Greece, Italy and Spain are countries that are still seriously affected by the recent economic crisis, which in turn could influence the pricing pass-through mechanisms. The obtained results of these countries could also be compared with two of the strongest economies worldwide, the U.K. and the U.S. The methodology of the non-linear autoregressive distributed lags (NARDL) model, proposed by Shin et al. (2013), has been followed. Short- and long-run non-linearities are coherently tested for by deriving both the positive and negative partial sum decompositions of the dependent variables. Previous papers treated asymmetries separately for the short- and the long-run, which is less effective than the single-step estimation. The presence of a potential long-run relationship can be tested through a bounds-testing process irrespective of whether the underlying regressors are I(0), or I(1) or mutually cointegrated. Additionally, a graphical depiction of the short- and long-run responses of the two commodities to positive and negative oil shocks could be feasible by implementing the asymmetric dynamic multipliers approach, which allows us to observe the traverse to the new equilibrium after a disturbance in the system.

To foreshadow the empirical findings, they conclude that Cushing, OK WTI oil and retail gasoline prices provide mixed evidence of any asymmetric behavior in the cases under scrutiny. More specifically, short-run asymmetry is found in the Italian market, while in the Spanish market there is strong evidence of both short- and long-run asymmetry. The remaining cases (i.e., Greece, the U.K. and the U.S.) illustrate a symmetric pass-through scheme of oil to retail gasoline prices. The rest of the paper is structured as follows. Chapter 2 describes the data and introduces the econometric approach, while the results are presented and discussed in Chapter 3. Finally, Chapter 4 offers concluding remarks and discusses potential policy implications, while future work venues are also presented.

2. Methodology and data

2.1. Methodology

The following form presents the traditional linear Error Correction Modelling (ECM) specification proposed by Engle and Granger (1987) in which both the short- and long-run asymmetric behaviors are not taken into account:

$$\Delta gasoline_t = \mu + \rho_{gasoline} gasoline_{t-1} + \rho_{wti} wti_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta gasoline_{t-1} + \sum_{i=0}^{q-1} \beta_i \Delta wti_{t-1} + \varepsilon_t \quad (1)$$

where wti_t refers to the Cushing, OK WTI spot oil prices, while $gasoline_t$ stands for retail gasoline prices. The symbol delta (Δ) signifies first differences, while p and q are the lag orders of the dependent and independent variables, respectively. This methodology provides profoundly misleading results when it comes to both non-linearities and asymmetries in the price transmission mechanism. In contrast, the analysis makes use of the methodology of the Non-Linear