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Rent seeking oligopolistic behaviour in European gasoline markets

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Abstract

This paper explores the asymmetric adjustment speed of gasoline price in twelve European Union (EU) countries transmitted directly in a single stage formulation. The empirical results shed new light on the taxation effect and its role to the price asymmetry nexus, pointing that in many EU countries a crude oil price increase is passed through more forcefully than a price decrease revealing a rent-seeking oligopolistic behaviour by the marketers.

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1. Introduction

Consumers often tend to believe that oil companies adjust the retail gasoline prices more quickly to cost increases than to cost decreases, creating an asymmetric adjustment path towards the long-run equilibrium ("*rockets and feathers*" hypothesis). Over the last decades, there is a plethora of studies investigating this phenomenon[1].

In a seminal paper, Bacon (1991) found sufficient evidence in favor of the price asymmetry debate in the UK. Borenstein *et al*. (1997) argue that retail prices in the UK over the period 1986 to 1992 responded more quickly to crude oil price increases than to decreases. In a recent study, Polemis and Fotis (2013) argue that gasoline prices in the European Union depict an asymmetric adjustment path while Greenwood-Nimmo and Shin (2013) support the existence of "*rockets and feathers*" hypothesis in three out of four major pre-tax and duty fuel markets in the UK.

In addition, Bachmeier (2013) supports that the price of oil does not respond contemporaneously to shocks to the US gasoline market. Lamotte et al. (2013) find that the adjustment to the long-term equilibrium after a shock to the crude oil price is lower when the crude oil price decreases than when it increases. Perdiguero (2013) states that the enhancement of competition may critically reduce the possibility of occurrence of oil price asymmetries. The author by using a meta – analysis approach tries to explain the heterogeneity of empirical results regarding *rockets and feathers* hypothesis. The empirical results indicate that the higher the levels of liberalization and competition the lower the asymmetric behavior of prices in the oil market.

Polemis and Fotis (2014) analyse price asymmetry in twelve European countries and the United States for a sample of weekly observations which spans the period from June 1996 to August 2011. They support the common perception that less competitive gasoline markets exhibit price asymmetry, while highly competitive gasoline markets follow a symmetric price adjustment path.

Despite the rich body of literature, none of the existing studies has tried to disentangle the possible asymmetric adjustment path by assessing the taxation mechanism levied on the gasoline price. In addition, most of these studies use the *OLS* method to estimate an error correction model (*ECM*). However, it is well established that dynamic OLS estimator (DOLS) is more efficient and yields improved performance than the *OLS* estimator (Stock and Watson, 1993).

Therefore, the contribution of this paper is two-fold. First, it goes beyond the existing literature by investigating the effect of taxation in a single stage gasoline price adjustment scheme. Secondly, it uses the DOLS estimator, thus overcoming the small sample bias of the *OLS* methodology.

2. The DOLS Error Correction Model

The *DOLS* model developed by Stock and Watson (1993) is among the simplest in the class of linear error correction models (Engle and Granger, 1987). The model is built around an asymmetric error correction model (*ECM*) of the following form:

$$\Delta y_{1,\tau} = \alpha_1 + \alpha_2\left(y_{1,\tau-1} - \beta_2 y_{2,\tau-1}\right) + \sum_i \varphi_{11}^i \Delta\varphi_{1,\tau-\iota} + \sum_i \varphi_{21}^i \Delta\varphi_{2,\tau-\iota} + \varepsilon_{1,\tau} \quad (1)$$

$$\Delta y_{1,\tau} = b_1 + b_2\left(y_{1,\tau-1} - \beta_2 y_{2,\tau-1}\right) + \sum_i \varphi_{21}^i \Delta\varphi_{1,\tau-\iota} + \sum_i \varphi_{22}^i \Delta\varphi_{2,\tau-\iota} + \varepsilon_{2,\tau} \quad (2)$$

where $y_{i,\tau}$ ($i=1,2$) is a scalar of $I(1)$ variables, the φ_i are autoregressive parameters, Δ is the first difference operator and $\varepsilon_{i,\tau}$ ($i=1,2$) is an *i.i.d.* process with zero mean and constant variance, σ^2_τ. The associated error correction representation is thus written as follows:

[1] For a literature review see Fotis and Polemis (2012) and Frey and Manera (2007).

$$y_{1,\tau} = \delta' D_\tau + \beta' y_{2,\tau} + \sum_{i=-k}^{k} \varphi_i' \Delta y_{2\tau-i} + u_\tau \quad (3)$$

In the cointegrating regression of $y_{1,\tau}$ on $y_{2,\tau}$ with appropriate deterministic terms D_τ, $Y_\tau=(y_{1,\tau}, Y'_{2,\tau})$ where $Y'_{2,\tau}=(y_{2,\tau}, \ldots\ldots , y_{n,\tau})$ is an $((n-1)\times 1)$ vector and β' the normalized cointegrating vector.

In order to allow for possible price and exchange rate asymmetries we construct the following *ECM*:

$$\Delta FRPG_{c,\tau} = a_0 + \sum_{i=0}^{k} a_i^+ \Delta CRP_{r,\tau-i} + \sum_{i=0}^{l} a_i^- \Delta CRN_{r,\tau-i} + \sum_{i=0}^{m} b_i^+ \Delta EXRP_{c,\tau-i} + \sum_{i=0}^{n} b_i^- \Delta EXRN_{c,\tau-i} +$$
$$\sum_{i=1}^{p} b_i \Delta FRPG_{c,\tau-i} + \lambda^+ ECMP_{\tau-1} + \lambda^- ECMN_{\tau-1} + \varepsilon_\tau \quad (4)$$

where *FRPG*, denotes the final price of gasoline, *CR* is the Brent spot price for Europe, *EXR* is the exchange rate between U.S dollar and euro/pound respectively and ε_τ stands for the error term. The Greek letter Δ is the first difference operator. We must mention that during the sample period, the level of taxation in all of the EU sample countries has not been stable. On the contrary, the excise and the value added taxes levied on gasoline have changed significantly within the sample period. This happened in order to comply with the EU directives suggesting a uniform minimum level of indirect taxation within the member states and meet other social and macroeconomic goals (i.e adjustment of the fiscal budget, increase in the taxation revenues, etc). In order to get reliable empirical results, we make the assumption that these tax shifts are reflected in the disturbance term (ε_τ). Short-run asymmetry is captured by similarly decomposing price and exchange rate changes into $\Delta x_t^+ = x_t - x_{t-1} > 0$ and $\Delta x_t^- = x_t - x_{t-1} < 0$ for x = *CR, EXR*. *ECMP* and *ECMN* measures the positive an negative error correction terms. Equation (4) also distinguishes between long and short run adjustments. If λ^+ is different from λ^-, $FRPG_\tau$ exhibits asymmetry in long run adjustment. If either a_i^+ is different from a_i^- or b_i^+ is different from b_i^- or both, $FRPG_\tau$ displays asymmetry in short-run adjustment. Finally, in order to assess the effect of taxation, we estimate equation (4) with net gasoline price (*NPR*) as a dependent variable.

3. Empirical results and discussion

Our sample comprises of a balanced panel dataset of 792 weekly observations for all of the twelve European countries over the period from June 1996 to August 2011. All variables are in their natural logarithms. Crude oil prices are taken from the US Energy Information Administration. Retail pre-tax gasoline prices are obtained from the European Oil Bulletin. Finally, data on the exchange rate are obtained from the European Central Bank.

Table 1 depicts the estimation results. We infer that negative crude oil price coefficients in the pre-tax model are larger, in absolute value, than their positive counterparts for the sample countries except for Belgium, Germany and UK (Panel A). This finding reveals that the effects of upstream price decreases are larger than those of price increases. On the contrary, in the post tax model the positive price estimates are larger, than their negative counterparts for the majority of the sample countries (Panel B). Further, over the estimation period, retail gasoline prices in both models do not register a significant response to variations in the exchange rate since the estimated coefficients are not statistically significant.

Regarding the speed of adjustment, we infer that the negative coefficients when significant are generally larger in their absolute terms than the positive ones for the majority of the sample countries over the two separate models. Lastly, the estimated autoregressive coefficient is statistically significant with the anticipated positive sign for all the sample countries.

Turning to the symmetry testing, we infer that in the post tax model the hypothesis of long-run symmetric adjustment speeds ($\lambda^{+}=\lambda^{-}$) cannot be rejected in seven out of twelve EU countries (except from France, Germany, Greece, Netherlands and Spain) indicating that in these countries consumers are somewhat insulated from fluctuations in the crude oil market leaving no room for a long-run rent-seeking behaviour (Greenwood-Nimmo and Shin, 2013). Similarly, when we test for short-run asymmetries (price and exchange rate) the null hypothesis ($Ho\text{: } \alpha^{+} = \alpha^{-}$ and $b^{+} = b^{-}$ respectively) cannot be rejected in all of the sample countries suggesting the existence of symmetric adjustment speeds in the short-run. When we simultaneously test the equality of all the short-run parameters ($Ho\text{: } \alpha^{+} = \alpha^{-} = b^{+} = b^{-}$ respectively), the null hypothesis (equality hypothesis) is rejected for all of the sample countries except for Ireland and Portugal. However, there is a tendency to over-reject the null hypothesis of symmetry due to the low power of standard F statistics (Galeotti et al. 2003).

Table 1: Empirical results

	Austria	**Belgium**	**Finland**	**France**	**Germany**	**Greece**
Panel A – Pre tax model						
Intercept	-0.00	-0.00	0.00	-0.00	0.00	0.00
$\Delta NPR_{\tau-1}$	0.41*	0.41*	-0.18*	0.41*	0.32*	0.57*
$ECMP_{\tau-1}$	-0.39*	-0.60*	-0.01	-0.36*	-0.65*	-0.56*
$ECMN_{\tau-1}$	-0.42*	-0.71*	0.01	0.00	-0.51**	-0.63*
ΔCRP_{τ}	0.15*	0.17*	0.15*	0.11*	0.18*	0.11*
ΔCRN_{τ}	0.18*	0.15*	0.17*	0.17*	0.16*	0.19*
$\Delta EXRP_{\tau}$	0.05	0.02	0.05	0.08***	0.02	0.10
$\Delta EXRN_{\tau}$	0.01	-0.01	0.15	-0.04	-0.04	0.06
Diagnostics						
Adjusted R-squared	0.35	0.19	0.14	0.42	0.25	0.31
St. error of regression	0.01	0.02	0.02	0.01	0.02	0.01
Symmetry testing						
$H_0\text{: } \lambda^{+} = \lambda^{-}$	0.31 (0.76)	1.18 (0.24)	0.18 (0.86)	4.77* (0.00)	1.31 (0.19)	0.53 (0.60)
$H_0\text{: } \alpha^{+} = \alpha^{-}$	1.75** (0.08)	0.08 (0.94)	1.94** (0.05)	0.73 (0.46)	0.59 (0.56)	1.84*** (0.07)
$H_0\text{: } b^{+} = b^{-}$	1.11 (0.27)	0.16 (0.87)	0.19 (0.85)	2.22* (0.03)	1.39 (0.17)	0.97 (0.33)
$H_0\text{: } \alpha^{+} = \alpha^{-} = \beta^{+} = \beta^{-} = 0$	78.26* (0.00)	40.88* (0.00)	30.65* (0.00)	96.55* (0.00)	50.52* (0.00)	0.53 (0.60)
Panel B – Post tax model						
Intercept	-0.00	-0.00	0.002	0.000	-0.001	0.003
$\Delta FRPG_{\tau-1}$	0.40*	0.39*	-	0.498*	0.413*	-
$ECMP_{\tau-1}$	-0.39*	-0.58*	-0.126**	-0.480*	-0.717*	-0.105
$ECMN_{\tau-1}$	-0.34*	-0.68*	-0.159*	-0.264*	-0.673*	-0.055
ΔCRP_{τ}	0.32*	0.33*	0.365*	0.294*	0.429*	0.161
ΔCRN_{τ}	0.27*	0.40*	0.346*	0.232*	0.354*	0.320*
$\Delta EXRP_{\tau}$	0.09	0.09	-0.087	0.072	0.044	0.089
$\Delta EXRN_{\tau}$	-0.00	-0.12	0.477**	-0.011	-0.057	-0.105
Diagnostics						
Adjusted R-squared	0.28	0.99	0.12	0.50	0.24	0.99
S.E of regression	0.02	0.00	0.11	0.01	0.04	0.01
Symmetry testing						
$H_0\text{: } \lambda^{+} = \lambda^{-}$	0.47 (0.64)	0.41 (0.68)	0.40 (0.69)	0.78* (0.01)	3.49* (0.00)	2.29* (0.02)
$H_0\text{: } \alpha^{+} = \alpha^{-}$	0.81 (0.42)	2.85* (0.00)	0.20 (0.84)	1.45 (0.15)	0.95 (0.34)	0.00 (0.99)
$H_0\text{: } b^{+} = b^{-}$	0.40 (0.65)	0.93 (0.35)	1.52 (0.13)	0.51 (0.61)	0.34 (0.74)	3.17* (0.00)
$H_0\text{: } \alpha^{+} = \alpha^{-} = \beta^{+} = \beta^{-} = 0$	72.51* (0.00)	57.6* (0.00)	36.73* (0.00)	94.88* (0.00)	5.85* (0.00)	96.43* (0.00)

***, **, * Significant at *0.10, 0.05* and *0.01* respectively. P-values are in parentheses.

Table 1: Empirical results (*continued*)

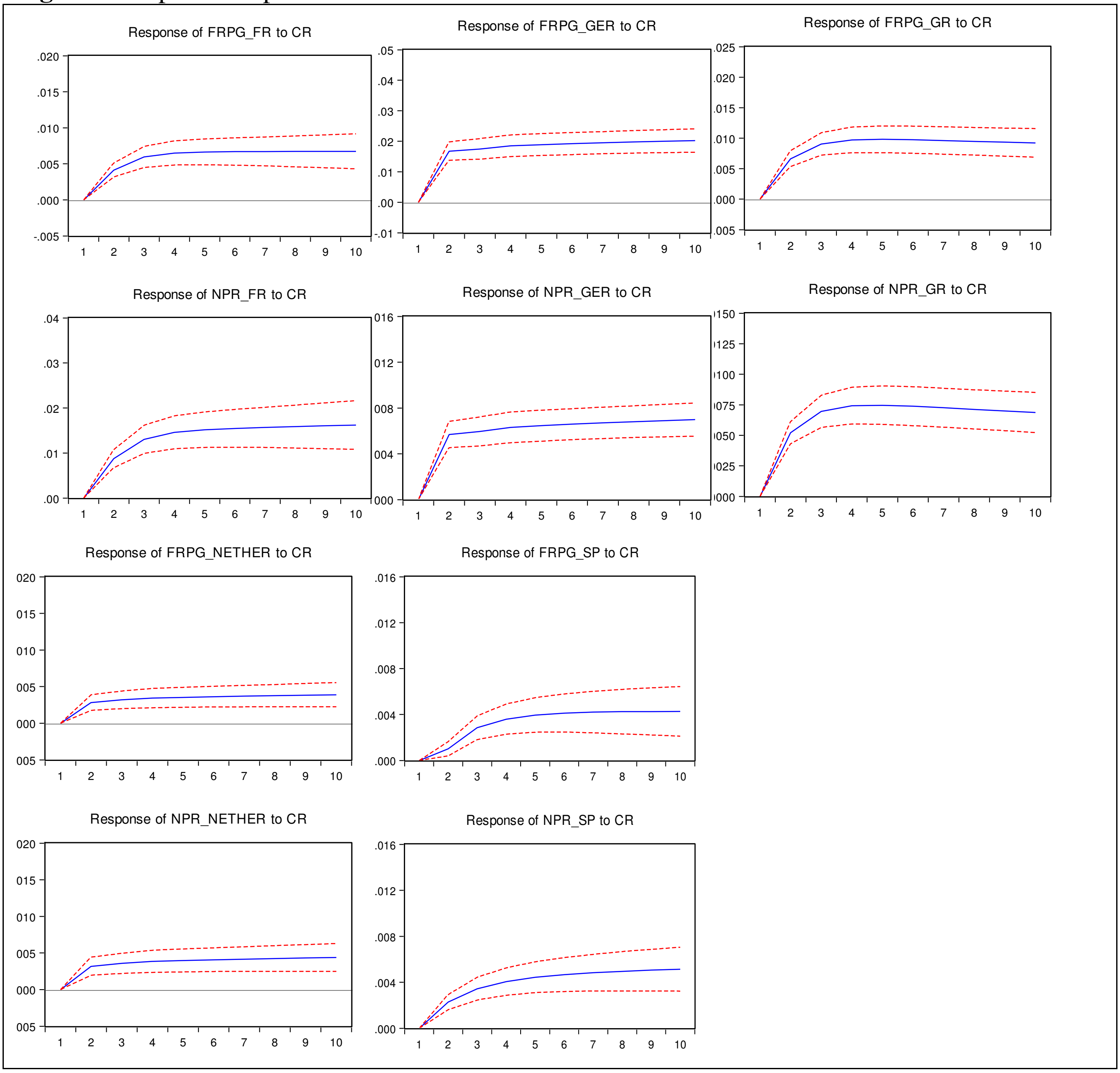
	Ireland	Italy	Netherlands	Portugal	Spain	UK
Panel A – Pre tax model						
Intercept	0.00	-0.00	0.00**	0.00	0.01*	-0.00*
$\Delta NPR_{\tau-1}$	0.01	-	-	-	0.54*	0.32*
$ECMP_{\tau-1}$	0.06	-0.03	-0.31*	0.02	-0.30*	0.05
$ECMN_{\tau-1}$	0.25**	0.10	0.06	0.03	-0.27*	-0.38*
ΔCRP_{τ}	-0.04	0.12*	0.14*	-0.00	-0.01	0.08*
ΔCRN_{τ}	0.03	0.12*	0.17*	0.05**	0.09*	0.05***
$\Delta EXRP_{\tau}$	0.11	-0.03	0.04	0.01	-0.02	-0.01
$\Delta EXRN_{\tau}$	-0.00	-0.02	0.03	0.07	0.03	-0.15
Diagnostics						
Adjusted R-squared	0.45	0.29	0.28	0.44	0.24	0.10
St. error of regression	0.02	0.01	0.01	0.01	0.01	0.02
Symmetry testing						
H_0: $\lambda^+ = \lambda^-$	1.30 (0.20)	1.00 (0.32)	3.45* (0.00)	0.007 (0.95)	0.45 (0.65)	5.19* (0.00)
H_0: $\alpha^+ = \alpha^-$	1.49 (0.14)	0.00 (0.99)	0.68 (0.50)	1.45 (0.15)	4.06* (0.00)	0.64 (0.52)
H_0: $b^+ = b^-$	1.05 (0.29)	0.44 (0.66)	0.10 (0.92)	0.45 (0.65)	0.56 (0.58)	0.74 (0.46)
H_0: $\alpha^+ = \alpha^- = \beta^+ = \beta^- = 0$	1.30 (0.20)	1.00 (0.32)	3.45* (0.00)	0.007 (0.95)	0.45 (0.65)	5.19* (0.00)
Panel B – Post tax model						
Intercept	0.003	0.001	0.004**	0.004	-0.000	0.003
$\Delta FRPG_{\tau-1}$	-	-	0.213*	-	0.559*	-
$ECMP_{\tau-1}$	-0.052	0.134	-0.600*	0.016	-0.532*	0.057
$ECMN_{\tau-1}$	0.010	0.067	-0.251*	0.013	-0.332*	-0.156**
ΔCRP_{τ}	-0.035	0.194*	0.338*	-0.041	0.237*	0.044
ΔCRN_{τ}	0.088***	0.245*	0.390*	0.111**	0.199*	0.204*
$\Delta EXRP_{\tau}$	0.063	-0.019	0.038	-0.014	0.079	-0.333
$\Delta EXRN_{\tau}$	-0.001	0.015	0.162	0.121	-0.070	0.155
Diagnostics						
Adjusted R-squared	0.41	0.26	0.32	0.51	0.40	0.30
S.E of regression	0.00	0.02	0.02	0.00	0.02	0.03
Symmetry testing						
H_0: $\lambda^+ = \lambda^-$	0.74 (0.46)	0.41 (0.68)	3.33* (0.00)	0.03 (0.97)	1.90** (0.05)	1.84 (0.07)
H_0: $\alpha^+ = \alpha^-$	1.45 (0.15)	0.93 (0.36)	0.86 (0.39)	1.70 (0.09)	0.99 (0.32)	1.75 (0.08)
H_0: $b^+ = b^-$	0.53 (0.60)	0.17 (0.87)	0.53 (0.59)	0.39 (0.69)	1.02 (0.31)	1.33 (0.18)
H_0: $\alpha^+ = \alpha^- = \beta^+ = \beta^- = 0$	0.97 (0.41)	4.07* (0.01)	4.84* (0.00)	1.03 (0.38)	7.39* (0.00)	3.61* (0.01)

***, **, * Significant at *0.10, 0.05* and *0.01* respectively. P-values are in parentheses.

To analyze more fully the asymmetric price adjustment in the five EU countries (France, Germany, Greece, Netherlands and Spain), we examine the impulse response functions of pre and post tax retail prices to a one standard deviation shock in crude oil prices (Figure 1). The estimation results do indicate that pre-tax prices (*NPR*) tend to respond faster to an increase in crude oil prices than the final gasoline prices (*FRPG*). However, the response difference becomes statistically insignificant as the retail price adjustment goes into the fifth week and beyond. This finding is in alignment with the study of Greenwood-Nimmo and Shin (2013) suggesting that oligopolistically competitive firms in the five EU countries may exploit tax legislation to conceal rent-seeking behaviour. Another possible explanations for the existence of asymmetric gasoline price movements in these countries are related with the oligopolistic pricing behaviour (Radchenko, 2005)and the nonlinear consumer search effort (Johnson, 2002).

Lastly, except for the possible exercise of market power describe above, asymmetries in the gasoline market are likely to be the outcome of other market parameters. As such, policies to suppress asymmetric price movements are not likely to have the anticipated results (Polemis, 2012). The best policy in order to protect consumers from welfare loss concerns the implementation of regulatory and behavioural measures as well. In addition, in some of these EU markets (i.e Spain and Greece) a further opening of the gasoline industry to new entrants such as hypermarkets or big retail stores will enhance the level of competition. In these countries, the removal of certain legal or technical barriers (i.e absence of vertical integration, the establishment of new filling stations, etc) will further suppress the asymmetric gasoline price adjustment.[2]

Figure 1: Impulse Response Functions



Note: Each row of the diagram shows the response of final (FRPG) and net (NPR) retail price to a one standard deviation shock of the crude oil price (CR). FR = France, GER = Germany, GR = Greece, NETHER = Netherlands and SP = Spain. The dotted lines display the corresponding 95% confidence bounds.

[2] Regarding Spain see for example Jiminez and Perdiguero (2012).

4. Conclusions

Using the DOLS framework, we have found strong evidence suggesting the validity of the "*rockets and feathers*" hypothesis in five out of twelve EU countries. Particularly, we infer that in the post tax model the hypothesis of long-run symmetric adjustment speeds cannot be rejected in seven out of twelve EU countries (except from France, Germany, Greece, Netherlands and Spain). This finding indicates that in these countries consumers are somewhat insulated from fluctuations in the crude oil market leaving no room for a long-run rent-seeking behaviour. Similarly, when we test for short-run asymmetries (price and exchange rate) the null hypothesis (*Ho:* $\alpha^{+} = \alpha^{-}$ and $b^{+} = b^{-}$ respectively) cannot be rejected in all of the sample countries suggesting the existence of symmetric adjustment speeds in the short-run

To analyze more fully the asymmetric price adjustment in the five EU countries, we examine the impulse response functions of pre and post tax retail prices to a one standard deviation shock in crude oil prices. The estimation results indicate that pre-tax prices tend to respond faster to an increase in crude oil prices than the final gasoline prices. However, the response difference becomes statistically insignificant as the retail price adjustment goes into the fifth week and beyond. We infer that this pattern infers a rent-seeking oligopolistic behaviour by the marketers. The oligopolistic structure of the local gasoline markets along with crude oil volatility triggers the price asymmetric adjustment path. In order to tackle with possible gasoline asymmetric adjustment speed, the policy makers and the government officials must pursue policies aimed at the implementation of a stable regulatory regime. For this reason, a further opening of the gasoline industry to new entrants such as hypermarkets or big retail stores in countries with significant market power (Greece and Spain) will allow competition forces to be fully implemented. In these countries, the removal of certain legal or technical barriers will further suppress the asymmetric gasoline price adjustment.

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