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Dynamic pricing in the spanish gasoline market: A tacit collusion equilibrium

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ABSTRACT

During the last twenty years, the Spanish petrol market has undergone an intensive restructuration process; it has changed from being a state-owned monopoly to total liberalization and privatization. This liberalization process was accompanied by measures that facilitated the creation of a ''national champion,'' the Repsol Group, which is a huge, vertically integrated company with a high market share in all the industry's segments. Using a dynamic model, this paper analyses whether the prices established by companies in the Spanish gasoline market, after the restructuration process, fits with a tacit collusion equilibrium. The empirical results show that a strategic behaviour of companies occurs and is compatible with a tacit collusion price strategy. So, the restructuration process does not seem to have introduced effective competition into the Spanish gasoline market.

1. Introduction

In the last twenty-five years, the Spanish petrol market has undergone an intensive restructuration process typified by the liberalization and privatization of all its segments. In a little over two decades, the Spanish oil sector has gone from being a state-owned monopoly to being completely liberalized. As Correljé (1990) pointed out, the trigger for this restructuration process was Spain wanting to join the European Community (EC), and this forced the opening of its markets to competition. However, the measures introduced were not directed exclusively towards creating competition in the sector, because they also brought about the setting up of a huge Spanish company known as a "national champion".

With respect to the retail petrol commercialization segment, the principal measures aimed at introducing competition into the market began in 1985 with the 5/1985 Royal Decree. This law made it possible to set up a parallel network of service stations, which were not state controlled, to eliminate administrative prices and replace them with a price cap regulation. The later 4/1988 and 4/1991 Royal Decrees brought in measures to reduce the minimum distances between petrol stations, with the intention of maximizing the parallel petrol station network and thus increasing the competition.

After 1992, the impetus to liberalize became stronger and stronger. The 34/1992 law passed on 22 December, which aimed to eliminate the oil monopolies, recognized the freedom of business activity in all the market segments. The elimination of minimum distances between petrol stations came in 1995, the liberalization of final diesel prices in 1996 and petrol prices in 1998, and the granting of free access by third parties to the oil product logistical network in 1998. Finally, the opening up of the CLH Group (a hydrocarbon logistics company) to capital funds in 2000 completed the liberalization process and the introduction of competitive policies.

However, parallel to the introduction of competitive policies were measures to facilitate the creation of a ''national champion'' that would dominate the market.[2] To achieve this, a huge, vertically integrated company funded by Spanish capital, and with a huge market share in all segments, was established. The Royal Decree 4/1991 of 29 November established that the monopolistic company's assets, which up until that time had been CAMPSA, should be divided among the three companies with refining capacity in Spain; this division was in accordance with the track records of their market quotas. This meant that Repsol, which owned five refineries, received 58% of the nation's

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[2] This is not unique to the petrol market because, as Arocena (2006) demonstrates, it applies to the whole energy sector.

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service stations, as well as the same percentage of the CLH Group's capital. Repsol underwent various partial privatization processes before becoming fully privatized in 1997. Consequently, concentration and a high degree of vertical integration are two characteristics of the Spanish petrol market. One important aspect of the vertical integration, which needs to be emphasized, is that it allowed the big oil companies to either directly or indirectly fix the final price in a high percentage of the service stations.[3] This means that there are a drastically reduced number of agents that fix the market prices, and this facilitates collusive agreements.

After the restructuration, the market was heavily liberalized in terms of free entry, location and prices. This permitted new operators to enter, which brought about competition and an improvement in social welfare. However, the presence of Repsol, a huge company funded with Spanish capital, which dominates all the market segments, may impede the effective development of competition significantly. This article's main objective is to analyse whether the restructuration process has effectively culminated in competitive prices, or whether tacit collusion leading to over pricing has occurred. The small number of agents are not the only feature of the Spanish gasoline market that facilitates collusive agreements. Following the study by Ivaldi et al. (2003), the Spanish gasoline market meets virtually all the features that facilitate collusive agreements. These features are specifically:

- The existence of entry barriers, both legal and economic
- A high frequency of interaction between the players as they are in the market every day
- A very transparent market because prices are publicly available through the website of the Ministry of Industry, Tourism and Trade
- The presence of a mature market without significant innovation processes
- Symmetry in the cost structure of service stations, as their main cost, the price of crude, is identical for all operators
- The existence of multimarket contact because companies are present in all areas in Spain
- Presence of a highly inelastic demand
- Lack of purchasing power by consumers
- The presence of a common cooperation project by the majority of agents within the hydrocarbon transport company CLH
- Lack of an operator with a radically different cost structure that can act as a "maverick"

Obviously, the Spanish gasoline market does not meet absolutely all features that facilitate collusive agreements. For example, the presence of cycles in the demand makes it difficult to maintain collusive agreements. I used just this feature to test the presence of tacit collusion equilibrium in the Spanish gasoline market. The other feature that does not meet in the Spanish gasoline market is the presence of some horizontal differentiation. However, as indicated by Ivaldi et al. (2003), horizontal differentiation has an ambiguous impact on the ease of achieving and maintaining collusive agreements. Finally, the existence of asymmetries in the capacity constraints makes it more difficult to sustain collusive agreements. You might assume that larger firms are better able to supply its service stations, although the capacity of the pump is very low and similar between different operators. We are, therefore, facing a market that meets the vast majority of the features that make achieving and maintaining collusive arrangements in the market.

Despite previous analyses of price behaviour in the Spanish petrol market, dynamic methodology has not been used. However, according to Hosken et al. (2008), this approach is necessary to understand the extent of price evolution, and has been adopted in our paper. The results should complement those already obtained for the Spanish market. Contín et al. 1999 show that the evolution of prices after the restructuring process does not fit in a fully competitive market, and Contín et al. (2001) show that the CLH's monopoly can be an obstacle to the development of competition. Regarding the analysis of vertical relationships, Bello and Cavero (2008) show that vertical integration leads to lower final prices, while Contín et al. (2008 and 2009) show that the prices of diesel and petrol move symmetrically with respect to the international price of Rotterdam.

Taking into account the previous empirical results and this, we have a complete picture of the evolution and characteristics of prices in the Spanish petrol market after the intensive restructuration. This may serve as experience for other countries and other energy sectors that have yet to initiate such reforms. A second finding of this article is the empirical evidence for the dynamic model implemented by Borenstein and Shepard (1996) for a European country. Following on from the disparate results obtained by Borenstein and Shepard (1996), and by Hosken et al. (2008) for the North American market, this article now provides empirical evidence for the adaptation of this model to the price dynamics of a European market, such as Spain.

The paper has the following structure. Section 2 presents the dynamic price model and Section 3 the data used in the study. Section 4 shows the empirical model and Section 5 presents the results obtained. Finally, Section 6 analyses the main conclusions of the article.

2. Dynamic price model

Many authors have pointed out the difficulty of indicating whether or not there is collusion by observing only the variables of cost, price and current demand. This is the case largely due to the fact that non-cooperative behaviour can be compatible with diverse price patterns. However, dynamic price models have established relationships that make it possible for us to establish company behaviour more consistently.

Green and Porter (1984) make an interesting attempt to explain company behaviour using dynamic models. In this theoretical model, the authors consider that the companies have imperfect information, and when a certain variable that affects them (normally profits or quantity sell) falls to a certain level, they respond with a price war against their competitors. This is the case because companies do not know whether the fall in their variable is due to normal market conditions or whether, on the other hand, one of their rivals has broken the collusion agreement. This means that the best response for the company is to punish their competitors with a price war. Thus, the collusion is more difficult to maintain when the demand is low. We have discounted the empirical application of this model, as companies in the Spanish fuel sector know each other very well and have large amounts of information.

Rotemberg and Saloner (1986) later put forward a model in which companies adjust their margins in the present as a result of positive demand shocks. In this model, stages of high demand are due to identical and independently distributed demand shocks during which companies have a strong incentive to leave the collusion. As the demand shocks occur identically and are independently distributed, current demand will have no effect

[3] The big companies either own the petrol stations and fix the prices directly, or have exclusive supply contracts and recommend or fix the final price indirectly. For a more detailed analysis of the vertical relationship in the Spanish petrol market, see Bello and Cavero (2007 and 2008) and Perdiguero and Borrell (2008).

on expected future demand and expected penalties will remain constant. This means that, in periods of high demand, collusion can be maintained only by reducing the profit from leaving, that is, by reducing margin. This model is different from Green and Porter (1984)'s model, where it is more difficult to maintain the collusion when the demand is low.

We consider Haltiwanger and Harrington (1991)'s model to be more appropriate. This model is a reformulation of the one designed by Rotemberg and Saloner (1986), introducing a determinist demand cycle. We believe this because, in our market, it is easy to detect a deviation in the price, which is public, and to respond rapidly at almost no cost. In addition, demand has a strong seasonal component and no unexpected demand shocks are observed. As we can see in Fig. 1, the volume rises from the annual minimum in January to August and then falls until December.

This model supposes that there are N symmetrical companies and that each of them produces

$$q_{it} = \frac{1}{N} Q_t \tag{1}$$

Where Q_t is the total amount by the industry at time t. Therefore,

$$Q_t = \sum_{i=1}^{N} q_{it} \tag{2}$$

In this case, the function for profits for each company will be given by

$$\Pi_{it} = (p_t q_{it}) - (c q_{it}) \tag{3}$$

That is

$$\Pi_{it} = (p_t - c) q_{it} \tag{4}$$

Let us assume that the amount sold by each company will depend on the price applied and on the current point in the cycle

$$q_{it} = \frac{Q_t(p_t(t); t)}{n} \tag{5}$$

So the function for company profits would end up as follows:

$$\Pi_{it} = (p_t(t) - c)\left(\frac{Q_t(p_t(t); t)}{n}\right) \tag{6}$$

The model developed by Haltiwanger and Harrington considers that the penalty, should any company leave, will last for an infinite period of time. Hence, the company will compare the benefits it will obtain from the collusive agreement, from time τ until infinity, with τ being the time when the penalty for leaving would begin, updated by a discount rate δ, with the profits it would obtain at time t if it left. This type of model becomes more difficult to maintain as the number of companies in collusion increases. We might think that this type of model would not fit into a petrol market, where there are thousands of petrol stations. We must clarify that, despite the existence of a large number of points of sale, the vast majority of prices are directly or indirectly fixed by a limited number of large companies. This is especially true in the Spanish gasoline market, as already mentioned, which has a high vertical integration.

The model shows that companies will maintain the collusion price only if the profits expected from the collusion – which the company would lose if it left – are greater that the profits that the company would obtain if it left. The model assumes that, if it left, the company would supply all market demands. For the collusive agreement not to be broken, therefore, the following must be true:

$$p_t(t) \equiv \sum_{\tau=t+1}^{\infty} \delta^{\tau-t}\left[p_t(\tau) - c)\left(\frac{Qt(p_t(\tau); \tau)}{n}\right)\right] \geq (n-1)(p_t(t) - c)\left(\frac{Qt(p_t(t); t)}{n}\right) \tag{7}$$

That is, the benefits that firms achieve from jointly maximizing the profits of the industry in each of the periods actualized to time t (the left side of the equation) must be greater than the benefit that the company obtains for set a lower price and cover the entire market during a period (the right side of the equation).

If we assume, as in our case, that the penalty for leaving occurs only in the next period—that is, if we assume that $\tau = t+1$, then we will have

$$p_t(t) \equiv \delta\left[(p_t(t+1) - c)\left(\frac{Qt(p_t(t+1); t+1)}{n}\right)\right] \geq (n-1)(p_t(t) - c)\left(\frac{Qt(p_t(t); t)}{n}\right) \tag{8}$$

Haltiwanger's and Harrington's model assumes that marginal costs remain constant over time. If we allow the marginal cost to vary over time, we can see how our equilibrium equation takes on the following form:

$$p_t(t) \equiv \delta\left[(p_t(t+1) - c(t+1))\left(\frac{Qt(p_t(t+1); t+1)}{n}\right)\right] \geq (n-1)(p_t(t) - c(t))\left(\frac{Qt(p_t(t); t)}{n}\right) \tag{9}$$

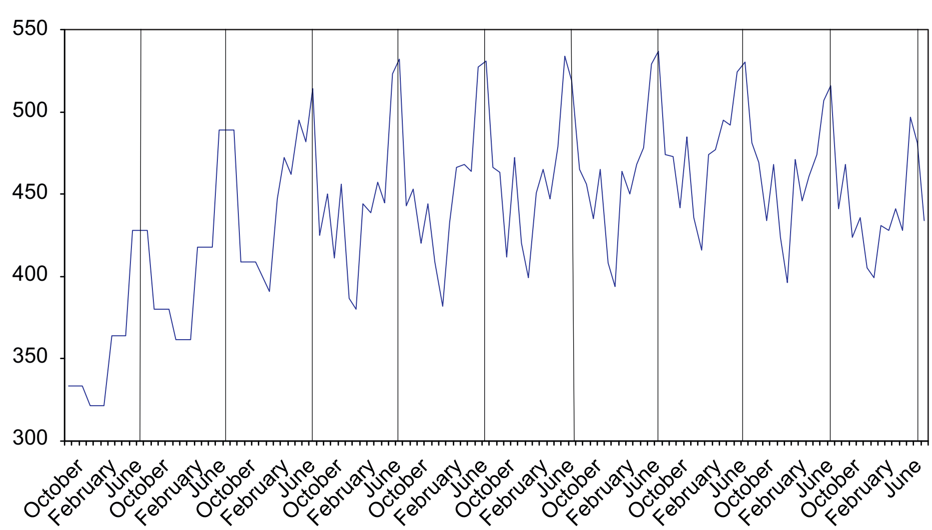

Fig. 1. Monthly sales of unleaded 95 gasoline in the Spanish market. (Thousands of cubic meters). Source: CORES, own elaboration.

It can be seen that, if we expect that $Qt(p_t(t+1);t+1)/n$ to be greater than $Qt(p_t(t);t)/n$, the first term in the equation will be larger, and so we can increase $p_t(t)$ without breaking the collusive equilibrium equation. A positive relationship can be seen, therefore, between expected demand and the current price. On the other hand, if we expect $c(t+1)$ to be greater than $c(t)$, the first term in the equation will be smaller, and so we must reduce $p_t(t)$ in order to continue to comply with it. We will see, therefore, a negative relationship between expected costs and the current price.

What emerges from the theoretical model, and what we subsequently demonstrate empirically, is that there is a positive relationship between a current margin and the demand expectations, and a negative relationship between a current margin and the cost expectations.

3. Data

For the empirical analysis, we used data on retail prices, the spot price of gasoline and demand for gasoline, as well as the price of Texas crude oil. We calculated the variable "margin" as the retail price (sale price to the public), minus the spot price of gasoline.

The retail price is the price paid by consumers at service stations. We have the monthly average for each Spanish region from October 1998 to September 2008. These data have been extracted from the Monthly Price Reports published monthly by the CNE, the Spanish energy commission. Specifically, we will use the average price of unleaded gasoline 95, the main gasoline consumed by domestic users. These prices have been transformed to remove both national state taxes and those added in recent years by some regional governments.

The spot price of gasoline and the price of crude oil have been extracted from OPEC's annual reports. Specifically, we have chosen the monthly average quoted Rotterdam spot price for premium unleaded gasoline and Texas-type crude oil for the same period, as mentioned above. As the Rotterdam spot price and Texas-type crude oil price are quoted in dollars, we have transformed these prices using the average dollar/euro exchange rate for each of these months. This information has been extracted from the European Central Bank. However, it would not be right for us to attribute the same marginal cost for all regions, as there are differences in transport costs. It seems obvious that regions near to refineries, those situated on the coast (where there are alternatives to pipeline transportation) and principally regions with a better pipeline connection, will have a lower transport cost.

To attempt to reflect this variation in costs, we will modify the spot price of gasoline with the transport cost charged by CLH to the retail companies. It should be remembered that this price is fixed freely. We have obtained these prices from the CNE website.

Concerning the amount of demand, we have the quantity of unleaded 95 for each region for every month of the period mentioned above. These data have been extracted from the Boletín de Hidrocarburos, a publication issued monthly by the CORES, a public body charged with overseeing the level of reserves. As we can see in graph 1, the amount sold follows the same seasonal pattern as observed in other places, as we can see in Borenstein and Shepard (1996) for the United States. The volume rises from the annual minimum in January to August (where it has its annual maximum) and then falls until December.

This pattern is followed by all the regions, although with a different rate of change. This last aspect makes us think that it is more than likely there is heteroscedasticity in our estimate.

The impossibility of obtaining the prices charged to the retail sales companies by the refineries is a limitation in our study. However, it must be pointed out that even if we knew the wholesale price, we could not state that the margin found was the real economic margin, as we would not be taking into account aspects such as the opportunity cost and the wholesale labour costs. In addition, for companies that are vertically integrated, this wholesale price may not reflect the true economic price, as taxation aspects would come into play, with attempts to minimize tax payments. This could distort our analysis greatly. Because of all this and due to the fact that our objective is not to measure the margin but rather the changes it undergoes, the aggregate margin we have calculated could be highly valid for the objective of this study.

Although the model assumptions are at firm level, we can test these hypotheses using data at the aggregate level. The model assumes that there are N symmetric firms as hypotheses derived at firm level are maintained perfectly to pass at the aggregate level. The existences of asymmetric firms only hamper the ease of maintaining collusive agreements but under any circumstances invalidate the hypotheses derived from the theoretical model.

4. Empirical model

As we have already indicated, the empirical analysis is intended to observe the effects of expected demand and cost on current margins. In order to be able to carry out this analysis, we will be obliged to make predictions on both expected demand and gasoline spot price.

In order to predict the quantity sold, we assume that the companies carry out their expectations based on the previous and current information about the quantities sold. As we have observed, the quantity sold by the market has a marked cyclical component, although it is affected by the price levels set by the companies. As the quantity sold may vary widely from one region to another, the expectations of demand are carried out on a region-by-region basis. After taking the aforementioned factors into account, we present the following prediction of demand for the region i:

$$q_{it} = a_0 + a_1 q_{it-1} + a_2 p_{it-1} + a_3 cicle_j + a_4 time_j + \xi_{it} \tag{10}$$

Where q_{it} and q_{it-1} represent the amount sold at time t and $t-1$, the variable p_{it-1} represents the public sale price at services stations at time $t-1$. The variable $cicle_j$ is a dummy variable that takes the value 1 in the months from January to August and zero otherwise, and the variable $time_j$ is a variable that grows every period. For nearly all regions, the R^2 of these predicting equations is between 0.65 and 0.75. The variable q_{it+1} is the fitted values from estimating [10].

With respect to wholesale prices expectations, we consider the evolution of the wholesale prices for crude oil in the preceding periods to be a good indicator of what the level will be in the next period. We use the Texan crude oil rates, rather than the European market, to avoid any endogenous problems that any intrinsic shock within the European market might cause. The spot gasoline price prediction equation would be, therefore

$$pricespot_t = b_0 + b_1 crudeUSA_{t-1} + b_2 crudeUSA_{t-2} + b_3 crudeUSA_{t-3} + b_4 cicle_j + \eta_{it} \tag{11}$$

Where the variable $pricespot_t$ is quoted for spot price of gasoline in the period t, and the variables $crudeUSA_{t-1}$, $crudeUSA_{t-2}$ and $crudeUSA_{t-3}$ are the quoted price for Texas-type crude at time $t-1$, $t-2$ and $t-3$. As in the previous equation, the variable $cicle_j$ is a dummy variable that takes the value 1 in the months from January to August, and zero otherwise. Equation [11] applies to all the regions, since the international wholesale price is the same for all geographical regions. The R^2 of this regression is

0.92. The fitted value from this regression is the expected wholesale price for the period.

Once we have the equations for predicting the volume of demand and the spot price of gasoline, we can begin to observe the relationship between these variables and margin. A first, simple specification would be given by the following equation[4]:

$$margin_{it} = \alpha_1 q_{it} + \alpha_2 q_{it+1} + \alpha_3 pricespot_t + \alpha_4 pricespot_{t+1} + \alpha_5 \Delta pricespot_t + \varepsilon_{it} \tag{12}$$

Where $\Delta X_t = X_t - X_{t-1}$. The variable q_{it+1} is the expected demand for the next period and $pricespot_{t+1}$ is the expected spot price of gasoline.

An important issue that these models deal with, and which we must incorporate into our model, is the possibility that there may be temporary asymmetries in the change in retail prices. The results in the literature are ambiguous, as we have come across many studies that have found asymmetries (Borenstein et al., 1995, Dufy-Deno, 1996, Grasso and Manera 2007) as articles with a contrary result (Godby et al., 2000, Bachmeier and Griffin, 2003). In fact, the econometric analyses carried out for the Spanish market by Contín et al. (2008 and 2009) show symmetrical behaviour with respect to the international wholesale price movements. Our model should, therefore, admit these asymmetries in order to see whether they actually happen in the Spanish market.

To do this, we use the same VAR model as Borenstein and Shepard (1996)[5]:

$$\begin{aligned} margin_{it} &= \alpha_1 q_{it} + \alpha_2 q_{it+1} + \alpha_3 pricespot_{t+1} + \beta_1 \Delta preciospot_t^+ \\ &+ \beta_2 \Delta preciospot_t^- + \beta_3 \Delta preciospot_{t-1}^+ + \beta_4 \Delta preciospot_{t-1}^- + \beta_5 \Delta preciospot_{t-2}^+ \\ &+ \beta_6 \Delta preciospot_{t-2}^- + \beta_7 \Delta price_{t-1}^+ + \beta_8 \Delta price_{t-1}^- + \beta_9 \Delta price_{t-2}^+ \\ &+ \beta_{10} \Delta price_{t-2}^- + \beta_{11} price_{t-1} + \beta_{12} pricespot_{t-1} + \gamma_{it} \end{aligned} \tag{13}$$

where $\Delta X_t = X_t - X_{t-1}$, and where the superscripts + and − indicate whether the variations are positive or negative. We have not introduced previous periods into the change in spot gasoline price variable, as it seems unlikely that the change in the spot price of gasoline would take more than two months to feed into the retail price. The inclusion of the variables with a further delay did not appear to be significant, since the main results of the model were unaltered.[6]

Both the reduced model and this latest expanded model we have just presented include variables, which we consider to be endogenous. We consider the expected demand, the current demand, the spot price of gasoline and the expected spot price to be obviously endogenous, otherwise the estimate by OLS would not be consistent and they would be biased. Because of this, we will make an estimate of least squared at two stages, using instrumental variables. The existence of heteroscedasticity seems probable, but the results presented are robust given its presence in the errors.

5. Results

The estimates for the two models can be seen in Table 1.

The specification (1) corresponds to the specification set out in Section 4. In this specification, we assume that the expectations of the companies follow trends. To check the robustness of the analysis in the specification (2), I assume that such expectations are adaptive, while in specification (3), I assume they are rations. As you can see, the results are not modified significantly.The Hansen J statistic shows that the instruments are valid. In addition, the Hausman test indicates at 1%, as we suspected, that it is preferable to use fixed effects.

As we can see, the signs of the variables for market expectations are the expected ones, both with the reduced model and the expanded model. These results are significant at 1%. It seems, therefore, that we can see empirical evidence of companies' strategic behaviour and that this behaviour coincides with a strategy of tacit price collusion. As noted in Borenstein and Shepard (1996), if firms compete in Bertrand or Cournot in a single period, then there would be no significant relationship between the margins at the time *t* and the expected demand and costs. Competitive equilibria subject to competition in more than one period are "customer loyalty" and "inventory theory". However, these two explanations appear not to be supported by the data.

Concerning customer loyalty, it is true that companies may have an incentive to take future conditions into account in current decisions. Let us imagine, for example, that a reduction in costs is expected, leading consumers prefer to buy in the future rather than in the present, even though future purchases would take place in the same service station because of the consumer's loyalty to that service station. In this case, the service stations (and their supplier) would have an incentive to win new customers now, which would lead them to cut their price and, therefore, to cut their margin. Customer loyalty theory would indicate that the margin would move in the same direction as cost expectations (positive sign) and in the opposite direction to demand expectations (negative sign). As we will see in the econometric results obtained, the customer loyalty theory is not supported by these results.

Concerning inventory theory, the standard models tell us that a company that expects rising (falling) demand in the next period will increase (reduce) its inventory capacity in the current period. It must be pointed out that service stations have a very low inventory capacity and are limited to receiving a new fuel delivery every few days. The existence of any significant inventory effect must, therefore, come from the wholesale companies. If the refineries increase their purchasing in the present to anticipate expected higher demand, the price should increase, and if this increase is not fully passed on to final prices (something that seems very probable), margin will be reduced. This would indicate us that the relationship between margin and demand expectations would be negative, which goes against our model and against the statistical results we will find. This theory is, therefore, also not supported by the empirical evidence, which strengthens our theory about tacit price collusion.

By the same token, the dynamics of the margin for the Spanish market do not appear to follow the evolution proposed by Maskin and Tirole (1988). As Hosken et al. (2008) point out, the theoretical model predicts that the margins should increase vigorously, followed by slight and gradual decreases, in order to grow rapidly again once the cycle has finished. As we can see in Fig. 2, the margin for the Spanish petrol market does not appear to show this trend, since its variations are either the same or more important when rising than when falling; it also shows positive and negative alterations that do not correspond with the theoretical model by Maskin and Tirole (1988).

Although the empirical evidence does not seem to fit with the model of Maskin and Tirole (1988), it is perfectly compatible with the notion that a market leader may set the pace for the dynamic evolution of the tacit price collusion. Despite the theoretical model shown in Section 2, assuming the existence of *N* symmetric

[4] Like in Borenstein and Shepard (1996) in this and the following estimation equations, we suppress the constant term, which is absorbed by city and time-fixed effects.

[5] See Borenstein and Shepard (1996) for a detailed explanation of the development of this model.

[6] Both equations have been estimated in differences and the results are not significantly altered.

Table 1
Econometric results by two steps least squares (2LS) (dependent variable: margin; number of observations = 1920).

	Equation 12 (1)	(2)	(3)	Equation 13 (1)	(2)	(3)
q_{it}	−0.594***	−1.053***	−0.121***	−0.397***	−0.447***	-0.104***
	(0.136)	(0.345)	(0.026)	(0.100)	(0.162)	(0.028)
q_{it+1}	**0.597*** **	**1.056*** **	**0.123*** **	**0.397*** **	**0.447*** **	**0.140*** **
	(0.136)	**(0.344)**	**(0.026)**	**(0.100)**	**(0.161)**	**(0.028)**
$pricespot_t$	0.480***	0.725***	0.168***			
	(0.096)	(0.211)	(0.051)			
$pricespot_{t+1}$	**−0.401*** **	**−0.620*** **	**−0.083* **	**−0.540*** **	**−0.565*** **	**-0.572*** **
	(0.098)	**(0.205)**	**(0.051)**	**(0.088)**	**(0.115)**	**(0.058)**
$\Delta pricespot_t$	−0.972***	−1.203***	−0.657***			
	(0.093)	(0.200)	(0.021)			
$\Delta pricespot_t^+$				−0.534***	−0.549***	-0.508***
				(0.036)	(0.038)	(0.032)
$\Delta pricespot_{t-1}^+$				0.367***	0.364***	0.372***
				(0.078)	(0.084)	(0.047)
$\Delta pricespot_{t-2}^+$				0.163**	0.164**	0.076
				(0.067)	(0.078)	(0.052)
$\Delta pricespot_t^-$				−0.387***	−0.372***	-0.364***
				(0.040)	(0.044)	(0.037)
$\Delta pricespot_{t-1}^-$				0.719***	0.727***	0.683***
				(0.071)	(0.082)	(0.044)
$\Delta pricespot_{t-2}^-$				0.143***	0.144**	0.190***
				(0.053)	(0.058)	(0.047)
$\Delta price_{t-1}^+$				−0.011	0.003	0.012
				(0.082)	(0.089)	(0.070)
$\Delta price_{t-2}^+$				−0.298***	−0.371***	-0.267***
				(0.069)	(0.082)	(0.056)
$\Delta price_{t-1}^-$				−0.339***	−0.349***	-0.323***
				(0.086)	(0.094)	(0.075)
$\Delta price_{t-2}^-$				−0.032	−0.025	-0.044
				(0.038)	(0.043)	(0.028)
$price_{t-1}$				1.080***	1.103***	1.096***
				(0.074)	(0.090)	(0.020)
$pricespot_{t-1}$				−0.548***	−0.530***	-0.531***
				(0.054)	(0.063)	(0.044)
Hansen J Statistic	25.600	15.441	84.731***	17.587	16.444	15.427
	(0.109)	(0.632)	(0.000)	(0.4153)	(0.4926)	(0.5648)

Fixed effects by autonomouscommunity and month not show in the table. Robust standard errors in brackets. *P*-Value (1%***, 5%**, and 10%*)
Endogenous variables: q_t, q_{t+1}, $pricespot_t$, and $pricespot_{t+1}$
Instruments: population_t, time_t, time_t^2, $\Delta\text{crudeUSA}_t$, and cicle_t, Region_i.

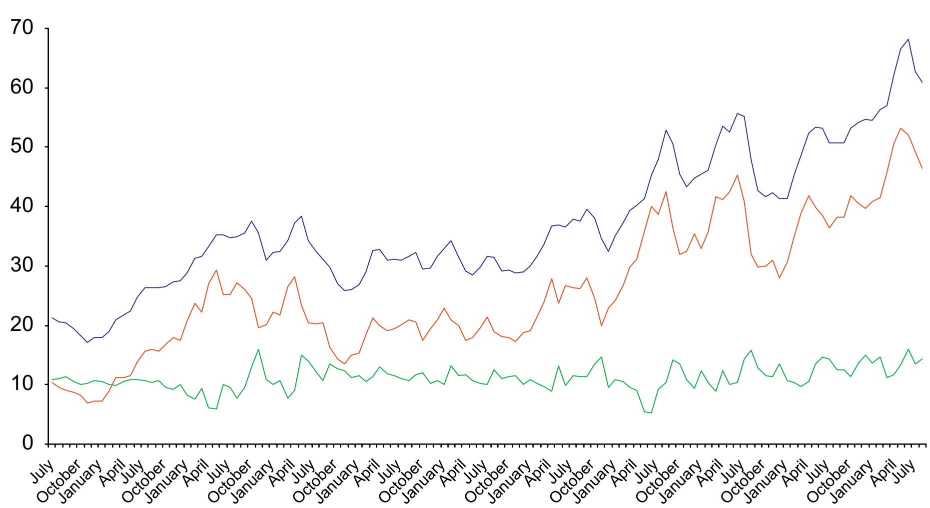

Fig. 2. Evolution of average final prices, Rotterdam spot prices and margins for the unleaded 95 gasoline in Spain. Source: Ministry of Industry, Tourinsm and Trade, own elaboration.

companies, the derived relationships are analogous if we assume there are *N* asymmetric companies. To do this, we need only to include the fact that the smaller companies have some type of limitation in covering the market, if the collusive agreement is broken; this factor may be capacity, which is highly likely for a small company. Regrettably, we do not have any individual data to prove empirically whether the pattern of collusive prices is achieved via a market leader.

With respect to the margin's possible asymmetrical absorption of the international wholesale price movements, the results seem to show rather symmetrical behaviour by the companies. Despite not being the best methodology to analyse possible price movement asymmetries, the results show that over half the variation is passed on to the prices during the first month, and within two months the whole amount has been transferred. In fact, the results show slightly positive asymmetry, which is to say that the decreases in the international spot rates for petrol are passed on slightly more rapidly than the increases. This may, in fact, be due to the regionally aggregated monthly data and to methodology that is not specific to this type of phenomenon. The only studies carried out using an error correction model for the Spanish market were by Contín et al. (2008 and 2009). The authors, using a multivariate error correction model over the period 1993–2004, conclude that diesel and gasoline retail prices respond symmetrically to increases and decreases in the wholesale prices.

6. Conclusions

In the last two decades, the Spanish petrol market has experienced a radical privatization and liberalization process. In less than twenty-five years, the market has passed from being a state-owned monopoly to complete liberalization and privatization, including all the industry's segments. Parallel to this liberalization process, which was brought about by Spain's desire to enter the European Community, were measures taken to create a ''national champion''. The result was Repsol, a huge, vertically integrated company funded with Spanish capital with a huge market share in all segments. Despite there already being empirical analyses of specific parts of the functioning of the Spanish petrol market; there is no empirical evidence as to whether the price dynamics of the aforementioned markets regulates itself or if there is tacit price collusion.

Using a dynamic model, we have been able to relate the current margin existing in the Spanish oil industry with expected demand and costs. The significant nature of variables in both estimates, together with the fact that the signs predicted by the theory have been obtained, leads us to conclude that strategic behaviour of companies in this market occurs and is compatible with a tacit collusion price strategy, in the case of unleaded gasoline, the main product consumed by domestic users. We have also obtained empirical evidence that there is symmetry in the absorption of changes in spot gasoline prices in the final price. Contín et al. (2008 and 2009) obtain the same result when examining the pricing behaviour of the Spanish retail gasoline market over the period 1993–2004.

So, in spite of the intensive liberalization process, the presence of a ''national champion'' with high market quotas in all segments does facilitate a collusive price equilibrium. The liberalization process has not achieved one of its main objectives, which was to establish effective competition in the Spanish petrol market.

Future research on the Spanish gasoline market could go in the direction of debate on mechanisms to increase the competition level. One possible reference could be the case of France, where the introduction of gas stations by the hypermarkets has led to a significant increase in competition and, consequently, a reduction in prices. It must be pointed out that this process of establishment by the hypermarkets in the retail section of gasoline distribution is still at a very early stage in Spain and we will perhaps have to wait quite a time before the effects on competition – and consequently on welfare – are significant.

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