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Asymmetric evidence of gasoline price responses in France: A Markov-switching approach

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ABSTRACT

It has been documented that retail gasoline prices respond more quickly to increases in wholesale prices than they do to decreases in wholesale prices. However, there is little empirical evidence that identifies the link between the pass-through of oil prices to gasoline in different volatility regimes. Using a Markov-switching model on weekly observations of fuel prices from 1990 to 2011, we find that fuel prices respond significantly faster to increases in crude oil prices than to decreases in crude oil prices. However, when volatility is low, the transmittal of a price change from crude oil to retail fuel is higher compared to periods of high volatility. These results provide important information on the behavior of retailers. The findings of this paper therefore provide clues for better understanding the recent dynamics of fuel prices and some policy implications.

1. Introduction

Recent market disruptions and oil price volatility raise concerns about the evolution of retail gasoline prices. The last decade has been characterized by a "breathtaking ascent" and increased volatility of the price of crude oil (Smith, 2009, p.145). The subsequent effect of these changes on gasoline prices has significantly affected consumers' budgets and increased the pressure of the public opinion and political authorities on the players of the oil industry (See Boroumand et al., 2015b). Producers, refiners, retailers, or, most of the time, multinational oil companies are regularly accused of using changes in crude oil prices to unreasonably increase their margins, especially in times of crisis, when the issue of the purchasing power of households is in focus. A frequent accusation made is that following an increase in crude oil prices, the oil industry rapidly adjusts gasoline prices upward, but following a decrease in crude oil prices, it slowly adjusts prices downward. Many economists view positive oil price shocks as the major cause of recessions in the United States, which inevitably appeal to the presence of asymmetries in the transmission of oil price shocks (Kilian and Vigfusson, 2011). Understanding the relationship between the prices of oil and gasoline prices over the past 20 years is then important for future energy policies. Indeed, higher prices and the market volatility of oil and gasoline make it difficult for policy makers to design efficient and fair tax policies, especially in times of budgetary difficulties, and to protect consumers' welfare from external shocks.

This paper addresses arguably two of the most important questions in energy economics: (1) Can we capture fuel price volatility and reproduce the different phases of the volatility cycle? (2) Is there an asymmetric response in the transmission of crude oil prices to the change in wholesale gasoline prices? Our contribution is twofold. First, we are able to identify regime changes in the volatility of fuel prices. As most economic and financial variables exhibit a nonlinear behavior over time and may interact with each other in a nonlinear manner (Atil et al., 2014), we use a nonlinear approach based on a Markov-switching model to explain the evolution of oil prices. Indeed, geopolitical crises and changes in regulations can affect the linearity of the series and divert their historical relations with other parameters. Unlike models of structural changes, which admit only occasional and exogenous Markov-switching models allow frequent changes at random time points and are suitable to analyze the dynamics of oil prices. This approach allows us to identify two distinct periods. Using a weekly data set on oil prices from May 1990 to April 2011, we found basically two different regimes of volatility: the 1990s are characterized by a low volatility, and the 2000s by explicitly high-volatility parameters.

This first result allows us to analyze the pass-through of oil prices to gasoline prices in different volatility regimes, which is our second contribution. We focus on diesel, which represented 80.4% of French fuel consumption in 2010, while the premium grade underwent a strong decrease and represented 19.3% of French consumption. Overall,

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we find that fuel prices respond significantly faster to increases than to decreases in crude oil prices. Our results, however, allow us to comment on the asymmetries in the two periods of volatility. Under both low and high volatility, retailers respond more to increases in oil prices than to decreases, but in period 1 (with low volatility), the transmittal of a price change from crude oil to retail fuel is higher compared to period 2 (with high volatility). These results provide important information on the behavior of retailers: as volatility can increase the myopia of economic agents, prices are more sticky when there is more volatility, while retailers seem to be more reactive when there is a low volatility in the price of Brent. To the best of our knowledge, there is only one paper – Radchenko (2005) – linking volatility[2] to asymmetries. He finds that under oligopolistic coordination, where stability is the key to maintain the cartel, increased volatility leads to a decline in gasoline asymmetry. He particularly finds a faster adjustment of gasoline prices to an oil price reduction. Our findings are different, especially because gasoline prices do not react to an oil price reduction with high volatility.

This article contributes to several literatures. First, it is related to a growing stream of literature on asymmetric price transmissions. Since the landmark paper by Borenstein et al. (1997), a large set of papers have documented the evidence that gasoline prices respond asymmetrically to oil price increases and decreases. Frey and Manera (2007) conducted a review of the literature on the response to these asymmetries. Most studies show that there is an asymmetric response to price transmissions: when the price of oil declines, operators do not affect the decrease immediately and/or not in full, but when it increases, the operators will increase rapidly and/or completely. Most of the studies focus on the U.S. market, 26 out of 34 in the survey of Frey and Manera (2007). A recent meta-analysis by Perdiguero-Garcia (2014) shows that of half of the 61 studies, only one focuses on France. We managed to count three studies that concern the French case: Audenis et al. (2002), Gautier and Le Saout (2012), and Lamotte et al. (2012). The French case is interesting because it adds an additional parameter to take into account the transmission of the Brent oil prices, gasoline prices, and the euro/dollar exchange rate. Audenis et al. (2002) find that the speed of adjustment to a shock on the price of crude oil is more rapid when prices rise than when they fall, using monthly data in the 1980–2000 period. Lamotte et al. (2012) also highlights an asymmetry in the French market, using weekly data between 1990 and 2011. The authors show that a 1% increase in the price of Brent leads to an immediate increase of 0.12% in the price of diesel, while a decrease of the same magnitude in the price of Brent does not cause an immediate drop of 0.07% of the price of diesel. However, Gautier and Le Saout (2012) did not observe asymmetry using daily data between 2007 and 2009. The temporal difference may partly explain these results. Finally, Galeotti et al. (2003) focus on the short-run price asymmetries of five European countries – France, Germany, Italy, Spain, and the UK – and found that three of them, including France, experience asymmetric price transmissions when input prices rise or fall. The difference in results could be explained by the different existing market structures. By adding the different regimes to the study of asymmetric price transmissions, our paper adds to the previous results in the literature by distinguishing high and low-volatility periods.

The paper also contributes to the literature on nonlinearities in the oil price–output relationship. The nonlinear impact of oil price has been studied for different outputs such as economic growth (Hamilton, 2003; Kilian and Vigfusson, 2011, and more recently Narayan et al., 2014), firm returns (Narayan and Sharma, 2011), and stock returns (Narayan and Gupta, 2014; Phan et al., 2015). One of the main outcomes of these studies is that oil price affects outputs differently depending on the sign, magnitude, or geography of the change. For example, Narayan et al. (2014) study the impact of oil price on growth in 45 countries and found a nonlinear impact of oil price on growth, i.e., oil price increases for example do not affect countries in the same way depending on the degree of development for example. The debate between Kilian and Vigfusson (2011) and Hamilton (2011) beef up the existence of asymmetries and nonlinearities: standard linear models may not be able to capture the reallocation effect following unexpected changes in oil prices; Hamilton (2011) observes that negative oil price shocks have almost no impact on the economy while positive oil shocks often lead to economic downturn, while the strength of the oil price shock impact nonlinearly the economy. Reallocations happen when capital and labor are sector or product specific and cannot be moved easily from a sector to another or within the same industry. Such nonlinearities are often taken into account in the studies on the oil price–output relationship but were not fully considered in the study of asymmetric price transmission (see Frey and Manera, 2007, for a literature review). Our methodology combines both linear and nonlinear models to understand the asymmetric price transmissions.

Our results have implications for the future and for policy making. First, identifying price volatility regimes can be useful for governments that are willing to stabilize fuel prices. Even if the macroeconomic impact of the volatility of fuel prices is uncertain, being aware of the volatility raises several issues about fuel taxation and regulation. Fuel taxation could indeed be used to stabilize fuel prices. Because oil prices are differently transmitted to fuel prices depending on the period, the results show that the distribution of welfare is not the same under low and high volatility. When volatility is low, retailers face less uncertainty and then transmit oil prices to fuel prices more intensively than under high volatility. Prices are thus stickier under high volatility, which increases the welfare of consumers when the oil price increases but decreases their welfare when the oil price decreases compared to the low-volatility period. A better regulation should then be implemented in order to encourage retailers to better account for oil prices when they fix gasoline prices.

The remainder of the paper is structured as follows. Section 1 presents the data set and the French context. In Section 2, we introduce the Markov-switching analysis. Section 3 discusses the asymmetric response of retail prices to Brent prices. A brief conclusion and policy implications are presented in Section 4.

2. Data

The French consumption of oil is currently 1.7 million barrels per day. According to the *Union française des industries pétrolières* (UFIP, French Oil Industry Association), diesel consumption continues to grow (80.4% of consumption in 2010), while premium grade has undergone a strong decrease (19.3% of consumption in 2010). The production of premium grade is in surplus, allowing France to export its gas, while diesel production is in deficit and forces France to import to meet its needs.

In France, like in many other countries, the number of gasoline stations decreased in the last several decades. France has 12,051 gasoline stations, against 14,902 in Germany and 22,500 in Italy; 41% of the stations are owned by supermarkets and hypermarkets, 47% by oil companies, and 12% by independents. The share of supermarkets and hypermarkets is constantly increasing. The density of the network of gasoline stations fell from 4.44 in 1990 to 2.45 per 100 square kilometers in 2005.

Regarding fuel prices at the pump, the average price of diesel and SP95 (premium grade) remains close to the European average, with a price of 1.55 euros per liter, whereas the European Union (EU) average is 1.57 euros, and an average price of 1.36 euros for gasoil, with an EU average of 1.39 euros. Taxes make up an important component of the retail price. There are two taxes on gasoline in France: the first one is the *Taxe intérieure sur les produits pétrolieres* (TIPP, Internal Tax on Oil Products), and the other is the value-added tax (VAT). For the SP95, the tax price is 0.69 euro (EU average EUR0.67), and taxes (TIPP and VAT) represent 0.86 euro (EU average EUR0.85). For diesel, the tax price is EUR0.70 (EU average EUR0.72), and taxes represent EUR0.66 (EU average EUR0.66). To sum up, oil taxes, although the fourth source of the French state budget, remain within the EU average.

[2] Radchenko (2005) uses a measure of oil volatility based on standard deviations, an approach that differs from ours.

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