

Price Asymmetries in the Italian retail and wholesale gasoline markets

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Abstract: In this paper we consider the interaction among crude oil price, wholesale and retail gasoline prices. After a re-examinations of methodology typically proposed to test for asymmetry in price movements in each of the various stages in the production and distribution of gasoline from the crude oil price through the refinery to the retail pump, it seems appear the inconsistency of results. For this reason we decompose the three time series in short - and long – run components, and we analyze the latter.

Keywords: asymmetric error correction model; Granger causality; Hodrick – Prescott filter; information and statistical modelling.

1. Introduction

Many consumers complain that gasoline prices rise more quickly when crude oil prices are rising than they fall when crude oil prices are falling, exhibiting an asymmetric relationship. Most of the previous research on the subject confirms at least part of what consumers suspect: it provides evidence of an asymmetric relationship between gasoline and crude oil prices. Bacon (1991), probably, was the first to study the problem of different response to price increases and decreases. After, many Authors have examined the asymmetries between oil and gasoline prices but with contrasting evidence¹ (due, for example, to period of the data used, to time frequency, to econometrics models). Aim of this paper is to assess the presence of asymmetries in the adjustment speed of Italian prices. We estimate the relationship at different stages of the process of price formation. We consider separately (i) crude oil price and Platt’s quotation (wholesale market) and (ii) Platt’s and gasoline prices (retail market). In order to assess the asymmetries in price formation we use an asymmetric error correction model (A – ECM), one of the most popular specification for this analysis. Taking into account the critics to the A – ECM, we also filter the series and analyze their long – run components. Data are the weekly time series from January, 2000 to November, 2008 of crude oil price (Brent), gasoline spot price (Platt) and the before – tax gasoline retail price (Gasol). In particular, we consider the Europe Spot Price, available from Energy Information Agency (EIA); for the ex – refinery gasoline price we have considered Platt’s CIF/Med. The net of taxes retail price is from Italian Economic Development Ministry. All prices are expressed in logarithmic.

The organization of the paper is as follow. In Section 2 we report the results of A – ECM in the two market stages. Section 3 reports the Hodrick – Prescott (HP) filtering

¹ An overview of literature is in Grasso and Manera (2007).

procedure for decomposing time series into business cycles and long – run components. Finally, section 4 closes with some concluding remarks.

2. Testing asymmetry in retail and wholesale markets

Firstly, we test the integration order of the three series in presence of structural breaks with the Zivot and Andrews (1992) test, in which the breakpoint is estimated rather than fixed. The test accepts the null hypothesis of unit root for the three series. As it known, if the variables are integrated of order one (I(1)), they may form a linear combination which is stationary, or I(0). If this is the case, the variables are cointegrated. In order to test the cointegration hypothesis in the retail and wholesale markets we use the Engle – Granger two – step procedure. It suggests the presence of a cointegration relationship in each stage of production – distribution chain (Tab. 1). Following the majority of literature, we use an A – ECM (Granger and Lee, 1989) in the two market stage:

$$\Delta x_{1t} = \alpha^+ \hat{\varepsilon}_{t-1}^+ + \alpha^- \hat{\varepsilon}_{t-1}^- + \sum_{i=1}^k \beta_i^+ \Delta x_{1t-i}^+ + \sum_{i=1}^k \beta_i^- \Delta x_{1t-i}^- + \sum_{i=0}^k \varphi_i^+ \Delta x_{2t-i}^+ + \sum_{i=0}^k \varphi_i^- \Delta x_{2t-i}^- + \dots + \sum_{i=0}^k \gamma_i^+ \Delta x_{mt-i}^+ + \sum_{i=0}^k \lambda_i^- \Delta x_{mt-i}^- + u_t. \quad (1)$$

where:

$\hat{\varepsilon}_t^+ = \hat{\varepsilon}_t$ if $\hat{\varepsilon}_t > 0$ (0 otherwise) and $\hat{\varepsilon}_t^- = \hat{\varepsilon}_t$ if $\hat{\varepsilon}_t \leq 0$ (0 otherwise) are the Error Correction Terms; $\Delta x_{mt-i}^+ = x_{jt-i} - x_{jt-i-1} > 0$ and $\Delta x_{mt-i}^- = x_{jt-i} - x_{jt-i-1} \leq 0$ for $j = 1, \dots, m$ and $i = 0, \dots, k$ are oil price and Platt's quotation in the wholesale market while, in the retail one, they represent Platt's and net of tax gasoline prices. In order to allow for asymmetries, cointegration residuals and first differences of x 's can be decomposed into positive and negative values. Table (1) reports the results obtained from estimation in the two markets.

We consider the two markets separately.

In retail market, the coefficients estimated appear to be significant. The adjustment coefficients have the expected negative signs which imply that they indeed reflect an error correction mechanism that tends to bring the system closer to its long – run equilibrium. In the short terms effects are also statistically significant. They reflect the dependence of industrial price by Platt's quotations and by themselves. From test statistics F, we accept the null hypothesis in the error correction terms. An asymmetric effect is only in autoregressive component. We now test Granger causality (Tab. 1) between Platt and Gasoline in cointegrated system. The null hypothesis of no causality is rejected. In wholesale market, conversely, the results appear in contrast. Only the autoregressive components are significant while the other coefficients are not statistically significant, including the adjustment coefficients. We also test for Granger causality but we accept the null hypothesis (Tab. 1). Results show paradoxical outcome. Crude oil price, that is the raw material in gasoline markets, has not effect on the gasoline spot price. Like the retail market, the asymmetric effects are only autoregressive. We can't test, moreover, the hypotheses of asymmetries because the coefficients are not statistically significant (Granger e Lee, 1989).

Table 1, Engle – Granger bivariate cointegration test, Coefficient estimates, F test for asymmetric effects and Granger causality test.

Retail Market		Wholesale Market	
<i>Cointegration (Dependent Variable)</i>	<i>p-value</i>	<i>Cointegration (Dependent Variable)</i>	<i>p-value</i>
Gasoline price	<0,001	Platt's quotation	<0,001
Coefficient estimates			
<i>Input Variable</i>	<i>Estimate</i>	<i>Input Variable</i>	<i>Estimate</i>
α^+	-0,130393*	α^+	-0,015617
α^-	-0,078832*	α^-	-0,097045
$\beta_{Gasoline}^+$	0,125328 **	β_{Platt}^+	-0,221111**
$\beta_{Gasoline}^-$	0,382217*	β_{Platt}^-	0,261170*
β_{Platt}^+	0,164487*	β_{Brent}^+	0,103179
β_{Platt}^-	0,121313*	β_{Brent}^-	-0,031951
Constant	0,002134	Constant	0,006236
F test's p-value for asymmetric effects			
$\alpha^+ = \alpha^-$	0.263		
$\beta_{Gasoline}^+ = \beta_{Gasoline}^-$	0.006	$\beta_{Platt}^+ = \beta_{Platt}^-$	0,001
$\beta_{Platt}^+ = \beta_{Platt}^-$	0.275		
<i>Granger causality test</i>	<i>p-value</i>	<i>Granger causality test</i>	<i>p-value</i>
Platt's does not Granger cause Gasoline	<0,001	Oil does not Granger cause Platt's	0,169

Notes: “*” indicates statistical significance at 1%; “***” indicates statistical significance at 5%.

3. The long – run components

The empirical evidence of asymmetric price speed in short – run in the distribution – production chain and the acceptance of null hypothesis in adjustment coefficients induce to think over the cost components and their importance in the gasoline market. Moreover, we could think that in long – run components it is more difficult interpose, because they include, for example, labour cost, inventory change, refinement burden, handling expense, *etc.*, that are, generally, not much manageable by the companies. The short – run components, instead, are principally related to companies' profit and to variations of gasoline markets, in particular crude oil and Platt's quotations. In order to identify the two components, we decompose time series into long – run and business cycle components and studying temporal dynamics and presence of interrelationship among them. We use the Hodrick – Prescott filtering procedure to decompose the three time series. In our computations, we set $\lambda = 270400$, as it has been suggested for weekly data. In fig. 1 we report the graphical representation of long – run components. By the analysis of it emerges the relationship between long – run with a peculiarity since 2008, July. Crude oil price is grown in the period analyzed but we can't observe a similar increment of Platt's quotation. Differential between the two long – run components (Fig. 2), in fact, is decreasing and it appears deleted in the last period. Considering that crude oil cost is the price of the raw material, the progressive approaching can be due both to intermediate production costs reduction and to speculative movements that, especially in that period have conditioned the futures market. However, the approaching between Platt's quotation and crude oil price is not reflected in net-of-tax gasoline price that seems following the oil price rather than ex – refinery gasoline price. For this last

point, we have to do some further considerations. The decreasing of Platt's quotation can be due to the mechanism of price fixation. Peculiar is, furthermore, the specular movements between net of tax gasoline price and Platt's quotation and between net of tax gasoline price and crude oil price.

Figure 1, Long-run component of crude oil price, Platt's quotation and net-of-tax gasoline price.

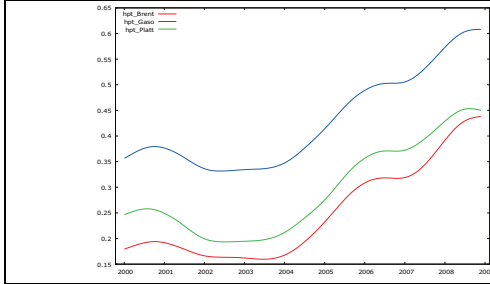
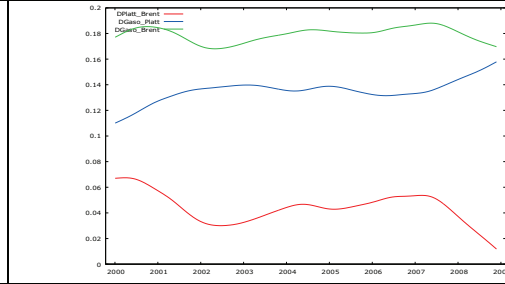


Figure 2, Difference among long-run component of crude oil price, Platt's quotation and net-of-tax gasoline price.



Consumption reduction that has been registered in the last period for the high oil prices could have reduced the Platt's quotations with the progressive approaching to crude oil long – run component while margin between the differential of gasoline price – Platt's quotation and gasoline – crude oil prices is in steady state.

4. Conclusion and further research

This work presents some preliminary results of a research concerning the asymmetric speed in the Italian gasoline markets. As it is known, the study of asymmetric effects is done using several econometric methodologies, most of which are based on the concept of cointegration between output and input prices. Studies typically differ in one or more aspects. In this work, the A – ECM has point out the presence of asymmetric effects only in the autoregressive components in the production – distribution chain. In order to analyze possible causes we have used the HP filtering procedure to decompose the time series in long – run and business cycle components. The study of the cyclical behaviour can be aim of further research.

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