CNC
COMISIÓN NACIONAL DE LA COMPETENCIA

REPORT MONITORING THE AUTOMOTIVE FUEL DISTRIBUTION MARKET IN SPAIN

June 2012

CONTENTS

EXECUTIVE SUMMARY 1

I. INTRODUCTION 3

II. COMPETITION INDICATORS IN THE AUTOMOTIVE FUEL MARKET IN SPAIN 6

II.1 EVOLUTION OF RETAIL PRICES OF AUTOMOTIVE FUELS 7

II.2 EVOLUTION OF DISTRIBUTION MARGINS FOR AUTOMOTIVE FUELS 12

II.3 FUEL RETAIL PRICE DISPERSION 15

III. ASYMMETRIES IN THE SPEED AT WHICH INTERNATIONAL PRICES ARE PASSED THROUGH TO RETAIL PRICES 24

III.1 PRESENTATION OF THE EMPIRICAL RESULTS 26

III.2 POSSIBLE CAUSES OF THE ASYMMETRIES IN THE PASS-THROUGH OF INTERNATIONAL PRICES TO RETAIL PRICES IN THE SPANISH AUTOMOTIVE FUEL MARKET 39

IV. CONCLUSIONS 42

CNC
COMISIÓN NACIONAL DE LA COMPETENCIA

REPORT MONITORING THE AUTOMOTIVE FUEL DISTRIBUTION MARKET IN SPAIN. "ROCKETS AND FEATHERS" IN SPAIN

EXECUTIVE SUMMARY

- The fuel sector in Spain was liberalised during the 1990s, although since then, there has been a still unclosed debate as to the degree of competition actually achieved. In this context, the Spanish antitrust authority, the Comisión Nacional de la Competencia (CNC), has issued diverse reports on this sector, the most recent ones in 2009 and 2011.
- The 2011 Report, titled *Follow-up Report on the CNC's Automotive Fuel Report*, sought, amongst other objectives, to assess the degree of compliance with the recommendations made in the previous report of 2009, study the recent evolution of the primary competition indicators in the sector and evaluate and revise the 2009 Report recommendations. Over the length of that Report, the CNC found that increases in international prices for automotive fuel may be passed through to prices at the pump more quickly and intensely than are the reductions in those international prices, a pricing asymmetry that is colloquially referred to as the "rockets and feathers" phenomenon and considered a possible sign of a less than competitive functioning of the market. The CNC therefore made a commitment to carry out a more in-depth analysis of this problem.
- Furthermore, on 30 September 2011 the CNC was tasked by the Government Executive Committee for Economic Affairs, through the State Secretary for Energy, with analysing, as a follow-up to its reports of 3 September 2009 and 9 March 2011, distribution margins for automotive 95 octane unleaded petrol and A-type diesel, along with the recent evolution of the market, specifically in the last week of September 2011.
- In view of the above, this Report primarily analyses two questions. First, the evolution of fuel prices and distribution margins in Spain during last year as well as the dispersion of retail prices, in order to have the elements needed to assess the degree of competition in the sector. Second, the Report provides empirical evidence that supports cogent conclusions regarding the existence of pricing asymmetries in Spain in the period 2005-2011 and evaluates the possible causes of this phenomenon. The Report therefore makes several conclusions:
- **In the first place**, the evolution of the automotive fuel market in Spain during 2011 shows that prices and margins in the country continue to rank amongst the highest in the EU and above those recorded in comparably sized economies, a finding compatible with a lower level of competition throughout the entire marketing chain.

- **Second**, the provincial analysis shows there is a direct relation between retail supplyside concentration (service stations) and the average pre-tax prices in the province, an issue that will be dealt with in greater detail in the in-depth study of the structure of the Spanish fuel market that is currently being carried out by the CNC.
- **Third**, the results obtained in the analysis of the Spanish fuel market show there are asymmetries in the speed of adjustments of domestic retail prices to changes in international fuel prices, quite clearly for 95 octane unleaded petrol (GNA) and more weakly for A-type diesel (GOA). The asymmetries mean that when international fuel prices increase, domestic service station pre-tax prices react more rapidly than when those international prices decrease. This asymmetry has harmful effects for consumers, as they do not benefit quickly from falls in international prices, but do see the prices they pay climb faster when international prices rise.
- **Fourth**, collusion, whether tacit or explicit, is one possible explanation of this phenomenon, though not the only one. The existence of asymmetries in the adjustment of national retail prices does not on its own imply operators are engaging in conducts contrary to competition law. Some of the explanations found in economics theory for the rockets and feathers problem apply to the Spanish case and to the results obtained in the analysis. In any event, these explanations are associated with markets where effective competition is weak and in which consumers consequently fare worse than would be expected in a more competitive market, which justifies the search for actions aimed at removing certain elements identified in the CNC report of September 2009 that act as barriers for introducing competition in this sector.
- **Fifth**, all of the above heightens the urgency of implementing the recommendations made by the CNC in its September 2009 report, which were aimed at enhancing competition by reducing barriers to entry and expansion by oil operators.

I. INTRODUCTION

(1) There has been open debate about the degree of competition achieved by the Spanish fuel market since the early 1990s when the sector's liberalisation was considered to have been completed, putting an end to the traditional monopoly. In this context, the Spanish competition authority has been monitoring that market for antitrust purposes, giving rise to different reports, the most recent ones in 2009 and 2011. From 2003 to mid-2008, a sharp rise was seen in international crude prices, accompanied by a rise in the retail price of fuel that raised concerns about the functioning of this market. This promoted the National Competition Commission (CNC) to monitor the sector, leading to the publication on 3 September 2009 of the *Report on competition within the automotive fuel sector*, which found price and margin differentials in Spain with respect to other European countries and the existence of significant barriers to entry and to expansion by new operators in the retail and wholesale segments of the fuel market, which diminished the intensity of competition in the market and could contribute to the observed differentials. The CNC therefore formulated a series of recommendations aimed at public authorities and lawmakers to improve the functioning of the market and facilitate a more efficient competitive dynamic in the sector.

(2) On 9 March 2011 the CNC released its *Follow-up Report on the CNC's Automotive Fuel Report*, which sought to assess the degree of fulfilment of the recommendations made in the previous 2009 report and, if applicable, the advisability of strengthening or expanding those recommendations. In that report the CNC analysed the distribution margins and retail prices and their comparison with other similar economies, and examined the competitive situation and structure of the Spanish market. All of this led to the conclusion that the recommendations from the first report had not been implemented and hence remain valid. Other factors were identified that could be contributing to the lessening of competitive intensity detected in the market, factors that apparently correlated with the market power wielded by certain wholesale operators.

(3) The factors pinpointed in the March 2011 report indicate that the Spanish fuel market could contain certain rigidities in the transfer of changes in international prices to domestic retail fuel prices. The empirical evidence of these rigidities and their causes has been widely studied by economic scholars in numerous academic works on the markets of different countries in recent decades. These studies examined whether the speed and intensity at which international crude oil prices (or, as applicable, the wholesale prices) are passed through to retail prices is or is not symmetric. If it is not symmetric and the speed and intensity of transfer is greater for increases in the price of crude than for declines, the phenomenon is colloquially referred to as “rockets and feathers”. Studying this

phenomenon is of interest to competition authorities, given that one reasonable explanation is the existence of collusion or the exertion of market power. In the previous report, the CNC saw certain signs that fuel prices might not be reacting to variations in international prices as would be expected in a competitive market, because the data showed that increases in international prices for automotive 95 octane unleaded petrol and A-type diesel are possibly passed through faster and more intensely to the price at the pump than are the decreases in those international prices. Nevertheless, given the apparent lack of consensus in economics literature on the existence or not of asymmetries of this kind in the Spanish market, the said report pointed to the need for a new in-depth analysis of this phenomenon in order to corroborate their existence and, if so, to identify the possible link in the value chain where the asymmetries arise, so that new recommendations could possibly be made for improving the level of competition in those markets.

(4) Furthermore, on 30 September 2011 the CNC was tasked by the Government Executive Committee for Economic Affairs, through the State Secretary for Energy, with analysing, as a follow-up to its reports of 3 September 2009 and 9 March 2011, distribution margins for automotive 95 octane unleaded petrol and A-type diesel, along with the recent evolution of the market, specifically in the last week of September 2011.That task was given to the CNC under article 25 of the Competition Act 15/2007 of 3 July 2007, which provides that the CNC, within the scope of its consultative powers, may be consulted on matters of competition, *inter alia*, by the Government.

(5) In view of the above, this report reflects the two exercises conducted by the CNC. The first, which is set out in chapter II, seeks to fulfil the mandate issued by the Government and continue the CNC's monitoring of this sector, analysing the evolution of fuel prices and distribution margins in Spain in the last year, and updating the data included in the previous reports, in order to have the requisite information for evaluating the degree of competition in the sector.

(6) The second exercise is done pursuant to the commitment made by the CNC in its report of 11 March 2011 to provide the evidence to be able to draw conclusions regarding the analysis of asymmetrical pricing in the Spanish market based on the most up-to-date empirical evidence. Chapter III of this report examines the available evidence, presents the results obtained from the empirical analyses performed, evaluates the possible explanations and analyses the measures that would be advisable to implement in relation to the rockets and feathers phenomenon.

(7) This report was prepared with the assistance and collaboration of the Ministry of Industry, Energy and Tourism and of the Comisión Nacional de Energía (Spanish Energy Commission; hereinafter CNE).

(8) This report also takes into account the observations on the *Follow-up Report on the CNC's Automotive Fuel Report* of 9 March 2011 that were submitted to the CNC by the Asociación Española de Operadores de Productos Petrolíferos (Spanish Association of Petroleum Product Operators; hereinafter AOP), by Repsol YPF, S.A. and by the hydrocarbons logistical operator Compañía Logística de Hidrocarburos (CLH) on 17, 25 and 30 March 2011, respectively.

II. COMPETITION INDICATORS IN THE AUTOMOTIVE FUEL MARKET IN SPAIN

(9) The CNC reports dated 3 September 2009 and 9 March 2011 analysed the evolution of competition in the automotive fuel market in Spain having regard to a series of indicators on commercial prices and margins.

- Evolution of retail prices before taxes (pre-tax prices or PTP)[1] for 95 octane unleaded petrol (GNA-95) and A-type diesel (GOA), in comparison with the recorded behaviours of refined fuel prices in international markets and of the euro-dollar exchange rate, and in comparison with the recorded behaviour of the prices of these products in other countries or geographical areas comparable with Spain.
- Evolution of gross distribution margins[2] for 95 octane petrol (GNA-95) and diesel A (GOA), in comparison with the recorded behaviour of these indicators in the EU.
- Evolution of the degree of price dispersion for pre-tax retail prices (PTP) inside Spain, by province.
- Reaction of retail prices to variations in international prices for fuels (GNA-95 and GOA) imported into Spain.

(10) Said reports underscored that those indicators do not, on their own, prove the existence of constraints on competition, but they do depict in a simple aggregate manner the functioning of the fuel production and distribution sector in Spain and, therefore, serve as indicators of a low degree of competition.

(11) There follows an analysis of the first three indicators: namely the recent evolution of retail prices, of margins and degree of retail price dispersion. The dynamic between domestic retail prices and international prices of fuels is studied in chapter III.

---

[1] The retail pre-tax price of fuel (PTP) is obtained by subtracting from the retail price (RP) the taxes levied on fuels, at the national level (VAT, excise duties, national tranche of tax on retail sales) and regional level (regional tranche of the tax on retail sales). The PTP is a better measure than the RP for drawing international comparisons and studying profit margins. Hereinafter "prices" will refer to PTPs unless otherwise indicated.

[2] The gross distribution margin for fuels is a measure that estimates the margin in all logistical activities in the fuel distribution chain that are carried on in the country where the fuel is consumed. It is obtained by subtracting from the PTP the theoretical cost of importing the fuel (Ci), which in turn measures the spot price of importing the fuel (in the case of Spain, as for the EU as a whole, the Ci is a weighted average of the prices formed on the Rotterdam and Genoa international markets). Hereinafter, references to "margins" will mean the gross distribution margins, unless specified otherwise.

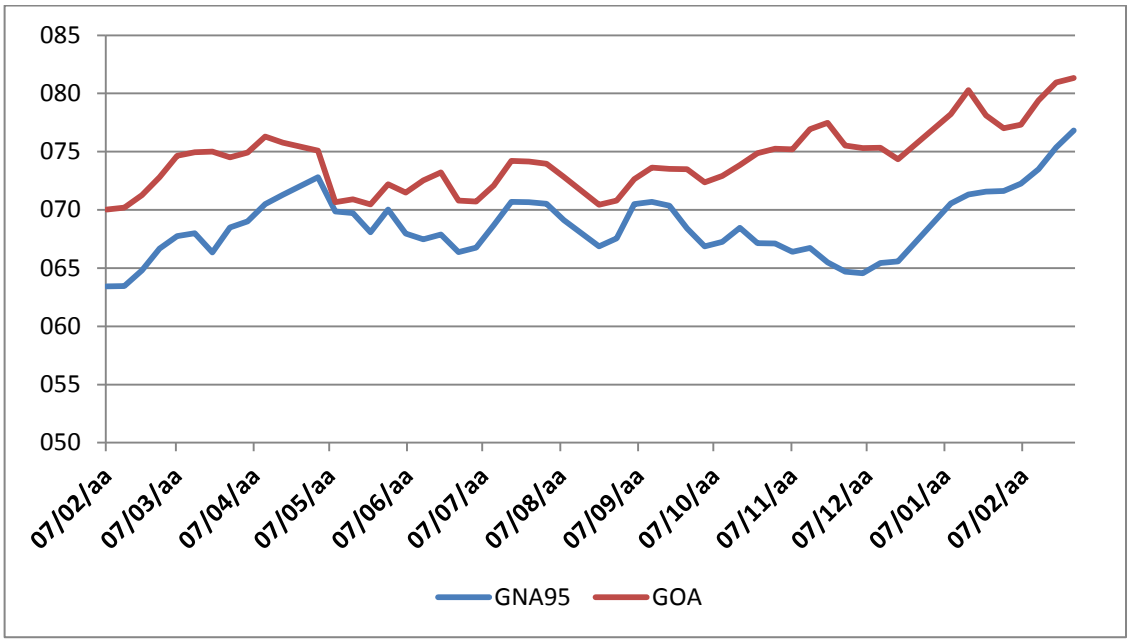
(12) This chapter also responds to the task set out by the Government Executive Committee for Economic Affairs to analyse the distribution margins of 95 octane unleaded automotive petrol and A-type diesel, as well as the recent evolution of the market, specifically the last week of September 2011. It bears mention in this regard that, having paid special attention to analysing the last week of September 2011 as well as the preceding and subsequent weeks and months, and having compared them to the rest of the years in the series studied, we have not identified specific elements that would merit differentiated attention. The empirical evidence presented in this report is consistent with what was observed in the last week of September 2011.

II.1 Evolution of retail prices of automotive fuels

(13) In the last year, retail fuel prices in Spain before taxes (PTP) trended upward:

- **From February 2011 to February de 2012, the prices of 95 octane unleaded petrol (GNA95) increased 21%**: in February 2011, GNA95 was priced at 63.4 c€/litre (7.02.2011) and by February 2012 it had risen to 76.8 c€/litre (27.02.2012).
- **From February 2011 to February 2012, the price of automotive A-type diesel A (GOA) rose 16%**: in February 2011, the GOA price stood at 70.0 c€/litre (7.02.2011) and in February 2012 it had moved up to 81.3 c€/litre (27.02.2012).

Figure 1. Pre-tax price (PTP) of 95 octane unleaded petrol 95 (GNA95) and A-type diesel A (GOA). Trend from February 2011 to February 2012. Data in c€/litre.



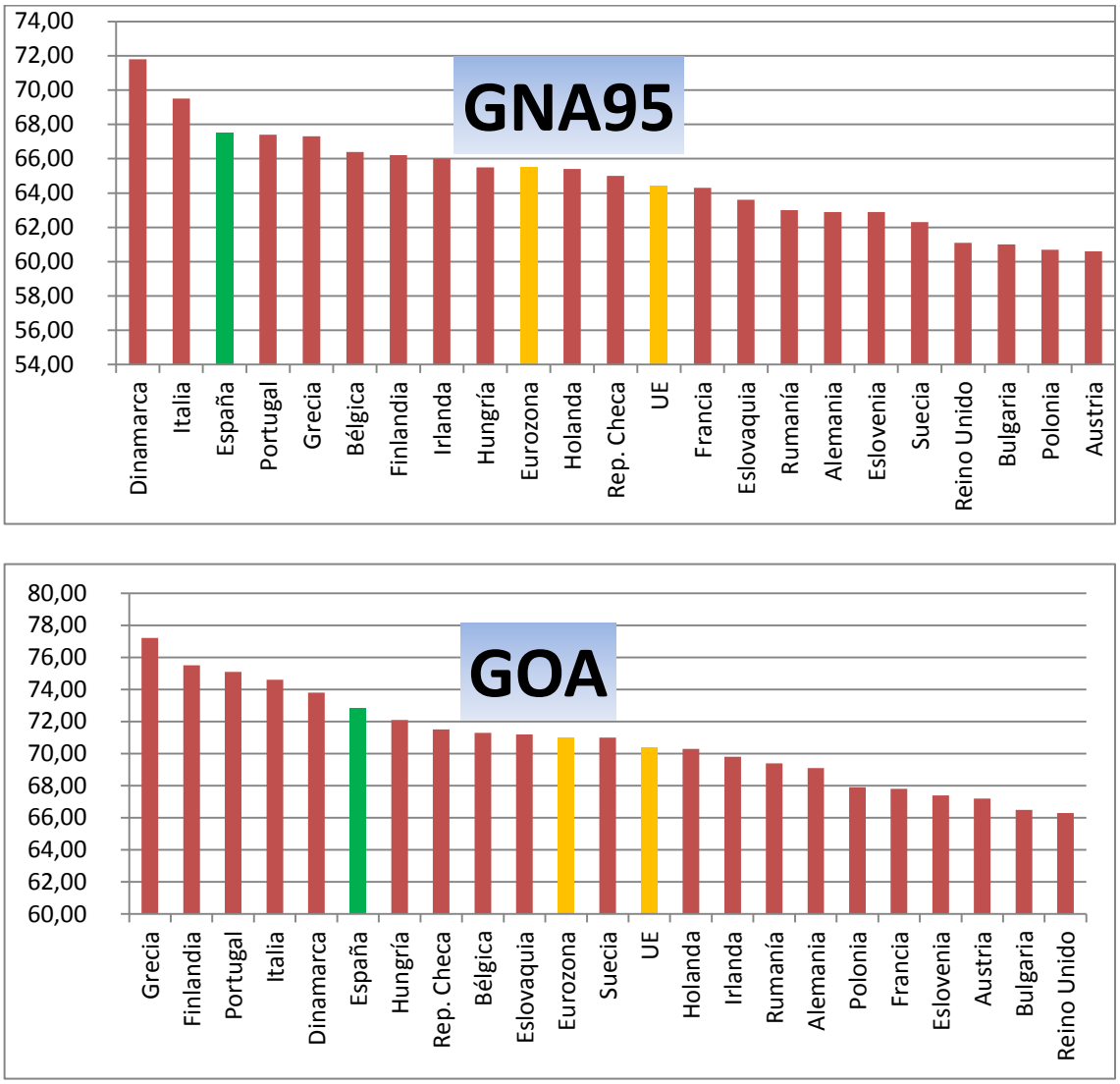
Source: European Commission. Oil Bulletin.

(14) This upward trend in pre-tax retail prices of fuels is common to all European countries,[3] although the increase in Spain was especially intense with respect to the pattern seen in the EU and in the Eurozone. In comparative terms, retail fuel prices in Spain, which were already amongst the highest in the EU, remained amongst the highest during the last year.

(15) Figure 2 compares the average pre-tax prices in 2011 between EU countries for petrol (GNA95) and diesel (GOA), respectively. As can be seen, in 2011 Spain was the country with the third highest PTPs for GNA95, and the sixth most expensive for GOA.

[3] It should be taken into account that retail PTPs do not include the discounts off the selling price obtained through fidelity cards and other arrangements in any of the countries analysed. Nevertheless, when making the comparison between countries, for purposes of evaluating the intensity of competition between operators it is more appropriate to use PTPs, because not all consumers qualify for those discounts (in fact, even those who are eligible cannot always use them because buying fuel is not always a planned act for consumers) and this represents the price levels that the operators use as reference for comparing themselves with their competitors. Also, the analysis of discounts has different implications for the analysis of the competitive environment, such as the impact of the degree of brand loyalty or the spillover effects on other markets or products that are not included to the same extent in the offering of all service stations, such as in-shop services, lubricants, repair services or even hypermarkets in some cases.

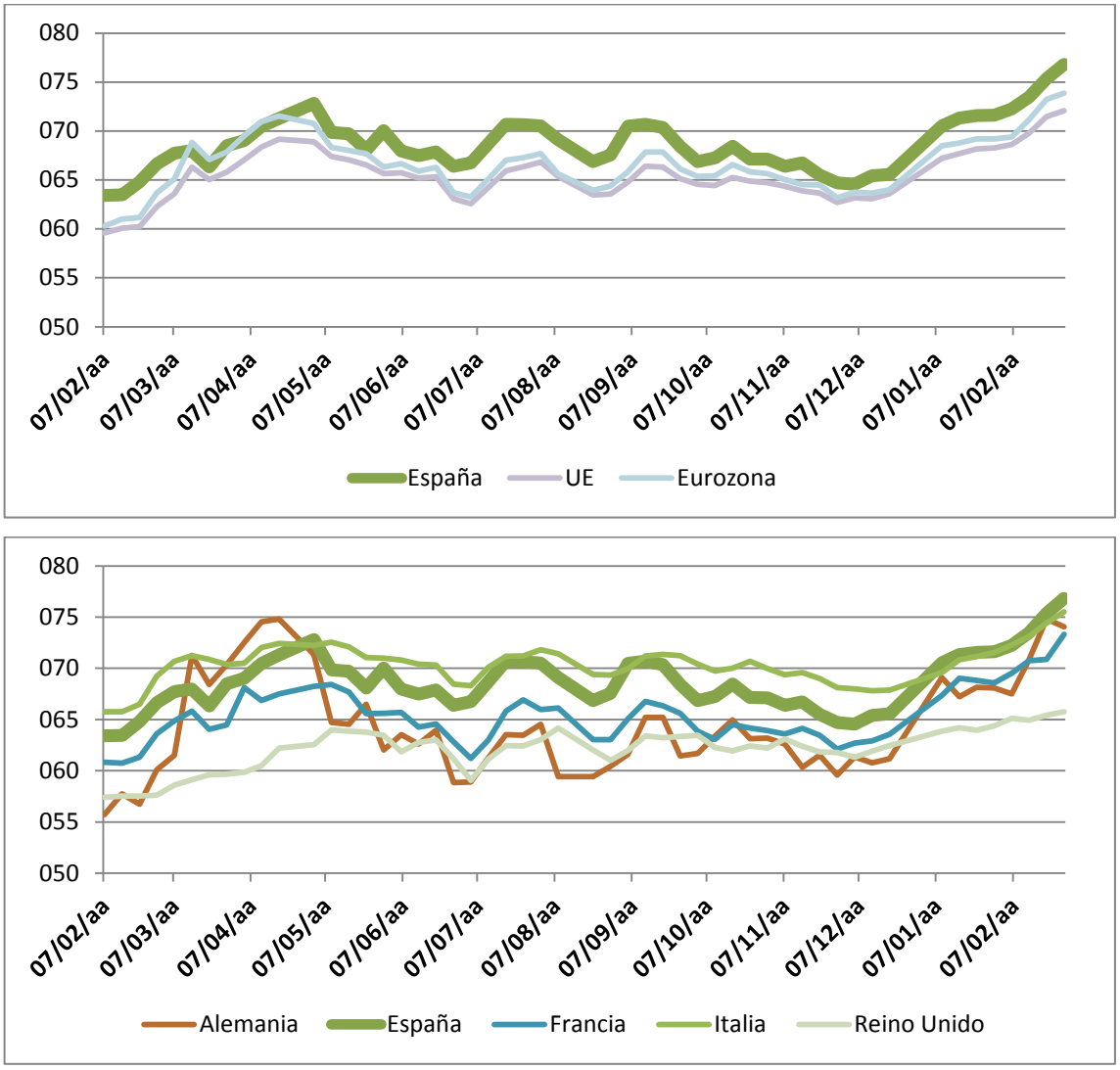
Figure 2. Pre-tax price (PTP) of petrol 95 (GNA95, top) and of diesel (GOA, bottom). Comparison between EU countries in 2011. Data in c€/litre.



Source: Prepared in house using data from MITyC, Annual report on fuel prices. Comparison 2010-2011.

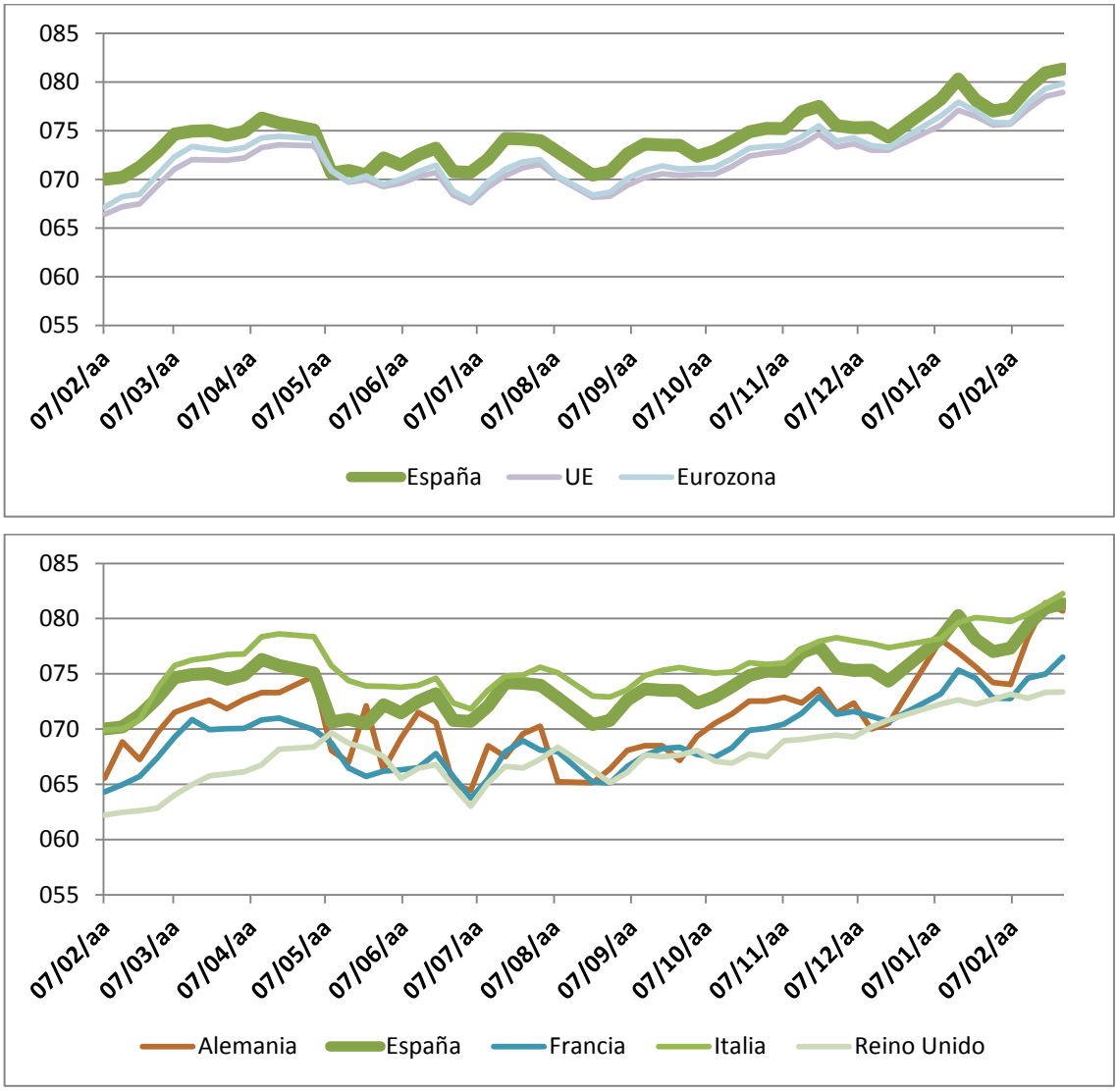
(16) Figures 3 and 4 depict in greater detail the comparative trend in the retail PTP for GNA95 and GOA in the last year (February 2011 to February 2012) for Spain, the EU, the Eurozone and the leading EU economies (Germany, France, Italy and United Kingdom). Figure 3 compares retail PTPs for GNA 95 in Spain, the EU, the Eurozone and those selected countries: Germany, France, Italy and United Kingdom. Figure 4 shows the same information for GOA.

Figure 3. Pre-tax price (PTP) of petrol 95 (GNA95). Comparison of Spain vs EU and Eurozone (top) and vs selected countries: Germany, France, Italy and United Kingdom (bottom). February 2011 - February 2012. Data in c€/litre.



Source: Prepared in house using data from the European Commission. Oil Bulletin.

Figure 4. Pre-tax price (PTP) of diesel A (GOA). Comparison of Spain vs EU and Eurozone (top) and vs selected countries: Germany, France, Italy and United Kingdom (bottom). February 2011 - February 2012. Data in c€/litre.



Source: Prepared in house using data from the European Commission. Oil Bulletin.

(17) As can be seen in the preceding figures, over the last year PTPs in Spain for both GNA95 and GOA trended higher than the EU and Eurozone prices and were near the top within the group of large Eurozone countries. At the end of February 2012, Spain was the country with the highest PTP for GNA95 and the second highest for GOA, behind Italy.

(18) Table 1 below shows the differences in retail PTPs (annual average) in Spain versus Germany, France, the Eurozone and the EU. The most remarkable point is that since 2005 PTPs in Spain have increased far more than in the EU as a whole and in the Eurozone: specifically, the PTP

differential with respect to EU grew 191%, whereas versus the Eurozone the PTP differential expanded 429% since 2005. The comparison with France and Germany yields similar conclusions for GOA, where the differential grew 40% with respect to Germany and 44% versus France. For GNA95, however, the differential with respect to Germany rose since 2005 (by 60%), but narrowed in the comparison with France (-27%).

Table 1. Average PTP differential in Spain with respect to Germany, France, the Eurozone and the EU (2005-2010) in c€/litre (a positive value indicates a higher PTP in Spain)

	GERMANY	FRANCE	EUROZONE	EU
AVERAGE DIFFERENTIAL 95 OCTANE UNLEADED PETROL 95 (c€/litre)				
2005	2.87	4.44	0.38	1.07
2006	3.31	3.87	0.51	1.28
2007	2.98	3.44	0.77	1.34
2008	5.18	3.22	1.09	2.00
2009	3.77	3.88	1.73	3.16
2010	4.05	3.85	2.00	3.01
2011	4.53	3.23	2.01	3.11
AVERAGE DIFFERENTIAL AUTOMOTIVE A-TYPE DIESEL (c€/litre)				
2005	2.58	3.52	0.63	0.99
2006	3.61	3.77	0.92	1.13
2007	2.06	3.73	0.79	1.23
2008	3.53	4.05	1.03	1.58
2009	3.45	4.98	1.83	2.25
2010	3.82	4.86	2.01	2.48
2011	3.61	5.08	1.91	2.57

Source: prepared in house based on data from the Oil Bulletin of the European Commission.

II.2 Evolution of distribution margins for automotive fuels

(19) Automotive fuel is refined from crude oil. Spain has practically no reserves of crude oil, so it must be imported.

(20) At present, there are nine refineries operating in Spain. Refining is a complex process and fairly rigid in terms of the products obtained (asphalts, lubricants, fuel oil, diesel, kerosene, naphtha and petrol and liquefied petroleum gases), which limits the possibility of adapting supply to demand precisely and quickly. Spain has a petrol surplus and diesel deficit. According to data from the Spanish Energy Commission (Comisión

Nacional de Energía; hereinafter, CNE),[4] in 2011 the trade balance (exports minus imports) for GNA95 was a 1.4 million mt surplus (equivalent to 27% of the GNA95 consumed in Spain in 2011), with a GOA deficit of 3.5 million mt (equivalent to 14% of GOA consumed in Spain in 2011).

(21) The benchmark markets for fuel imports[5] in Spain are Genoa (MED market) and, to a lesser extent, Rotterdam (NWE market). The CNE builds its indicator of fuel procurement costs in Spain (Ci) as the average of the benchmark prices in those two markets, in the following proportions: 70% MED, 30% NEW.[6] [7]

(22) Furthermore, fuel prices in international markets are quoted in US dollars, so for purposes of analysing the evolution of the cost of fuel imports in Spain it is more appropriate to convert the international price to euros.

(23) Gross distribution margins are therefore calculated as the difference between the PTP and the Ci. It bears noting that gross distribution margins include not just the profit made on fuel distribution, but also the costs of insurance and shipping, port unloading, primary storage, transportation to the secondary storage facilities, secondary storage and the distribution of the fuels to the points where they are consumed.

(24) Figure 5 compares the evolution of the retail PTP and the cost of supply (Ci) in Spain (GNA95 in the top of the figure and GOA at bottom) in euro cents per litre for the year 2011. As can be seen, the retail prices in a medium-term horizon trend fairly close to the international supply cost (Ci), which indicates that the weekly gross distribution margins are relatively stable in the period.[8]

---

4 CNE (2012), *Estadística de Petróleo en España*, April.

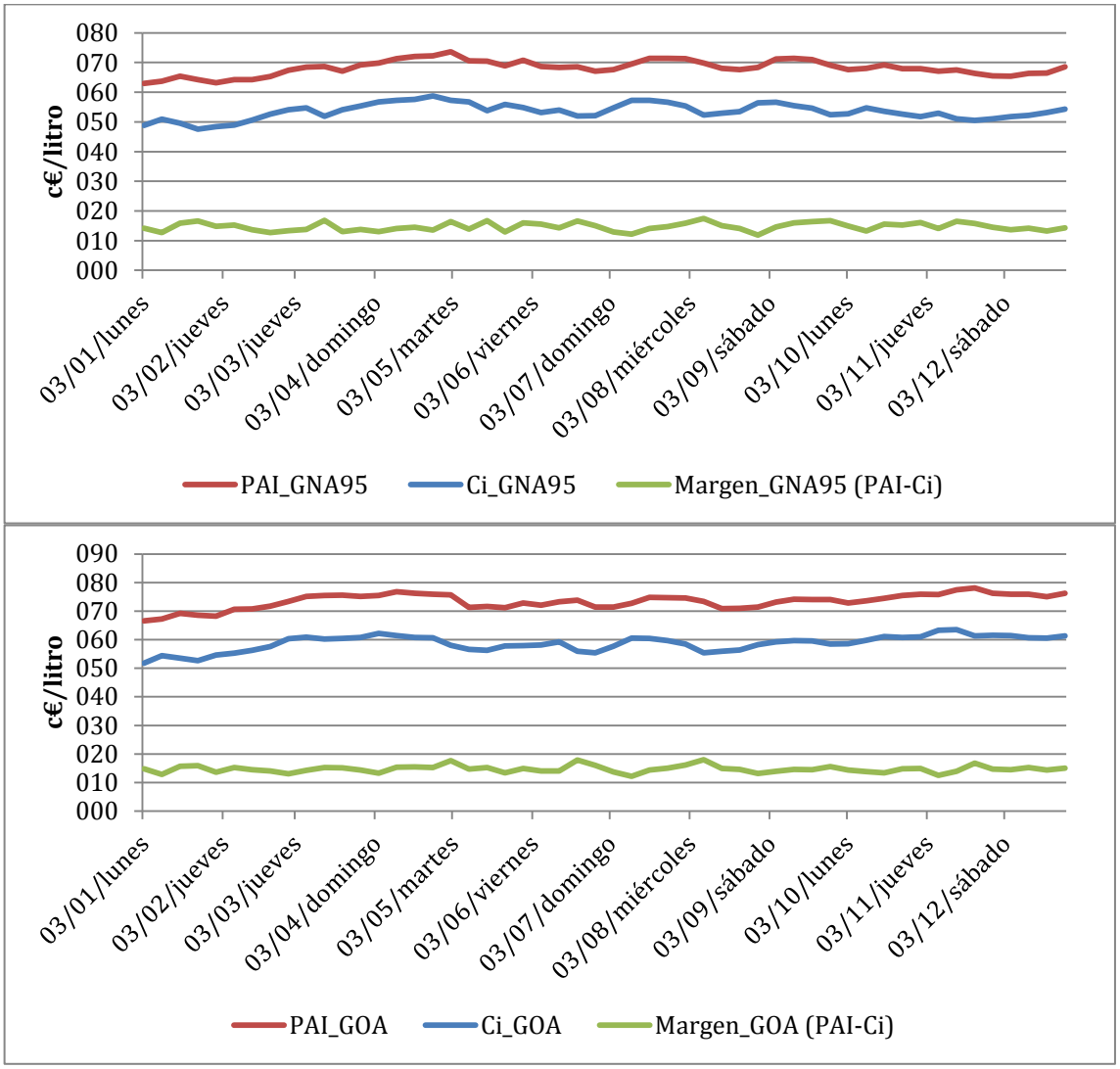
5 When analysing the benchmark international cost of fuel in Spain, it is better to use the data for the fuel price than the crude oil price, because the former reflects the opportunity cost, whereas the latter reflects the book cost of the crude used to produce the fuel.

6 See, for example, CNE (2011), *Informe de supervisión sobre la evolución del precio de venta al público de la gasolina 95 y del gasóleo de automoción en España durante 2010*. The specific benchmarks used by the CNE are: "Premium Unleaded 10 ppm MED CIF Cargoes Mid" and "Petrol 10 ppm NWE CIF ARA" for the Ci and of GNA95; and "ULSD 10 ppm MED CIF Cargoes Mid" and "ULSD 10 ppm NWE CIF Cargoes Mid" for the Ci of GOA.

7 For the EU as a whole the CNE uses 50% MED and 50% NWE.

8 The weekly gross distribution margins are used so that homogeneous comparisons can be made over time or between countries.

Figure 5. Evolution of pre-tax prices (PTP) and cost of supply (Ci) of 95 octane unleaded petrol (GNA95, top) and automotive A-type diesel (GOA, bottom)Year 2011. Data in c€/litre.



Source: prepared in house from the Oil Bulletin of the European Commission, data provided by the CNE and Estadística de Productos Petrolíferos (April 2012) published by the CNE.

(25) In 2011, the weekly margins averaged 14.66 c€/litre for GNA95 and 14.71 c€/litre for GOA, having increased with respect to the levels of previous years. As shown in table 2, the annual average margin in 2011 increased with respect to the margins in 2009 and 2010, although some containment was seen in margin growth in the last two quarters of 2011, as the gross distribution margin decreased with respect to the second quarter of 2011.

Table 2. Evolution of the gross distribution margin (PTP - Ci) for GNA95 and GOA. Years 2009-2011. Data in c€/litre.

	GNA95			GOA		
c€/litre	**SPAIN**	**EU**	**DIFF.**	**SPAIN**	**EU**	**DIFF.**
4Q 2010	13.04	10.59	2.45	13.23	11.75	1.48
1Q 2011	14.35	11.16	2.47	14.53	12.06	1.88
2Q 2011	14.82	12.61	1.54	15.16	13.83	0.70
3Q 2011	14.77	11.60	2.41	14.66	12.50	1.55
4Q 2011	14.72	n/a	n/a	14.48	n/a	n/a
AVG 2009	12.58	10.22	2.36	13.33	11.87	1.46
AVG 2010	13.51	11.28	2.23	13.49	11.75	1.74
AVG 2011	14.66	n/a	n/a	14.71	n/a	n/a
4Q 2010-3Q 2011	14.25	11.49	2.22	14.40	12.54	1.40

Source: Prepared in house using data from CNE, Informes semanales de supervisión del mercado de hidrocarburos and Estadística de Productos Petrolíferos (April 2012).

(26) Table 2 also shows that with respect to the EU, the gross distribution margin differential remains positive. In the case of GNA95, the gross distribution margin differential between Spain and the EU has remained largely stable during the last four quarters for which data is available, although it is true that during the second quarter of 2011 it experienced significant reduction that was corrected in the following quarter. For GOA, the margin in 2011 narrowed with respect to 2010 to levels similar to 2009.

II.3 Fuel retail price dispersion

(27) In its previous reports on the fuel sector, the CNC pointed out that pricing at the provincial level did not appear to depend on the distance from the locations where the fuel is produced and imported, a possible sign of the type of excessively uniform pricing policy independent of transport costs that is inconsistent with a competitive market.

(28) The reason why greater differences could be expected in the retail prices is that the service station PTPs are formed on the basis of cost, demand and supplyside structure parameters that differ from province to province and even within the same province, which should be reflected in average provincial prices recording greater differences.[9] In this context, we may distinguish between:

[9] It should be taken into account, in any event, that the provincial averages may include specific geographical areas, such as, for example, certain segments of motorways, in which

- Cost factors: different procurement costs between service stations.
- Demand factors: different price elasticities and income elasticities on the demand side, income differences, different population densities and different traffic volumes.
- Supplyside structure factors: differences in the ownership structures of service stations.

(29) In a competitive market, it is reasonable to expect that PTPs will be similar due to competitive pressure, although in this scenario the prices should be lower and more in in line with marginal costs. In the Spanish market, where PTPs and gross distribution margins remain higher than in the EU and those countries that most resemble Spain, and where the market has been traditionally characterised by strong entry barriers, the hypothesis that PTPs tend to be similar as a result of a highly competitive environment does not appear to be the most plausible conclusion, in line with what was stated in the 2009 and 2011 reports.

(30) In any event, the global analysis of provincial PTP dispersion that is presented below, similar to the analysis conducted in previous reports, has been supplemented by a study indicating the effect that price dispersion and supplyside concentration have on provincial PTPs.

a) *Indicators of dispersion of provincial PTPs*

(31) Table 3 updates to 2011 the dispersion measures used in the previous reports. As can be seen, the levels of provincial PTP dispersion remain low, indicating there is great similarity between provincial PTPs. Nevertheless, it should also be noted that dispersion of provincial PTPs has increased with respect to previous years, although at the cost of higher prices.

- For GNA95, the average provincial PTPs rose nearly 10 c€/litre, from 57.64 c€/litre in 2010 to 67.60 c€/litre in 2011 (17%). This increase has been accompanied by greater dispersion, both in absolute terms (as can be seen in the rise in the standard deviation, from 0.47 to 0.73, and in the larger range of the 2011 series) and in relative terms (with the coefficient of variation going from 0.82% to 1.08%).
- For GOA the average provincial PTPs rose nearly 20 c€/litre, from 55.51 c€/litre in 2010 to 73.01 c€/litre in 2011 (32%). This increase has been accompanied by greater dispersion, both in absolute terms (as can be seen in the rise in the standard deviation from 0.36 to

---

the conditions of competition and, consequently, prices are very different from one to the other.

0.81 and in the larger range of the 2011 series) and in relative terms (with the coefficient of variation going from 0.65% to 1.10%).

Table 3. Dispersion of annual average provincial PTPs ofGNA95 and GOA (c€/litre)

	GNA95		GOA	
	2010	**2011**	**2010**	**2011**
Avg*	57.64	67.60	55.51	73.01
Standard deviation	0.47	0.73	0.36	0.81
Sample variance	0.22	0.53	0.13	0.65
Range	3.08	4.64	2.67	5.06
Low	55.51	65.52	53.81	70.56
High	58.59	70.15	56.48	75.62
Coefficient of variation	0.82%	1.08%	0.65%	1.10%

** Average of annual average PTPs of each province. The annual mean PTP of each province has been calculated as the average of the weekly PTPs. Does not include Canary Islands, Ceuta and Melilla.*

Source: prepared in house with data from the Oil Bulletin of the European Commission, Informe Annual de precios de carburantes-Comparación 2010-2011 of the Ministry of Industry, Energy and Tourism and Estadística de Productos Petrolíferos (April 2012) of the CNE.

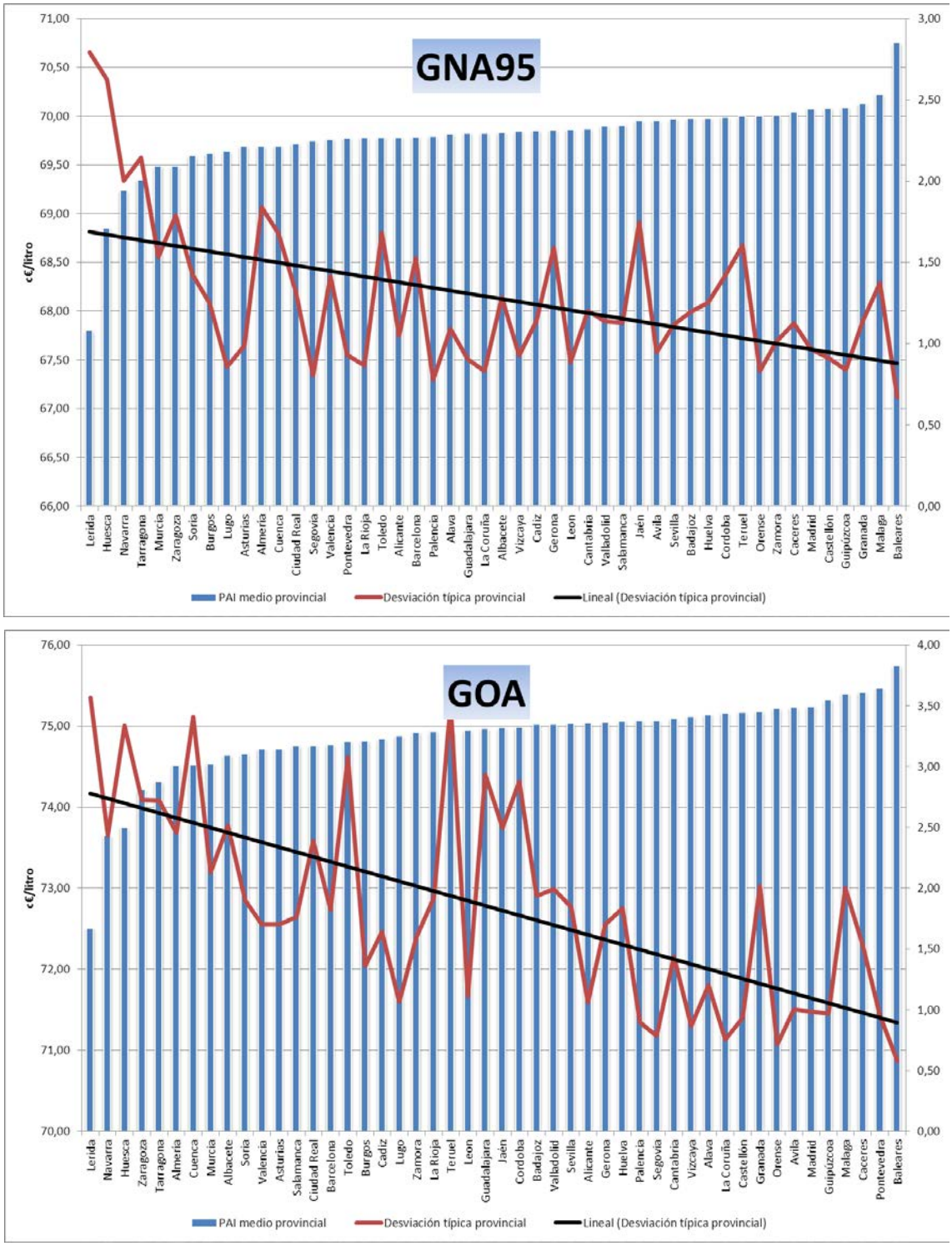
b) Relation between provincial PTP levels and PTP dispersion

(32) The degree of dispersion of provincial PTPs measures price differences within the same province.[10] An inverse relation between the provincial PTP dispersion and the average level of PTPs would reflect, in theory, that competition is more intense in the provinces that show higher PTP dispersion.

(33) Figure 6 compares provincial PTPs and PTP dispersion inside the province, ordered by province according to their annual average PTP. As can be seen, there is an inverse relation, both for GNA95 and for GOA, between the provincial average PTPs and the degree of PTP dispersion inside the province, that is, the lowest-priced provinces display greater price dispersion.

[10] Constructed as the arithmetic mean of the average prices in the period in question for service stations in the province.

Figure 6. Provincial average annual PTPs and standard deviation of annual average PTPs of service stations in the province, for GNA95 (top) and GOA (bottom). Year 2011. Data in c€/litre.



Source: prepared in house using data provided by the Ministry of Industry, Energy and Tourism and from the Estadística de Productos Petrolíferos (April 2012) of the CNE.

c) Relation between provincial PTPs and degree of market concentration

(34) If there is a direct relation between the average PTP levels and market concentration, and taking into account that PTP dispersion inside the province decreases as the PTPs increase, this would indicate, in theory, that the market concentration is driving prices upward due to the effect of less intense competition.

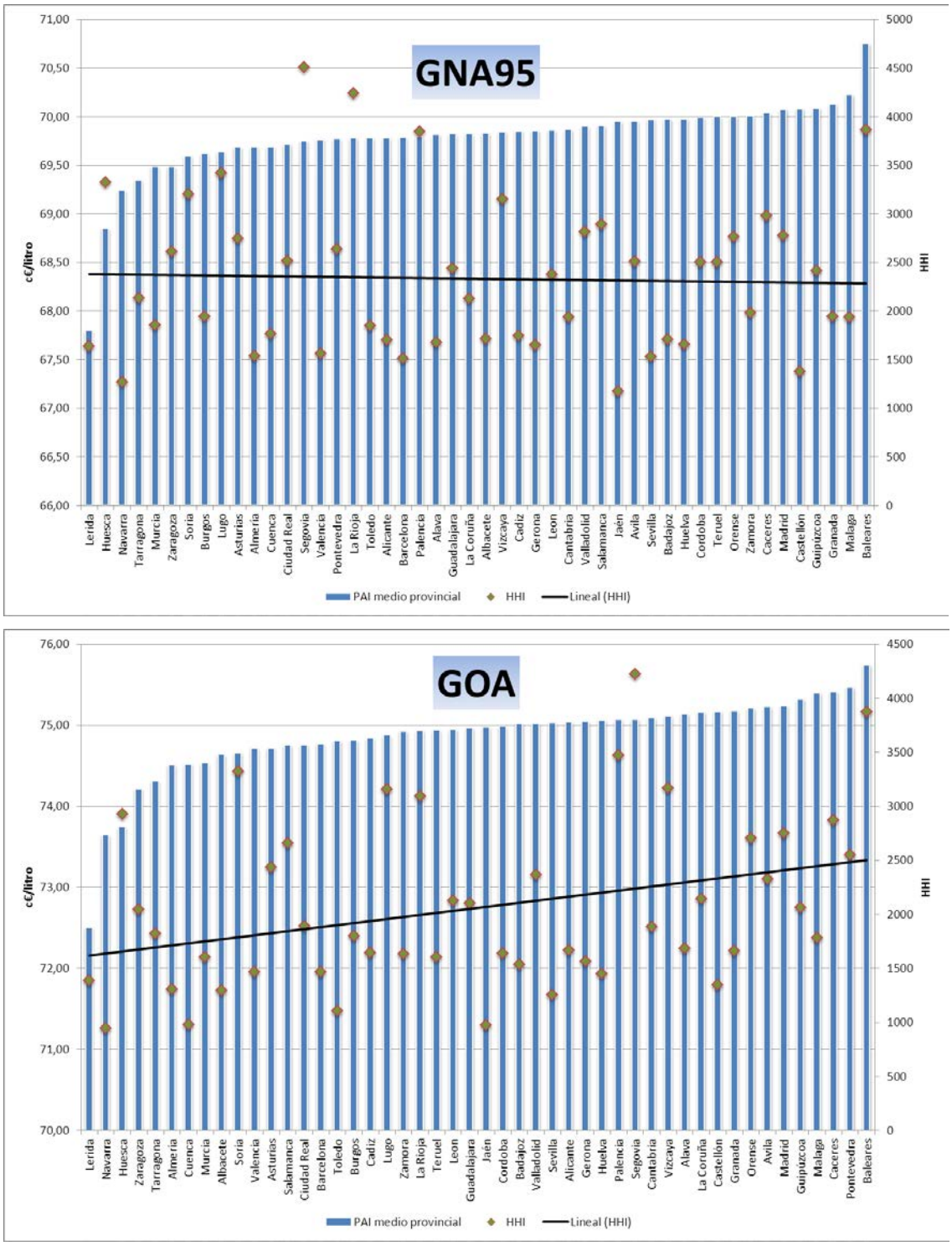
(35) There are various ways of measuring supplyside concentration. This section compares provincial PTPs with two simple indicators of the degree of supplyside concentration in each province: the HHI index[11] and the CR5 index.[12]

(36) Figure 7 graphs the relation between annual average provincial PTPs and the HHI as a measure of the degree of supplyside concentration in the province, ordered by provinces according to their annual average PTP. As can be seen, for GNA95 there is an inverse relation between the annual average PTP level and the degree of overall concentration, albeit a very weak one. In the case of GOA, however, a clear direct relation is seen: the greater the concentration, the higher the PTPs.

[11] The Hirschman and Herfindahl Index (HHI) is a measure of economic concentration in a market. It is defined as the sum of the squares of the market shares of the companies that operate in the market.

[12] The CR Index is a ratio of economic concentration in a market. It is based on the sum of the market shares of the leading companies: CR3 for the top three, CR5 for the top 5, etc.

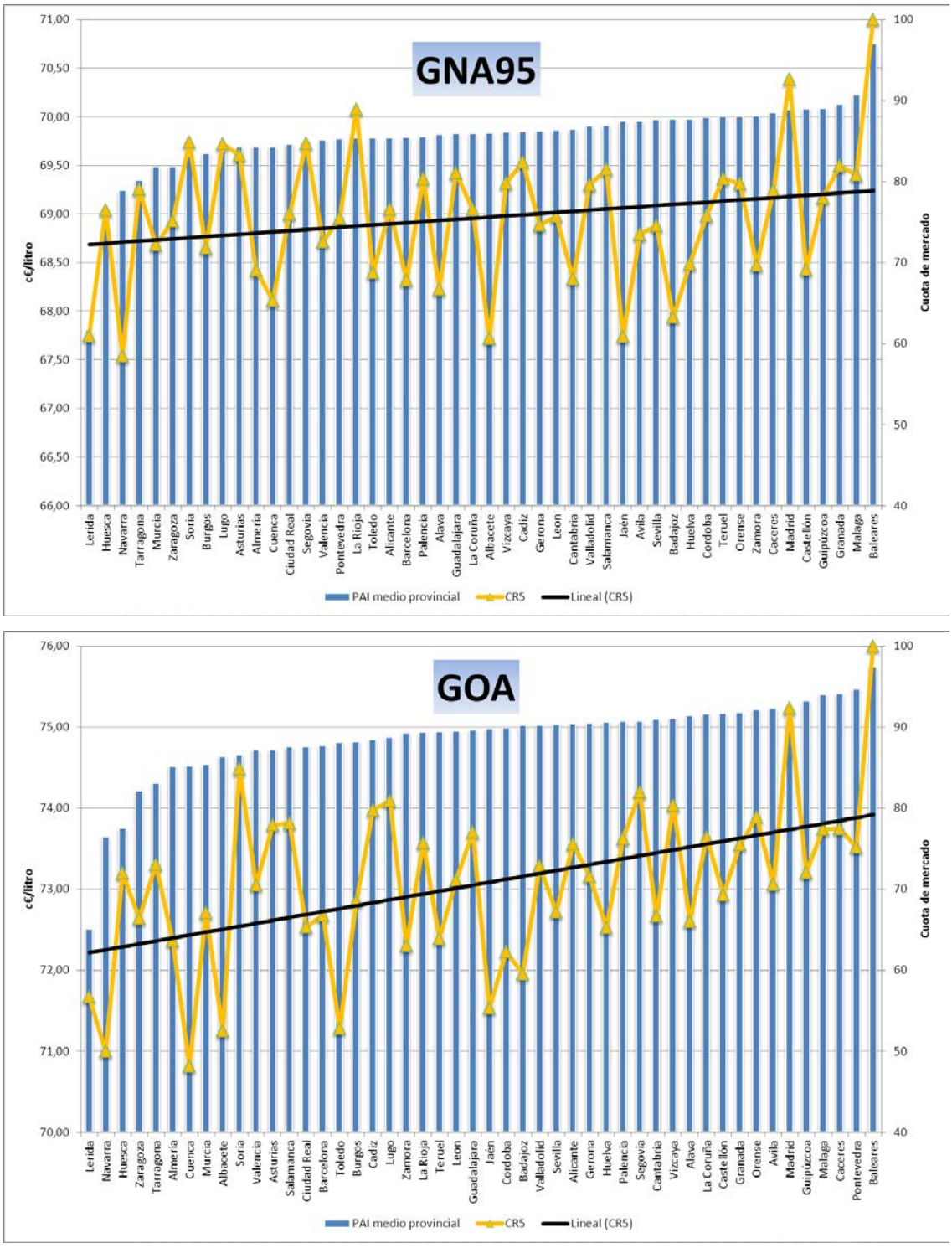
Figure 7. Provincial average annual PTPs and HHI in the province, for GNA95 (top) and GOA (bottom). Year 2011. Data in c€/litre.



Source: prepared in house using data provided by Ministry of Industry, Energy and Tourism.

(37) Figure 8 graphs the relation between annual average provincial PTPs and the combined market share in each province of the top five national operators (Repsol, Cepsa, BP, Galp and Disa), with the provinces ordered according to their annual average PTP. As can be seen for both GNA95 and GOA, although much stronger for GOA, there is a clear direct relation: the greater the presence of the leading national operators, the higher the PTPs.

Figure 8. Provincial average annual PTPs and market share in the province of the top 5 national operators, for GNA95 (top) and GOA (bottom). Year 2011. Data in c€/litre.



Source: prepared in house using data provided by Ministry of Industry, Energy and Tourism.

(38) From figures 7 and 8 above it can be inferred that for GOA there is a direct relation between market concentration and PTPs, such that greater concentration and presence of the major operators correlates with higher PTPs. Now, the presence of the biggest operators (as measured by the CR5 ratio) has greater impact on PTPs than does market concentration (as measured by HHI). This situation is also seen for GNA95, in which market concentration has a weak inverse relation with PTPs, whereas the presence of the main national operators has a positive impact on PTPs.

III. ASYMMETRIES IN THE SPEED AT WHICH INTERNATIONAL PRICES ARE PASSED THROUGH TO RETAIL PRICES

(39) The CNC reports of September 2009 and March 2011 on the automotive fuel market in Spain showed that the way in which variations in crude prices were being transferred to fuel prices in the years examined possibly indicated there were competition problems in the market. A previous Bank of Spain study in 2008[13] had associated the low intensity and pace at which changes in the price of crude oil were passed through to fuel prices with a scarcely competitive environment.

(40) Given that the focus of this study is Spain, it is more appropriate to focus our attention on analysing the transfer to retail prices in Spain of international fuel prices (that is, the price at which fuel is imported into Spain), and not of international crude prices, in order to avoid the effect of factors that may originate at the international level and to specifically analyse the factors are work in Spain. In any event, an analysis of the transfer of crude prices to ex-refinery prices in Spain could serve as basis for studying how the market functions in relation to refining fuel in Spain, but that question is not taken up here.

(41) The way in which the distinct relevant factors participate in the pass-through of international fuel prices to retail prices may reveal the existence of specific problems. And the analysis of those elements, such as the intensity and speed of the adjustment of retail fuel prices to changes in the international price of the fuels (how variations in the import price are reflected in the retail price) will determine if the adjustment is asymmetrical or symmetrical.

(42) Traditionally, the fuel market has been the object of diverse analyses regarding its structure; one approach to those analyses focuses on studying the existence of asymmetries in the speed and intensity of the pass-through of short-term changes in the fuel import price. Such asymmetry arises when the speed and intensity of adjustment differ depending on whether the international price goes up or down. When the asymmetries involve faster pass-through to retail prices of increases than of decreases, the asymmetries are termed positive and have come to be called the “rockets and feathers” phenomenon, a graphic reference to the speed at which prices go up and the slowness at which they come down.

(43) The existence of these asymmetries in a market is not desirable, given their negative effects in terms of efficiency losses and in the transfer of income from consumers to producers. Moreover, if reductions in the cost of the raw material are transferred faster in other countries, this will imply a

[13] Bank of Spain (2008), Monthly Economic Bulletin, November 2008.

competitive disadvantage for products that use fuel as a production input during times when the international price of the raw material is dropping. And what is more, when combined with periods of instability in international fuel prices, or with stages of medium-term increases in those prices, the rigidities can drive inflation upward in the fuel market and generate a transfer of income from consumers to wholesale and retail operators in the form of larger margins. This phenomenon acquires further importance in Spain because, as indicated in the preceding section, the market indicators seem to show that 95 octane unleaded petrol prices are higher here than in the rest of the EU and leading economies, which means that, with the same international fuel prices, the margins per litre of fuel are greater, all in the context, as has been pointed out by the CNC in the past, of strong structural barriers to the development of effective competition in the market.

(44) The origin of asymmetries in the adjustment of retail prices to changes in international prices can be of distinct natures, the concern of competition authorities being those that arise due to markets that have weak competitive dynamics and with barriers to entry and expansion. The academic literature on this phenomenon points to the use of focal prices in oligopolistic markets as a means of strategically coordinating the commercial policies of competitors, or the adaption of stocks of companies in environments with weak competition in response to variations in demand, as causes that explain the this kind of pricing asymmetry.[14] These asymmetries, which provide windfall profits for operators as they raise the average prices received throughout the chain by producers, tend to perpetuate themselves due to the existence of barriers to entry and expansion, which contribute to keeping the market from correcting itself.

(45) To corroborate the existence of this phenomenon in the Spanish market, the CNC has performed the pertinent model estimation, with the fuel import and retail prices, for GNA95 and for GOA (see Annex 1 to this Report). Section III.1 below summarises and analyses the results of that study, which show, at least in the period examined (2005-2011), the existence of asymmetries in Spain. Section III.2 examines the possible causes of this phenomenon and its implications.

[14] There is a abundant literature on the phenomenon, for example: Galeotti, M., Lanza, A., Manera, M. (2002) "Rockets and Feathers Revisited: An International Comparison on European Dealer Markets" Fondazione Eni Enrico Mattei. Bacon, R.; Kojima, M. (2010) "Asymmetric Petroleum Product Pricing in Developing Countries". World Bank. Extractive Industries for Development Series #18. Brown, S.; Yücel, M. (2000) "Dealer and crude oil prices: why the asymmetry?" *Economic and financial review*. 3Q 2000 (authors from the research department of the Federal Reserve of Dallas).

III.1 Presentation of the empirical results

(46) In a chronological analysis of the results of the studies and research conducted in the past,[15] one can see that the first works, which covered the final years of the past century, ruled out the existence of asymmetries in Spain. Thus, Galeotti et al (2003) did not identify asymmetries in the years from 1985 to 2000, and this was corroborated by Contin et al (2008) for the period 1993 to 1998. More recent works, however, point to the possible existence of asymmetries in more recent periods, as in the results reported by Perdiguero (2006) for 1998-2004, or by Contin et al (2008) for 1999 to 2004 for GNA95, although Contin et al (2009) discarded the existence of GOA pricing asymmetries in that same period. It has been considered necessary to update those studies to the most recent period in order to obtain up-to-date results.

(47) The estimation made covered the period 2005-2011 (specifically, from the first week of January 2005 to the first week of November 2011). It uses weekly data, as this is the frequency most commonly used in related economic literature.[16] The model evaluates the possible existence of short-term asymmetries in the transfer of changes in the import prices[17] for GNA95 and GOA to the retail prices for those fuels.[18]

---

15 Annex 1 contains a list of the principal studies consulted.

16 Lower frequencies (monthly or yearly data) do not provide conclusive results for the purposes of this analysis, as they require analysing very lengthy time periods in order for the results to be robust (several years, during which structural changes may be afoot in the market). With frequencies higher than weekly data (daily data), on the other hand, the models have statistical problems of heteroscedasticity, are affected by problems of laboriousness, the data are harder to obtain and it is more difficult to make international comparisons. Furthermore,in the case of Spain, a weekly frequency seems to be the one most widely followed by service stations for modifying their prices, or at least this seems to be the most representative frequency: all service stations have the specific obligation to report their retail selling price to the Ministry of Industry, Energy and Tourism every Monday, and to report subsequent modifications over the course of the week (Order ITC/2308/2007); but the stations that report their prices on Monday are the majority, whereas the rest of the week sees far fewer reports of price changes.

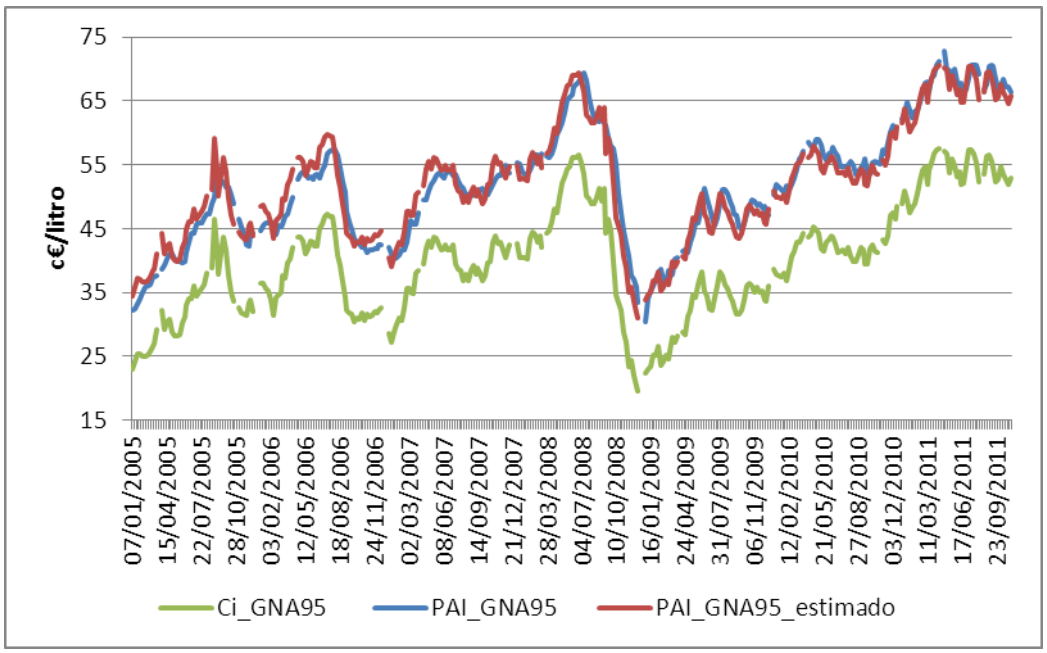
17 Theoretical price of importing fuels into Spain, composed of a weighted average of the Platt's CIF quotation for the Rotterdam (NWE market, 30% weighting) and Genoa markets (MED market, 70%). For GNA95, the weekly average of the daily average quotations of the following international benchmarks: 70% Premium Unleaded 50 ppm MED CIF Cargoes Platt´s and 30% Premium Unleaded 50 ppm NWE CIF ARA Platt´s. For GOA, the weekly average of the daily average quotations of the following international benchmarks: 70% ULSD 50 ppm MED CIF Cargoes Platt´s and 30% ULSD 50 ppm NWE CIF ARA Platt´s. The CNE normally uses these indicators to quantify the cost of supplies in Spain (Ci). These data have been provided by the CNE at the CNC's request.

18 Weekly pre-tax price (PTP) for Spain published by the Oil Bulletin of the EU and reported by the Ministry of Industry, Energy and Tourism. The weekly price is an average compiled by

(48) First, the results demonstrate there is a long-term stable relation between international prices (Ci) and retail prices (PTP) of fuels, so that the main factor explaining the long-term price pattern in Spain is the international price. This also means that there are no long-term asymmetries in the increases or decreases in the price of the raw material: increases and decreases in the price of the fuel on the international markets are transferred in equal proportion to retail prices in Spain. Now then, the results also show that, due to the possible existence of asymmetries in the short run, from 2005 to 2011 the average margin between the retail price and the cost of import widened, more for GNA95 than for GOA.

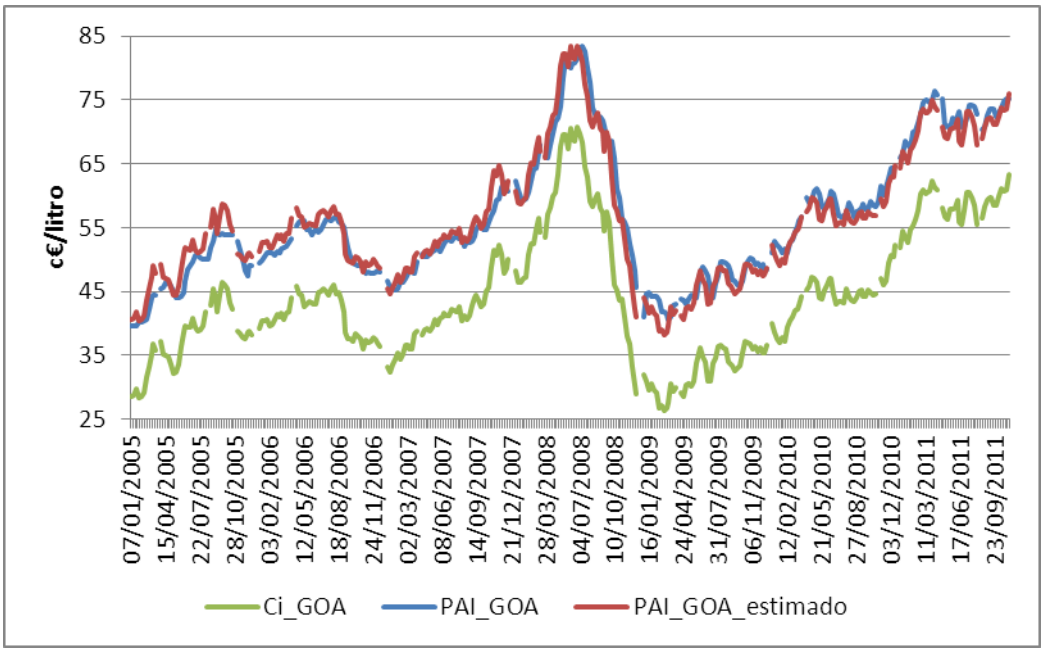
(49) Second, the results show, as can also be seen in figure 9, that in the short run (weeks), retail prices (blue line) do not react to variations in the average import prices (green line) immediately[19] (red line). This lag in adapting the equilibrium prices in the long term to "shocks" in international prices may point to the type of rigidities in domestic pricing mechanisms that are typical of non-competitive markets.

Figure 9. Evolution in cost of imports (Ci), of PTPs and of PTPs estimated according to the long-term relation for GNA95 (top) and GOA (bottom). Weekly data, January 2005-November 2011. Data in c€/litre.



the Ministry of Industry, Energy and Tourism of the prices reported to said body by service stations on Monday of each week.

[19] Estimated weekly pre-tax price (PTP) week for Spain for GNA95 and for GOA according to the models presented in table 4.



Source: prepared in house on the basis of the Oil Bulletin of the European Commission and data provided by the CNE.

A. <u>In the long-term, there is a stable relation between the variations in retail PTPs of GNA95 and GOA in Spain and the variations in the corresponding import prices</u>

(50) In the first phase, the study models, for GNA95 and for GOA separately, the behaviour of retail fuel prices (variable "p" in the equation) as a function of the import prices (variable "x" in the equation). The model includes a constant ("α") and is stochastic, so an error term is included in the estimate ("ε"). The subindex "t" represents the specific point in time. Thus, the long-term equation for GNA95 and for GOA is:

$$p_t = \alpha + \beta x_t + \varepsilon_t$$

(51) Table 4 below shows the results of this estimation for GNA95 (left) and for GOA (right).

Table 4. Results of the estimates of the long-term relations between retail prices (PTPs) and import prices (Ci) for GNA95 (left) and GOA (right). The variables are in c€/litre.

GNA95		GOA	
Variables	**Coefficients**	**Variables**	**Coefficients**
Constant (α)	10.614 (5.90)***	Constant (α)	11.482 (5.56)***
Import price (β)	1.042 (0.0145)***	Import price (β)	1.019 (0.0123)***
R^2	93.90%	R^2	95.35%
Number of observations	335	Number of observations	335
Standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%, * 10%.			

Source: prepared in house

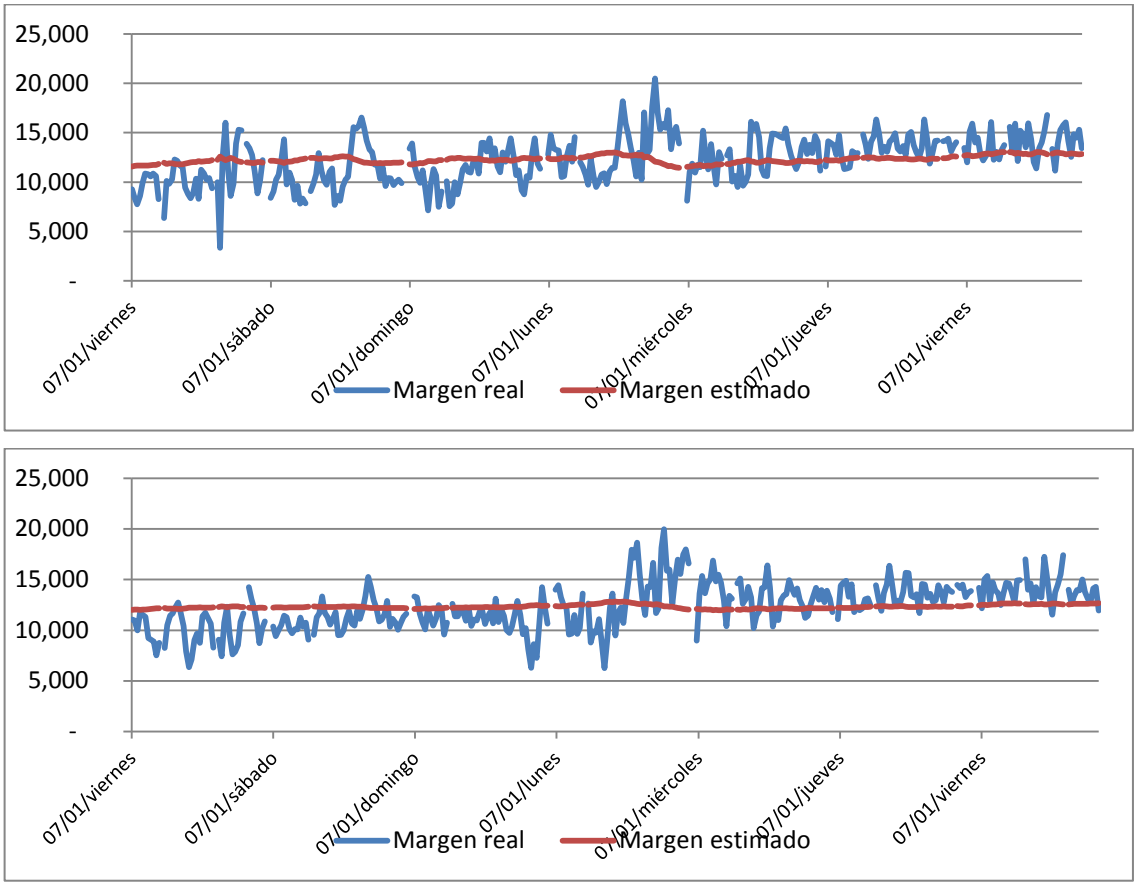
(52) As can be seen, both models present a good fit between the real value of the long-term retail price and the import price, to judge from the statistical R^2, very close to 100% in both cases.[20] According to the estimate, both for GNA95 and for GOA the cost of supply is fully incorporated into the retail price (given the value of coefficient "β", quite close to 1: 1.042 for GNA95 and 1.019 for GOA), which means that over the long term all variations in retail prices closely reflect the variations in the import price, so that the margin is constant for the purposes required for the estimates.[21]

(53) Given that the effect of the import price on the retail price over the long term is close to 1, coefficient "α" can be considered similar to the average margin over the period 2005-2011. This means that the average margin estimated over the 7-year period analysed is 10.61 c€/litre for GNA95 and 11.48 c€/litre for GOA. These levels are sharply below the margins of recent years, reflecting that margins trended upward in the last years of the period. Figure 10 below compares the estimated margin against the actual margin for GNA95 (top) and for GOA (bottom).

[20] Annex 1 details and expounds on the statistical properties of both models.

[21] Strictly speaking, since it is slightly higher than 1, the margin is actually growing but to a negligible extent for purposes of the estimates.

Figure 10. Comparison of real margin and estimated margin between pre-tax prices (PTPs) and the cost of supply (Ci) of 95 octane unleaded petrol (GNA95, top) and of automotive A-type diesel (GOA, bottom). January 2005 – November 2011. Data in c€/litre.



Source: prepared in house.

B. <u>In the short term, retail PTPs of GNA95 and GOA in Spain react faster to increases in the corresponding import prices than to decreases in those prices</u>

(54) The second phase involved estimating the short-term relation between retail prices (PTPs) of GNA95 and GOA and their respective import prices (Ci). The Error Correction Model (ECM) used specifically checks the possibility that the short-run adjustment of retail prices to changes in international prices is faster when the latter go up than when they come down. It is the most widely used model in the various studies of this issue (see Annex 1).

(55) ECM models are based on the assumption that in the short run, variations in import prices are not transferred immediately and fully to retail prices, but that there is some lag: the retail price will slowly revert to its long-term equilibrium level. According to the results obtained in the first phase of this study, there are signs that this may be how prices behave in the Spanish

market, as that lag is clearly seen in figure 9 above, in which the real PTPs (blue line) behave as predicted by the model in the long run, but with some lag with respect to that projection (red line).

(56) Furthermore, the ECM assumes that this price adjustment is done slowly until the long-term equilibrium level is reached; that operators evaluate in each period if they are at the long-term equilibrium level; and that, if they are not (i.e., in the terminology of the model, there is an "error"), they correct it in the next period, skewing retail prices upward if in the previous period those prices were below the long-term level, or a downward bias in the opposite case.

(57) Therefore, these models estimate the extent to which short-term variations in retail prices ("Δp_t") depend on deviations in the retail prices from the long-term equilibrium price in the previous period ("ε_{t-1}") and on the short-run variations in import prices ("Δx"), in the present period ("Δx_t") or in the near past ("Δx_{t-1}", "Δx_{t-2}", etc.). The most refined versions of these models also take into account the momentum that retail prices may have, such that a rise in retail prices tends to push prices upward in ensuing periods and, conversely, a decline in those prices tends to contain them. Lastly, to analyse the existence of asymmetries in the speed at which import prices are transferred to retail prices, a separation is made between the effects of the increases and of the reductions in import prices (thus, in the models, the "Δx^{+}" terms group together the upward variations in import prices, and "Δx^{-}" their downward movements).

(58) So, to achieve robust results,[22] the two type of regression models described above were tested: a first type without including the retail price momentum as an explicative variable, and a second type of models including that momentum:[23]

$$\Delta p_t = \theta \varepsilon_{t-1} + \sum_{i=0}^{n} \beta_i^{+} \Delta x_{t-i}^{+} + \sum_{i=0}^{m} \beta_i^{-} \Delta x_{t-i}^{-} + u_t$$

$$\Delta p_t = \theta \varepsilon_{t-1} + \sum_{i=0}^{n} \beta_i^{+} \Delta x_{t-i}^{+} + \sum_{i=0}^{m} \beta_i^{-} \Delta x_{t-i}^{-} + \sum_{i=1}^{q} \gamma_i \Delta p_{t-i} + u_t$$

(59) The results of these estimates for GNA95 and for GOA are presented separately below. Given that there are no notable differences between the models without the momentum effect and those with the momentum effect, only the former are presented, although Annex 1 also presents the results of the estimates made using the models with the momentum effect.[24]

---

[22] In turn, for each of these two types, diverse models were tested with varying lags in the dependent variables in order to find the best one from a statistical standpoint. Annex 1 details and expounds on these questions.

[23] However, given the similarity of results between the two types of models, as explained in Annex 1, for the sake of simplicity this section does not include the results of the second type of model (with price momentum). Both types of models are described in detail in Annex 1.

[24] The results are summarised here; the detailed results are presented in Annex 1.

B.1. For GNA95, there is a robust finding of existence of asymmetries

(60) Table 5 below shows the results of the short-term ECM model without momentum for GNA95.[25] The best estimate in statistical terms is obtained with a lag of two periods in the import prices (that is, the retail prices are significantly affected by variations in the import prices in the current week and in the two previous weeks), and the model has great explanatory power, as shown by the adjusted R^2 (75.84%).[26]

Table 5. Results of the ECM estimation for GNA95. Model with no "momentum effect"

Variables	Coefficients
Deviation from long-term equilibrium (θ)	**-0.1557** (0.0228)***
Contemporaneous rise of import prices (β_0^+)	**0.1002** (0.0437)***
Contemporaneous drop of import prices (β_0^-)	0.0270 (0.0446)
Rise after one period of import prices (β_1^+)	**0.4353** (0.0502)***
Decline after one period of import prices (β_1^-)	**0.3155** (0.0442)***
Rise after two periods of import prices (β_2^+)	**0.0755** (0.0391)*
Decline after two periods of import prices (β_2^-)	**0.2201** (0.0443)***
Adjusted R^2	75.84%
Number of observations	281
Robust standard errors with White heteroscedasticity in parentheses. Asterisks denote level of significance: *** 1%, ** 5%, * 10%	

Source: prepared in house

(61) As expected, in the ECM the coefficient associated with deviations from the long-term equilibrium ("θ") is negative, which shows that when operators get their retail prices "wrong" and deviate from the long-term equilibrium, they react in the following week to correct the deviation.

(62) The model shows that import price increases produce effects on domestic retail prices as from the same week as they occur (coefficient β_0^+), whereas drops in import prices only begin to affect domestic retail prices one week

[25] The results of the momentum model are very similar in relation to the asymmetries and can be seen in detail in Annex 1.

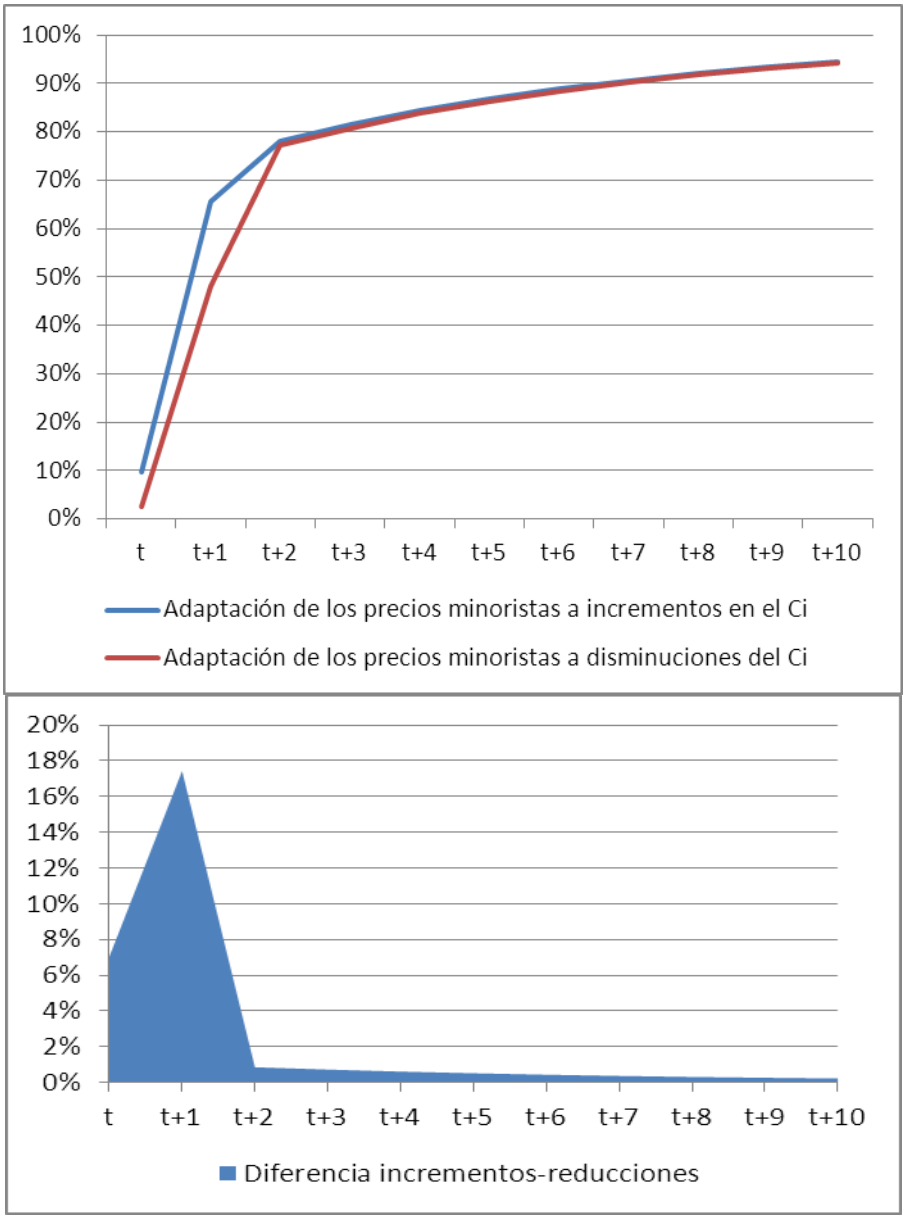
[26] The statistical properties of the regressions can be seen in detail in Annex 1.

later (the β_0^- is not significant, and the coefficient β_1^- is). This initial asymmetry is gradually corrected in the ensuing weeks, so that in the end, in absolute terms, a rise in international prices has the same effect on domestic retail prices as a decline. But in the meantime, the asymmetry generates the aforesaid effects of transfer of income, loss of efficiency and loss of competitiveness in the economic activity.

(63) Figure 11 below corroborates these same conclusions. The top of figure 11 shows how increases and decreases in import prices are cumulatively transferred over time, so that after ten periods (ten weeks) the adjustment is close to 95% of the total adjustment. Given that rising prices are passed through faster and more intensely to retail prices than price cuts, we have positive asymmetries (rockets and feathers) that should be submitted to a statistical validity test (Wald test). The bottom of figure 11, in turn, depicts the cumulative difference for each period of the percentage transfer of the increases and decreases in import prices to retail prices, that is, it represents the areas enclosed between the two curves from the top of figure 11 for each period considered.

(64) More specifically, it may be said that according to the long-term model, a change of 1 euro cent in the international prices of GNA95 generates, in the long run, a change of 1.042 cents in the domestic GNA95 price. That adjustment, as we have said, is not immediate: both in the case of an increase (blue line in figure 11) and of a decrease (red line), it will take 10 week for the 95% of the long-term effect to be passed through to the retail price. During the first weeks the effect of an increase dominates over the effect of a decrease but from the third week the cumulative effect is basically the same.

Figure 11. Results of the ECM estimation for GNA95. Model with no "momentum effect"



Source: prepared in house

(65) Similarly, the asymmetry effect surpasses the tests of joint significance of the parameters (Wald test), such that the asymmetries obtained for GNA95 are econometrically robust.

B.2. For GOA, weak asymmetries are found to exist

(66) Table 6 below shows the results of the short-term ECM model without momentum for GOA.[27] The best statistical estimate is obtained with a lag of two periods in import prices (that is, that retail prices are significantly affected by changes in the import prices in the contemporaneous week and in the two previous weeks). The model has great explanatory power, as shown by the adjusted R^2 (75.94%).[28]

Table 6. Results of the ECM estimation for GOA. Model with no "momentum effect"

Variables	Coefficients
Deviation from long-term equilibrium (θ)	**-0.0788** (0.0233)***
Contemporaneous rise of import prices (β_0^+)	**0.1056** (0.0410)**
Contemporaneous drop of import prices (β_0^-)	-0.0254 (0.0356)
Rise after one period of import prices (β_1^+)	**0.4643** (0.0553)***
Decline after one period of import prices (β_1^-)	**0.4890** (0.0541)***
Rise after two periods of import prices (β_2^+)	**0.1522** (0.0429)***
Decline after two periods of import prices (β_2^-)	**0.2468** (0.0461)***
Adjusted R^2	75.94%
Number of observations	281
Robust standard errors with White heteroscedasticity in parentheses. Asterisks denote level of significance: *** 1%, ** 5%, * 10%	

Source: prepared in house

(67) As expected, in the ECM the coefficient associated with deviations from the long-term equilibrium ("θ") is negative, which shows that when operators get their retail prices "wrong" and deviate from the long-term equilibrium, they react in the following week to correct the deviation.

(68) And with respect to the estimation of the coefficients associated with increases ("β^+") and with decreases ("β^-") in import prices, the results reveal that drops in import prices only affect domestic prices after one week (the coefficient β_0^- is not significant), whereas increases in import prices generate effects in the same week as they occur (coefficient β_0^+).

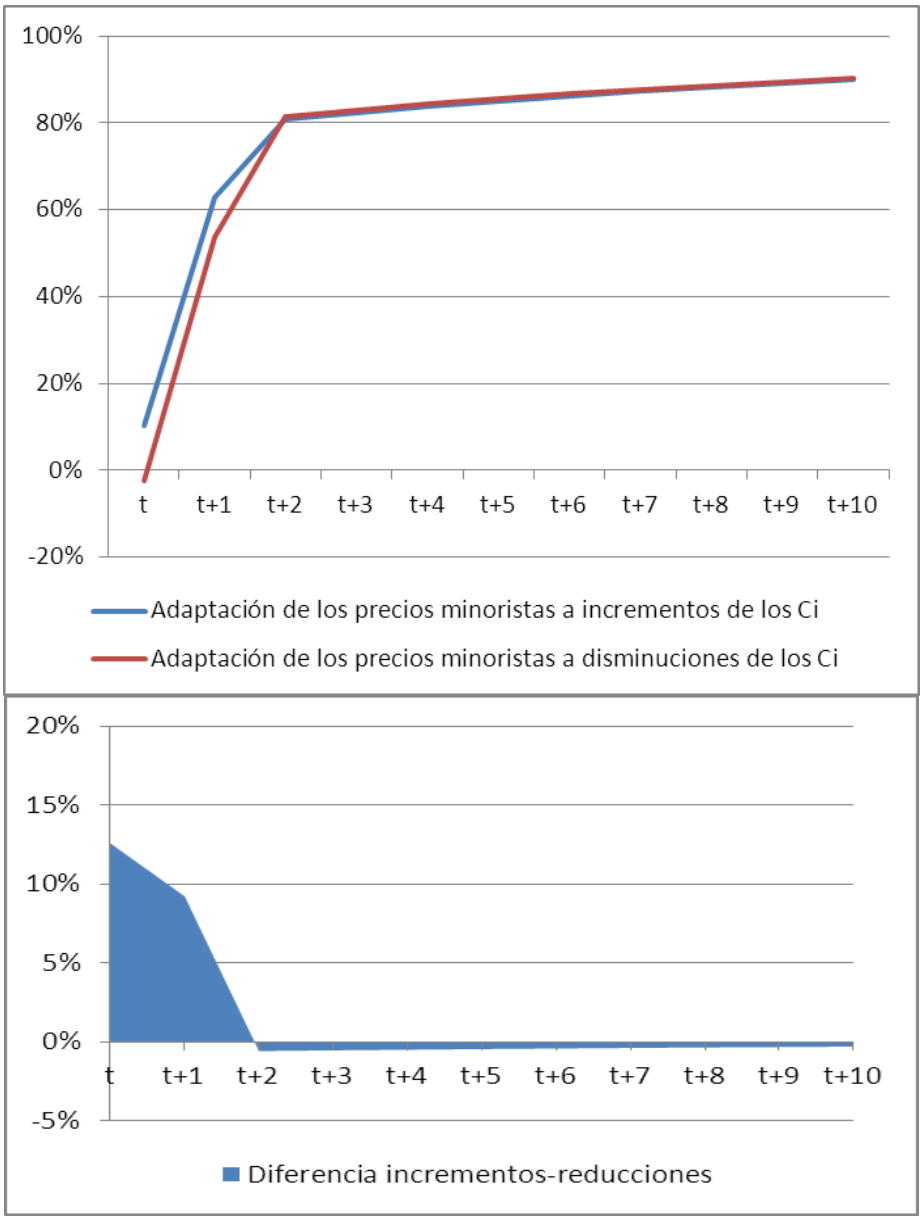
[27] The results of the model with momentum are very similar on the issue of asymmetries and can be seen in detail in Annex 1.

[28] The statistical properties of the regressions can be seen in detail in Annex 1.

This initial asymmetry is gradually corrected in the ensuing weeks, so that in the end, in absolute terms, a rise in international prices has basically the same effect on domestic retail prices as a decline in international prices. But in the meantime, the asymmetry generates the aforesaid effects of transfer of income, loss of efficiency and loss of competitiveness in the economic activity.

(69) Figure 12 below graphs the results of the estimates made. According to the long-term model, a change of 1 euro cent in the international prices of GOA generates, in the long run, a change of 1.019 cents in the domestic GOA price. The short-term estimates indicated that this adjustment is not immediate: both in the case of a price rise (blue line in figure 12) and of a decline (red line), it takes some 10 weeks until 90% of the long-term effect is passed through to the retail price.

Figure 12. Results of the ECM estimation for GOA. Model with no "momentum effect"



Source: prepared in house

(70) The short-term model estimates that the effect on retail prices is initially faster when there is an increase (blue line in figure 12) than when the cost of imports declines (red line). However, the test of significance of the model parameters (Wald test) does not allow to rule out with 95% confidence that GOA retail prices will react to increases and decreases in international prices symmetrically. Therefore, in econometric terms, the existence of asymmetries is a weak result.

C. *Analysis of the results*

(71) The econometric results presented in the preceding sections are compatible with the existence of an asymmetry in the speed at which changes in international fuel prices are passed through to the price in Spain, with increases in international prices having a quicker impact than decreases. This finding is robust for GNA95 and weak for GOA.

(72) These asymmetries can produce harmful effects involving transfer of income, efficiency losses and the diminished competitiveness of the Spanish economy as a whole. These costs arise because while the gross distribution margin is not greatly affected by increases in import prices, it is widened when the drops in import prices are not passed through to the end prices in the same way. Therefore, in absolute terms, a decrease in international prices will widen distribution margins more than an increase in international prices of the same amount, which has a cost for end consumers and for buyers for whom fuel is a production input, as they see a weakening of their competitiveness vis-à-vis competitors in other countries that do not have such asymmetries.

(73) Although these asymmetries are basically a short-term phenomenon, they can also trigger long-term effects. When fuel import prices rise, followed by a decrease in the same amount, the asymmetries widen the actual margin, because the effect in the first week of the transfer of the increase in import prices to retail prices will exceed the effect of the first week of transfer of the drop in import prices to retail prices. After a sufficiently long time period and a large number of changes in import prices, the short-term asymmetries will have an impact on the long-term margin. This may be one of the causes that explain the results obtained in the long-term estimations, where the effect of the cost of supplies on retail prices is slightly higher than one (1.042 for GNA95 and 1.019 for GOA). This "excess" over one implies that in the long run the gross distribution margin (retail prices less cost of import) increases (although very slightly). Other factors explaining part of that increase may also be inflation in the gross distribution margin components.

(74) As for the differences obtained in the intensity of the asymmetries and the robustness of the estimates for GNA95 and for GOA, they may be due to the greater power of the main distributors of GNA95 with respect to GOA distributors. In fact, the position of the main GNA95 distributors in Spain is stronger, given that Spanish refineries produce excess GNA95, whereas they do not produce enough GOA, which could lead to a certain amount of international competitive pressure in the case of GOA.

(75) Furthermore, the differences mentioned above could also be due, in part, to differences in the structure of demand in the GOA market versus GNA95. The typical buyer of GNA95 is the residential consumer, mainly touring cars, whereas with GOA, although the weight of those vehicles is large, an important part of the demand is professional and cannot be

disaggregated in the data. The price elasticity of residential consumers is very low, and their search costs are higher, compared to business and commercial drivers.

III.2 Possible causes of the asymmetries in the pass-through of international prices to retail prices in the Spanish automotive fuel market

(76) There are diverse explanations for the rockets and feathers problem in the automotive fuel market, running from tacit collusion between the major operators or the existence of search costs for consumers in the context of local market power, to apparently less worrisome explanations from the standpoint of market competition, such as production lags combined with finite fuel stocks.[29]

(77) There follows an assessment of the plausibility of the different explanations for the case of the Spanish market, having regard to its specific characteristics and structure.

(78) The Spanish automotive fuel market has been analysed by the CNC not only in the reports mentioned further above, but also in various concentration proceedings in which a differentiation was made inside the sector between i) the supply market or first sale of automotive fuels, ii) storage of petroleum products, iii) wholesale distribution or extra network of automotive fuels and iv) retail distribution of automotive fuel through service stations. This classification allows us to identify the phase in the production chain in which the asymmetries found are most likely to occur.

(79) The first academic works done by Borenstein et al (1997) highlight, of the explanations for this type of asymmetries, the existence of tacit collusion, based on the idea that faced with reductions in the international fuel prices operators would initially be hesitant to adjust retail prices downward in order to avoid the risk of triggering a price war, so that the retail price before the drop in the international price would become a focal point for sellers. Conversely, when international fuel prices rise, the operators would raise their retail prices quickly, in anticipation that their rivals, in order to avoid disrupting the *status quo* achieved, would likewise adjust prices quickly in order to protect their margins.

(80) The evidence that such asymmetries exist in Spain, together with an oligopolistic structure or the existence of local market power, do not by themselves imply there are behaviours contrary to competition law. In any

[29] Annex 2 offers a more exhaustive review of the academic literature on these matters.

event, they do demonstrate the need to reduce entry barriers in the different segments of the value chain.

(81) Furthermore, the existence of price-search costs by customers means that the latter will not always make their supply decisions taking into account all available information. In particular, it has been argued that buyers perceive a higher search cost in response to price cuts than to price hikes, so that they more actively seek out better prices when faced with price increases than with decreases. This means less demandside pressure when prices drop and this can reduce the intensity of competition in the market and encourage tacit collusion, with the consequent harm to consumers.

(82) Given that the upstream segments of the market are completely composed of professional operators who negotiate large contracts, it is reasonable to believe that information costs will be low in relation to the profits they can obtain from such conduct. These approaches are therefore considered mainly valid for explaining asymmetries in the retail segment of the market, characterised to a large extent by buyers with high search costs.

(83) In this sense, given the scarce presence in the Spanish market of operators with broad capacity to advertise their prices, as can be done by service stations located in large shopping complexes, the encouragement for the establishment of this type of operator may contribute to reducing those search costs and hence to increasing competition in the retail market. Similarly, other measures aimed at fostering transparency in the retail prices of service stations, such as enhancing real-time access to service stations prices from mobile devices,[30] would contribute to lowering those search costs.

(84) A third cause that may explain this phenomenon relates to the existence of production lags together with asymmetric costs of storage. The underlying idea is that decreases in the price of fuel in international markets boosts domestic demand, and given that the refining process takes several weeks, operators increase their sales by reducing their fuel stocks, which leads to a rise in the average storage costs (associated with the existence of decreasing average storage costs) and this partially counteracts the effect on the end price of the drop in the input prices. Conversely, when the international prices rise and depresses demand, stocks temporarily increase, which implies a reduction in the average storage costs due to better exploitation of economies of scale. According to this view, asymmetries in the speed of transfer of international prices to domestic prices arise as a result of the asymmetrical costs of storing the fuel.

[30] Nevertheless, from the standpoint of effective competition in the markets, greater price transparency may also have the perverse effect of facilitating supplyside coordination. Therefore, measures of this kind need to carefully weigh the efficiencies associated with having consumers who are more and better informed against the risks that such transparency may facilitate collusion.

(85) This phenomenon is more likely to occur in the upstream market (crude-international fuel market) or even in the upstream stages of the domestic market, instead of in the retail segment of the market. This is because in the retail segment, service stations have limited storage capacity and are normally replenished frequently.

(86) Nevertheless, a variant of this theory could explain asymmetries produced by rigidities in fuel imports, due to how the import contracts are structured or to the reception infrastructure in the destination country, that would render importers incapable of responding to price declines by increasing their fuel imports, while operators with refining capacity are able to respond quickly to increases in international prices and increase their exports, so that the domestic fuel demand drops faster and its price increases faster. In this case, “L” shaped storage costs do not have to exist for there to be asymmetries, and it would be sufficient for there to arise bottlenecks or delays in fuel imports which, in the face of higher demand, would confer greater temporary market power on the entrenched operators with refining capacity.

(87) In the latter case, taking into account the structure of refining and storage capacities of the Spanish market, which were already analysed in the previous CNC reports, a reduction of entry barriers to fuel imports should be promoted with the aim of achieving the greatest possible responsiveness of the domestic market. The role to be played both by CLH and by the rest of the storage capacities linked to refineries installed in Spain may be fundamental.

(88) In summary, it is seen that part of the factors which traditionally explain asymmetries of this kind are present in the Spanish market, and that the results obtained in this analysis are primarily associated with situations of lessened real competition in the market that leads to a worse outcome for the end consumers than would be expected a competitive market. Consequently, defence of the public interest warrants continued insistence on the need to find measures that help achieve a more competitive fuel market.

IV. CONCLUSIONS

One. The evolution of the automotive fuel market in Spain during 2011 shows that prices and margins in the country continue to rank amongst the highest in the EU and above those recorded in comparably sized economies, a finding compatible with a lower level of competition throughout the entire marketing chain

Two. The provincial analysis shows there is a direct relation between retail supplyside concentration (service stations) and the average pre-tax prices in the province. This question will be dealt with in greater detail in the in-depth study of the structure of the Spanish fuel market that is currently being carried out by the CNC.

Three. According to the analyses carried out, the short-term evolution of margins is influenced by certain rigidity in the adjustment of domestic retail prices to variations in the international prices, which explains the increases and decreases seen in margins in the very short term. The presence of rigidities in the adjustment of domestic retail prices to changes in international prices is not very credible in a traditional competitive process, and may indicate structural problems and tacit collusion in the market.

Four. The results obtained in the analysis of the Spanish fuel market show there are asymmetries in the speed of adjustments of domestic retail prices to changes in international fuel prices, quite clearly for 95 octane unleaded petrol (GNA) and more weakly for A-type diesel A (GOA). The asymmetries mean that when international fuel prices increase, domestic service station pre-tax prices react more rapidly than when those international prices decrease. This asymmetry has harmful effects for the end consumers, as they do not benefit quickly from falls in international prices, but do see the prices they pay climb faster when international prices rise.

Five. Collusion, whether tacit or explicit, is one possible explanation of this phenomenon, though not the only one. The existence of asymmetries in the adjustment of national retail prices does not on its own imply operators are engaging in conducts contrary to competition law. Some of the explanations found in economic theory for the rockets and feathers problem apply to the Spanish case and to the results obtained in the analysis. In any event, these explanations are associated with markets where effective competition is weak and in which consumers consequently fare worse than would be expected in a more competitive market, which justifies the search for actions aimed at

removing certain elements that act as barriers for introducing competition in this sector.

Six. All of the above heightens the urgency of implementing the recommendations made by the CNC in its September 2009 report, which were aimed at enhancing competition by reducing barriers to entry and expansion by oil operators.

CNC
COMISIÓN NACIONAL DE LA COMPETENCIA

ANNEX 1

EMPIRICAL ANALYSIS OF THE EXISTENCE OF ASYMMETRIES IN THE FUEL MARKET IN SPAIN

CNC
COMISIÓN NACIONAL DE LA COMPETENCIA

EMPIRICAL ANALYSIS OF THE EXISTENCE OF ASYMMETRIES IN THE FUEL MARKET IN SPAIN

I. INTRODUCTION: REVIEW OF THE LITERATURE

1. On 3 September 2009 Spain's antitrust authority, the Comisión Nacional de Competencia (CNC), released its *Report on competition within the automotive fuel sector*, in which it found there were numerous barriers to entry and to expansion by new operators in the retail and wholesale segments of the fuel market, and issued recommendations to reduce the effect of those barriers and facilitate a more efficient competitive dynamic. In order to assess the degree to which those recommendations have been followed and implemented, as well as their relevance and heightened importance in view of the sector's evolution, on 14 March 2011 a *Follow-up Report on the CNC's Automotive Fuel Report* was published. The follow-up report addressed the possible presence of asymmetries in the transmission of variations in the price of crude oil to fuel prices, commonly referred to as the "rockets and feathers" phenomenon and noted the advisability of carrying out a deeper analysis.

2. The present Report conducts a detailed empirical study of the existence of asymmetries in the pass-through of changes in international fuel prices to the retail pre-tax price (PTP) of fuels in Spain. The study uses the international fuel price instead of the price of crude because the former bears a more direct relation with the end price of automotive petrol and diesel (as it gives a closer reflection of the cost for service stations than does the price of unrefined crude), and because it is precisely the domestic channel for transmission of prices that is relevant to the competition advocacy functions of the CNC. In essence, the analysis carried out seeks to reply in the case of Spain to the question of whether increases in the international price of fuels are passed through more intensely and faster to retail prices than decreases.

3. The possible asymmetric transfer of changes in input prices to the output price has been amply studied in the academic literature, in many markets, not just for the fuel sector.[1] The fuel sector has been the object of many studies that analyse the possible existence of "rockets and feathers", without this phenomenon having been confirmed to exist in all countries. Whereas in certain countries and for specific periods, empirical evidence has been found of its presence, in other countries and other periods such evidence has not been obtained.

[1] For example, Peltzman (2000) examined more than 200 product markets and found asymmetric transmission of prices of inputs to prices of finished product in the more than two thirds of the markets analysed.

4. The seminal work on this problem is Borenstein *et al.* (1997), which introduced the error correction model (ECM)[2] methodology for analysing the phenomenon. This is the methodology used in nearly all of the studies, although with different variants or subsequent refinements. So, given that there is a relatively uniform methodology, what varies from study to study is the period sampled, the country examined, the phase of the distribution chain analysed and the data sampling frequency.

5. Borenstein *et al.* (1997), using fortnightly data, found evidence that retail petrol prices in the United States in the period 1986-1992 reacted asymmetrically to changes in the spot price and in the price of crude, responding more rapidly to increases than to decreases. The North American fuel market is the one that has been studied the most for the possible existence of downward pricing rigidities in response to changes in input prices. In this regard, Balke *et al.* (1998), using weekly data, also found evidence of this type of asymmetrical pricing. Conversely, Bachmeier and Griffin (2003), studying the same period as Borenstein *et al.* (1997) but with daily instead of weekly or fortnightly data, did not find empirical evidence of pricing asymmetries. Borenstein and Shephard (2002), using daily data for the period 1985-1995, concluded that wholesale petrol prices react asymmetrically to changes in the price of crude. But Kaufmann and Laskowski (2005), using monthly data, suggested that petrol prices in the United States adjust symmetrically to changes in the spot price. Johnson (2002), on the other hand, studied variations in the price of heating diesel and of petrol in response to changes in wholesale prices in 15 States in the USA, concluding that the price of diesel reacts symmetrically and the price of petrol asymmetrically.

6. This phenomenon has also been studied in several European countries. In Great Britain, Bacon (1991),[3] using fortnightly data, found evidence that petrol prices responded asymmetrically to changes in the spot trading price. Really and Witt (1998) and Wlazlowski (2003), using monthly data, found evidence that petrol prices responded asymmetrically to changes in the price of crude. But Bermingham and O´Brien (2011) did not turn up asymmetries between the wholesale price and the retail price for the period 1997-2009 with monthly data in Great Britain and in Ireland. Kirchgässner and Kübler (1992) undertook an analysis of the German market based on monthly data. Their empirical results showed that in 1980-1989 petrol prices reacted symmetrically to changes in the spot price, whereas in the period 1972-1979 petrol prices reacted faster to decreases than to increases in their spot price ("negative asymmetries"). Bettendorft *et al.* (2003) studied the Dutch market with daily data and

[2] The methodology is explained in detail in the following section.
[3] This was the first article that studied the "rockets and feathers" problem in the fuel market, but with a different methodology, a quadratic adjustment model that was replaced in the literature by the error correction model (ECM) after the ground-breaking article by Borenstein *et al* (1997).

asserted that the empirical evidence varied depending on the day of the week of the price readings. Asplund *et al.* (2000) analysed the Swedish market using monthly data to conclude that petrol prices reacted asymmetrically to changes in their wholesale price. Their study underscores that to fully understand the changes in prices one must examine databases with a frequency at least equal to the changes in the prices. And lastly, there are two studies on the Canadian market, both using weekly data, but with a different geographical scope and opposite results. On the one hand, Godby *et al.* (2000) examined prices in 13 Canadian cities and concluded that prices reacted symmetrically, while Eckert (2002) found evidence of asymmetries in prices in Windsor, Ontario.

7. With respect to Spain, the evidence is not conclusive either. Galeotti *et al.* (2003) analysed asymmetries in the petrol markets of several European countries, including Spain, and did not find evidence of asymmetrical pricing in our country using monthly data from 1985-2000. Similarly, a report from the Portuguese competition authority (2009) that also studied petrol markets in various European countries, although with weekly data, found no asymmetries for Spain in the period 2004-2008. Conversely, Contín *et al.* (2008) did find there was evidence of asymmetries using weekly data for the diesel market for the second subperiod they analysed, 1999-2004, but not for the first subperiod, 1993-1998. Perdiguero (2006) —together with Bacon (1991), the only two articles in this review of the literature that did not use the ECM methodology in any of its variants— in the context of a dynamic infinite game model, performed an empirical analysis in which he concluded that there were asymmetries in the diesel market in Spain in the period 1998-2004. Lastly, Contín *et al.* (2009), with weekly data, found no empirical evidence of the presence of asymmetries in the petrol market in Spain in 1993-2004.

8. Table 1 summarises the existing empirical evidence for the “rockets and feathers” phenomenon. The conclusion is that the results vary according to the type and frequency of data used, to the sampling timing and to the market analysed. The fact that the evidence is not conclusive makes it all the more necessary to carry out an in-depth analysis of the possible existence of asymmetries in the transmission of changes in the price of crude to the retail prices of automotive petrol and diesel.

Table 1. Summary of the empirical evidence for "rockets and feathers"

Article	Country	Period	Data frequency	Results
Portuguese antitrust office (2009)	EU15	2004-2008	Weekly	Symmetry
Asplund et al. (2000)	Sweden	1980-1996	Monthly	Asymmetry
Bachmeier and Griffin (2003)	USA	1986-1990	Daily	Symmetry
Bacon (1991)	Great Britain	1982-1989	Fortnightly	Asymmetry
Balke et al. (1998)	USA	1987-1996	Weekly	Asymmetry
Bermingham and O´Brien (2011)	Great Britain and Ireland	1997-2009	Monthly	Symmetry
Bettendorf et al.(1998)	Holland	1996-2001	Daily	Depends on day
Borenstein et al. (1997)	USA	1986-1992	Fortnightly	Asymmetry
Borenstein and Shephard (2002)	USA	1986-1993	Daily	Asymmetry
Contín et al.(2008)	Spain	1993-2004	Weekly	Symmetry 1993-1998 Asymmetry 1999-2004
Contín et al. (2009)	Spain	1993-2005	Weekly	Symmetry
Eckert (2002)	Canada	1989-1994	Weekly	Asymmetry
Galeotti et al.(2003)	Spain (and 4 other countries)	1985-2000	Monthly	Symmetry
Godby et al.(2000)	Canada	1990-1996	Weekly	Symmetry
Johnson (2002)	USA	1996-1998	Weekly	Symmetry diesel Asymmetry petrol
Kaufmann and Laskowski (2005)	USA	1986-1992	Monthly	Symmetry
Kirchgässner and Kübler (1992)	Germany	1972-1989	Monthly	Negative asymmetry 1972-79 Symmetry 1980-89
Perdiguero (2006)	Spain	1998-2004	Monthly	Asymmetry
Really and Witt (1998)	Great Britain	1982-1995	Monthly	Asymmetry
Wlazlowski (2003)	Great Britain	1982-2001	Monthly	Asymmetry

Source: prepared in house.

II. DATA AND METHODOLOGY

9. This report analyses whether asymmetries exist in the transfer of variations in the price of the fuels on the international markets used as benchmarks for Spain to the service station retail pre-tax prices of automotive petrol and diesel in Spain. The study uses the international benchmark price of automotive petrol and diesel for Spain, instead of the price of unrefined crude, because the former bears a more direct relation to the end prices of petrol and diesel (as it gives a closer reflection of the cost for service stations than does the price of unrefined crude) and because it is precisely the domestic channel for transmission of prices that

is relevant to the competition advocacy functions of the CNC. As pointed out by Borenstein *et al.* (1997) or Contín *et al.* (2008 and 2009), when the price of unrefined crude is used, the end price of petrol or diesel is made to depend to a certain degree on the demandside conditions for other refined products, given that crude oil is used to obtain a great variety of products, such as diesel, petrol, naphtha, kerosene, etc. According to the approach normally used in the studies of this market, the analysis focuses on the price of 95 octane unleaded petrol (GNA95) and automotive diesel (GOA), as they are the biggest selling fuels and the trend for other fuels correlates very closely with these two (CNC, 2009).

10. The series of fuel prices on the international markets used in the study have been supplied by the Spanish Energy Commission (Comisión Nacional de Energía — CNE) and are the international benchmark prices used for Spain, 70% composed by the spot price on the Mediterranean market (Genoa) and 30% by the sport price for the Northwest Europe market (Rotterdam). Specifically:

    - For 95 octane unleaded petrol (GNA95): 70% Premium Unleaded 50 ppm MED CIF Cargoes Platt´s and 30% Premium Unleaded 50 ppm NWE CIF ARA Platt´s.[4]
    - For automotive diesel (GOA): diesel 70% ULSD 50 ppm MED CIF Cargoes Platt´s and 30% ULSD 50 ppm NWE CIF ARA Platt´s.[4]

11. The data readings were weekly, with the price quotes for every Monday of the sampling period. The period studied begins in the first week of January 2005 and ends in the second week of November 2011, so the analysis takes in weekly prices over nearly seven years. A weekly frequency was chosen for the study, as the one most commonly used in the literature (see Table 1) and considered the best one for capturing the effects of price changes. A monthly or biweekly frequency might fail to reflect the lower-frequency transmittals of prices, whereas a daily frequency could introduce too much noise and make it difficult to distinguish periods of rising prices from periods of falling prices.[5]

12. The series of weekly service station prices of GNA95 and GOA have been supplied by the Ministry of Industry, Energy and Tourism (MINETUR), and also refer to the prices of every Monday during the seven years covered by the sample. The study uses the series of prices before taxes to eliminate possible distortions caused by different national taxes (VAT, hydrocarbons excise tax and tax on retail sale of certain hydrocarbons)

[4] Beginning in 2009, for environmental reasons, the sulphur content of these quotes was cut to 10 parts per million (ppm).

[5] In addition, an overly high data frequency increases the likelihood of an autoregressive conditional heteroskedasticity, which would make it necessary to use GARCH models such as those employed in studies of high-frequency financial data. The distortive effects of the autoregressive conditional heteroskedasticity are much smaller when a lower data frequency is used.

and regional taxes (some but not all Autonomous Communities have introduced a tax on retail sale of certain hydrocarbons, the so-called "healthcare cent").

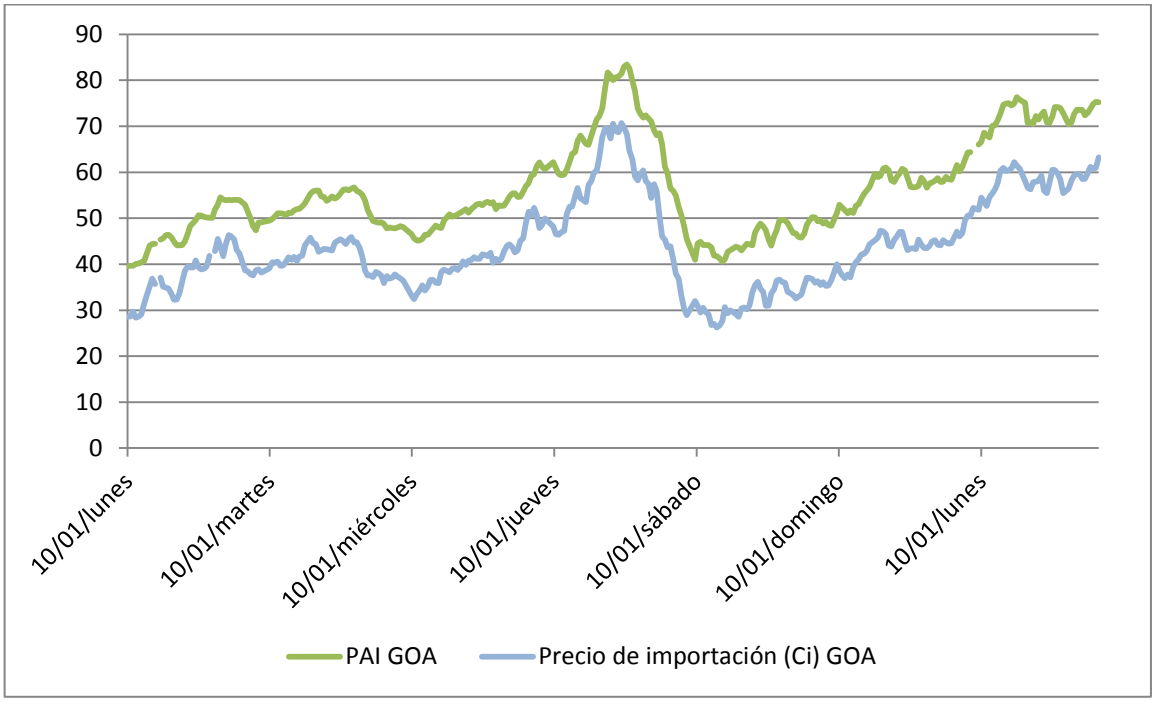
13. Table 2 presents the statistics describing the series of international benchmark prices for GNA95 and GOA (which, for the sake of simplicity, will hereinafter be referred to as import prices), and the series of service station pre-tax retail prices of GNA95 and GOA. Figures 1 and 2 show the evolution over time of each price pairing, the retail and import price, for automotive diesel and for 95 octane unleaded petrol during the 7-year sampling period. It can be seen that the import price and end price evolve very similarly for both automotive petrol and diesel. What is more, both trend upward.

Table 2. Descriptive statistics of the series of end and import prices of automotive diesel (GOA) and 95 octane unleaded petrol (GNA95)

	GOA		**GNA95**	
(c€/litre)	**End price**	**Import price**	**End price**	**Import price**
Avg	56.333	44.019	51.949	39.697
High	83.437	70.656	72.818	57.570
Low	39.603	26.251	30.381	19.578
Standard deviation	10.446	10.022	9.416	8.779
Median	53.906	42.537	51.861	39.558
Pearson CV	0.185	0.228	0.181	0.221
Asymmetry coefficient	0.716	0.634	0.186	0.1454
Kurtosis coefficient	2.60	2.73	2.43	2.41

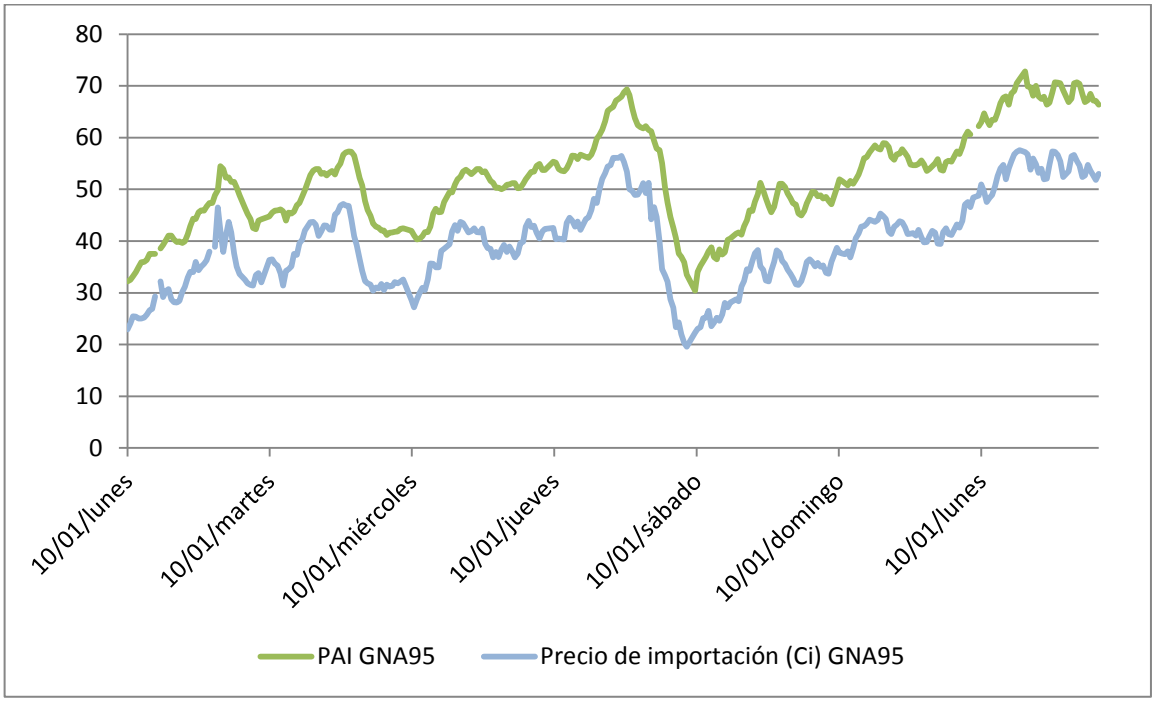
Source: prepared in house using data from the CNE and MINETUR.

Figure 1. Retail pre-tax price (PTP) and import price (Ci) of Diesel (c€/litre) from 2005 to 2011



Source: prepared in house using data from the CNE and MINETUR.

Figure 2. Retail pre-tax price (PTP) and import price (Ci) of GNA95 (c€/litre) from 2005 to 2011



Source: prepared in house using data from the CNE and MINETUR.

14. The graphs suggest that the series are not stationary (that is, their mean and variance are not stable over time), so that a simple regression could give a spurious correlation as a result (a correlation is spurious when the correlation between the variables appears high according to the adjusted R^2 but there is no real relation whatsoever between them), requiring application of the standard methodology used in the literature reviewed: the error correction model (ECM). This methodology mitigates the problem of spurious relations, but its application requires the fulfilment of two conditions: first, that the original series (in levels) are integrated of order one, I(1), that is, that the series are non-stationary in levels but are stationary in their first differences; and second, that a linear combination can be made with the series in levels that are stationary, that is, there is a long-term stable relationship or equilibrium between them. If both conditions are met, then the two series are cointegrated and the ECM can be applied.

15. To check the stationarity of the series of end prices (which we term p_t, as it will be our dependent variable in the estimation) and of import prices (which we term x_t, as this will be our independent variable or regressor in the estimation), both in levels and in first differences, we applied the standard methods: the unit root test, augmented Dickey-Fuller (ADF) test and the Philips-Perron (PP) test. Table 3 displays the results obtained from the application of those tests to the series in levels of retail prices (p_t) and import prices (x_t). The null hypothesis for these tests is the existence of the unit root, that is, that the series is not stationary. The null hypothesis was not rejected in any of the cases, as the values of the augmented Dickey-Fuller test and Philips-Perron test statistics are lower than the critical values for rejecting the null hypothesis at the standard significance levels. Therefore, the series in levels are not stationary.

Table 3. Unit root test for series in levels of retail prices (p_t) and of import prices (x_t)

	GOA		GNA95	
Statistical test	p_t	x_t	p_t	x_t
Test ADF	-1.796	-1.972	-2.090	-2.149
Test PP	-1.526	-1.352	-2.471	-2.302

The null hypothesis is the existence of a unit root and is not rejected in any case.

16. Table 4 shows the results of applying these tests to the series in first differences of retail prices (Δp_t) and import prices (Δx_t). In all cases the null hypothesis of a unit root is rejected at the maximum significance level of 1%. Therefore, the series in first differences are stationary. In conclusion, the series of end prices and import prices, both for diesel and for petrol,

are integrated of order one, and thus comply with the first condition for applying the ECM.

Table 4. Unit root test for the series in first differences of retail prices (Δp_t) and import prices (Δx_t)

	GOA		GNA95	
Statistical test	Δp_t	Δx_t	Δp_t	Δx_t
ADF test	-4.896***	-5.461***	-4.751***	-5.056***
PP test	-11.770***	-13.038***	-11.415***	-15.725***

*** Indicates rejection of the null hypothesis of existence of unit root at a 1% significance level.

17. To check for fulfilment of the second condition required to apply the ECM, the long-term relationship must be estimated (first stage of the ECM) and the stationarity of the residuals must be analysed. The long-term equilibrium relation is defined as follows:

$$p_t = \alpha + \beta x_t + \varepsilon_t \quad (1)$$

where ε_t represents the residuals from the long-term relationship. The long-term equilibrium relationship is estimated (the results are presented in the next section) and the same unit root tests are applied to the residuals of this equation. Table 5 presents the test results that indicate rejection of the null hypothesis of unit root at the 1% maximum significance level. Therefore, the residuals are stationary, which means that the end price and import price variables, both for diesel and for petrol, are cointegrated and the estimated equations represent the cointegration relationships.

Table 5. Unit root test for residuals of the long-term relationship (ε_t)

	GOA	GNA95
Statistical test	ε_t	ε_t
ADF test	-2.831***	-3.954***
PP test	-6.750***	-7.812***

*** Indicates rejection of the null hypothesis of existence of unit root at a 1% significance level.

18. The cointegration relationship shows us that the series of pre-tax prices at service stations and of import prices move together in the long run. But in the short run, transitory deviations from the long-term equilibrium situation may arise that are estimated in the second stage of the ECM.

19. The second stage of the ECM involves regressing the changes in the end prices (Δp_t) onto the changes in the import prices (Δx_t), introducing the past deviation from the equilibrium situation (ε_{t-1}) as explanatory variable.

To be able to distinguish the effects of increases and decreases in the import price, the latter variable is divided in two: $\Delta x_t^+ = \max\{\Delta x_t, 0\}$, whose associated coefficient (β_t^+) captures the effect of increases in the import price on the changes in the end price; and $\Delta x_t^- = \min\{\Delta x_t, 0\}$, whose associated coefficient (β_t^-) reflects the effect of decreases in the import price on the changes in the end price. Thus, if β_t^+ and β_t^- are different, this tells us that asymmetries exist, and if $\beta_t^+ > \beta_t^-$, the asymmetries involve stronger pass-through of the increases than of the decreases. The effects of the import prices on the end prices may be contemporaneous or past, so several lags will be included in the import prices until they are not significant and the model is chosen that presents the lowest value for the Schwarz information criterion (Contín *et al.*, 2008 and 2009). As per Borenstein *et al.* (1997) and the ensuing articles, the concrete specification of the ECM is as follows:

$$\Delta p_t = \theta \varepsilon_{t-1} + \sum_{i=0}^{n} \beta_i^+ \Delta x_{t-i}^+ + \sum_{i=0}^{m} \beta_i^- \Delta x_{t-i}^- + u_t \qquad (2)$$

where ε_{t-1} are the residuals from the equation estimated in the first stage lagged one period ($\varepsilon_{t-1} = p_{t-1} - \alpha - \beta x_{t-1}$), the associated coefficient (θ) for which, in absolute value, tells us the speed at which the adjustment to the long-term equilibrium is produced.

20. This model can be completed by considering the possibility that the past variations in retail prices themselves have effects on their contemporaneous variations, as was done by Borenstein *et al.* (1997) and some subsequent articles. So the model will also be estimated including past changes in retail prices (Δp_{t-i}) as explanatory variable:

$$\Delta p_t = \theta \varepsilon_{t-1} + \sum_{i=0}^{n} \beta_i^+ \Delta x_{t-i}^+ + \sum_{i=0}^{m} \beta_i^- \Delta x_{t-i}^- + \sum_{i=1}^{q} \gamma_i \Delta p_{t-i} + u_t \qquad (3)$$

21. The estimation of two different models also serves as a test of the robustness of the results, such that if the results obtained are very different in the two models, their soundness and credibility will be called into question, and if, on the other hand, the results are similar, this tells us they are robust for small changes in the models. The next two sections present the results of the ECMs, first for diesel and then for petrol.

III. RESULTS FOR DIESEL

22. Table 6 presents the results of the equation (1) estimation, the long-term relationship between the diesel retail price and import price. The effect of the GOA import price on the pre-tax price of GOA at the pump is significant at 1% and its value is very close to one (indeed, the null hypothesis that the coefficient associated with the import price is equal to 1 cannot be rejected). Therefore, all changes in the import price are finally transmitted to the service station retail price in long run. The adjusted R^2 of this simple model is quite high, more than 95%, so the import price, in

essence the cost of supply, explains the final price of the diesel to a large extent.

Table 6. Results of the long-term estimation for diesel

Variables	Coefficients
Constant (α)	11.482
	(0.556)***
Import price (β)	1,019
	(0.0123)***
R^2	95.35%
Number of observations	335

Standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%, * 10%.

23. Once the stationarity of the errors of the estimation in this first stage have been checked, the ECM second stage estimation is made, as reflected in equation (2). This is done by making estimates with a different number of lags of increases and decreases in the import price, selecting the one with the lowest Schwarz information criterion value, in which the increases and decreases have significant effects on the end price up to two periods after they occur.[6] So the estimation equation is:

$$\Delta p_t = \theta \varepsilon_{t-1} + \beta_0^+ \Delta x_t^+ + \beta_0^- \Delta x_t^- + \beta_1^+ \Delta x_{t-1}^+ + \beta_1^- \Delta x_{t-1}^- + \beta_2^+ \Delta x_{t-2}^+ + \beta_1^- \Delta x_{t-2}^- + u_t \quad (2)'$$

24. The model displays heteroskedasticity, so the standard errors of its coefficients have been calculated using White's heteroskedasticity-robust variance-covariance matrix. The model does not present autocorrelation problems according to the Breusch and Godfrey test (the LM test). The model has fairly strong explanatory power, with an adjusted R^2 close to 76%. The coefficient associated with the deviation from the long-term equilibrium (θ) is significant at 1% and negative, as it should be, given that if the retail price is higher than its estimated equilibrium level (positive error), it must come down to revert to the equilibrium level, and if it is lower (negative error), it must rise to reach the equilibrium. The absolute value of the coefficient (0.0788) tells us the proportion of the deviation from the long-term equilibrium of the preceding period that is corrected in the current one. Table 7 shows the results of the equation (2)´ estimation.

[6] When variables not significant at 5% have been presented in a model, the estimation is made again without including those variables, so the final model is the one that has been estimated taking into account only the significant variables.

Table 7. Results of the ECM (2)´ estimation for diesel

Variables	Coefficients
Deviation from long-term (θ)	-0.0788
	(0.0233)***
Contemporaneous rise of import prices (β_0^+)	0.1057
	(0.0411)**
Contemporaneous decrease of import prices (β_0^-)	-0.0254
	(0.0356)
Rise after one period of import prices (β_1^+)	0.4643
	(0.0553)***
Decline after one period of import prices (β_1^-)	0.4890
	(0.0541)***
Rise after two periods of import prices (β_2^+)	0.1522
	(0.0430)***
Decline after two periods of import prices (β_2^-)	0.2468
	(0.0461)***
Adjusted R^2	76.43%
Number of observations	281

White heteroskedasticity-robust standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%.

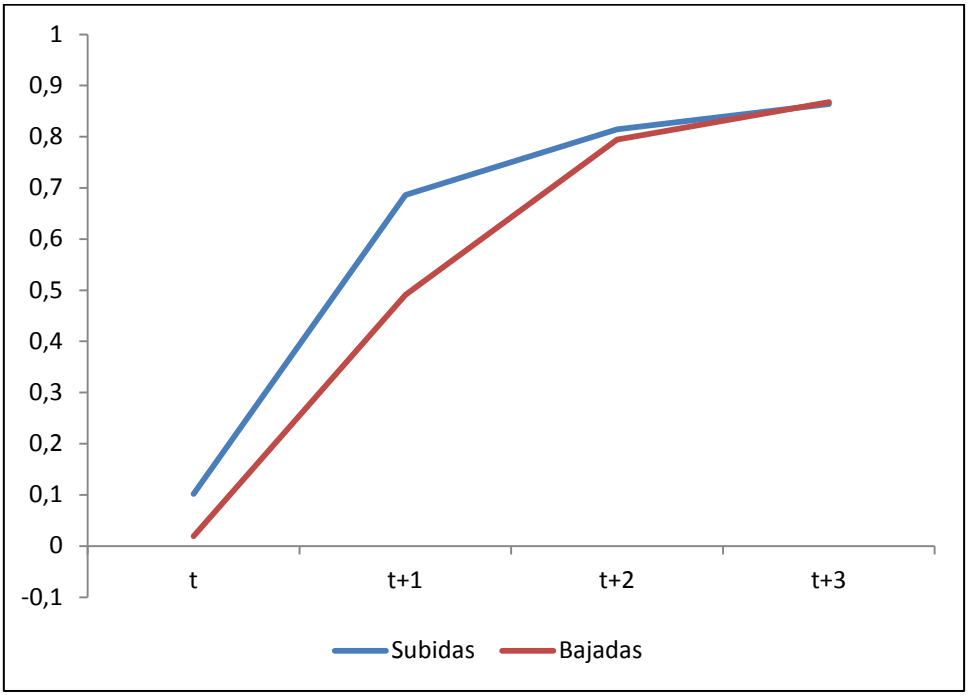
25. Whereas the contemporaneous increment coefficient is significant at 5% (in fact, its p-value is 0.0106, so it is significant at 1.06%), the contemporaneous decrease coefficient is not significant. That is, an increment in the import price has effects on the retail price in the same period as it occurs, but a decrease does not. When the import price rises one euro, the retail price goes up €0.1057 in that same period, whereas when the import price drops, the retail price does not change. After one period, both the increase and the decrease are significant at 1%, and the magnitude of their effects is similar. An increase of one euro in the import price drives the retail price up by €0.4643 after one period, whereas a one euro decline will reduce the retail price €0.4890 one period later. After two periods, both the increase and the decrease continue being significant at 1%, although in this case the decrease has a greater effect (0.2468) than the increase (0.1522). Thus, after two weeks the contemporaneous effect of the increase that was not seen when the import price declined is offset.

26. As per Contín et al. (2008 and 2009), we apply the Wald test to check the null hypothesis of equality of the import price increase and decrease coefficients, $\beta_i^+=\beta_i^-$. The rejection of this joint hypothesis would reveal a significantly asymmetrical response of pre-tax prices to changes in the international prices. The results obtained do not allow us to reject the null hypothesis (F=1.6071 and p-value=0.1880) so, even though asymmetries

have been found, the result is weak in econometric terms. In any event, in the first period an asymmetrical adjustment can be seen, as the increase coefficient is significantly different than the coefficient for reductions in the import prices (F=4.4248 and p-value=0.0363).

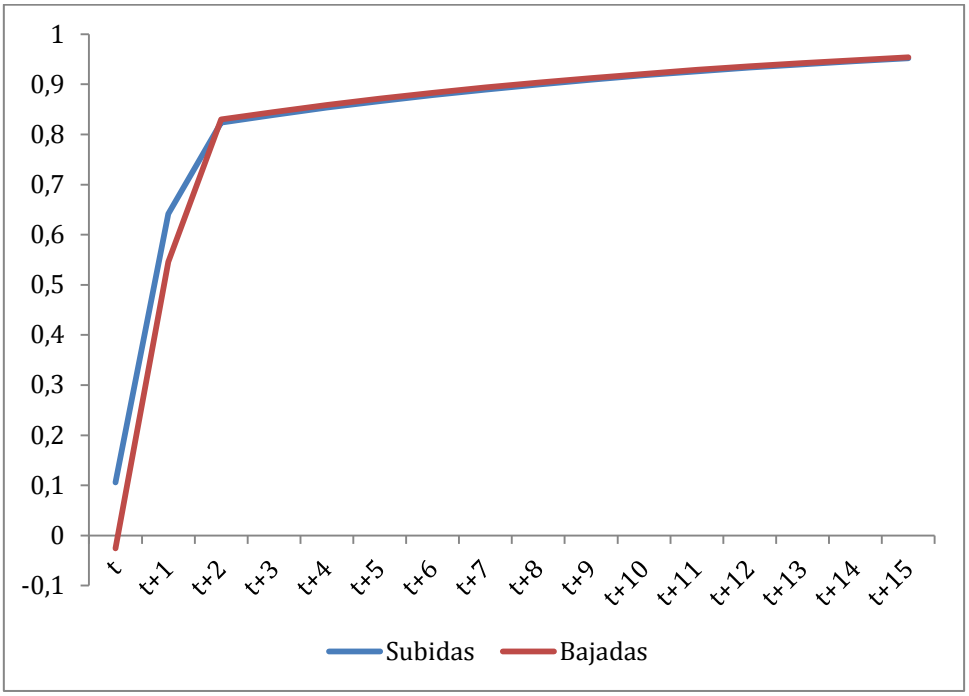
27. In order to be able to better visualise the transfer of the increases and decreases in the import price to the retail price over time, the cumulative adjustment functions are calculated (see, for example, Borenstein *et al.*, 1997; Johnson (2002; Wlazlowski, 2003 or Contín, 2008). These functions reflect the accumulated response of the retail price to increases and decreases in the import price over the course of different time periods. Figure 3 displays the cumulative adjustment functions for the contemporaneous period and the three ensuing weeks. It shows the positive contemporaneous effect of the increases and the null effect of the declines, and the greater cumulative effect of the increases until two weeks after the change in the import price, at which time the cumulative effects even out (t+2), and the decrease even has a slightly larger cumulative effect. After three weeks, the transfer of the changes in the import price to the retail price account for more than 70% of the total effect for the long term (calculated in the ECM first stage: 1.0197). After that (t+3), the accumulated effects of the increases and decreases are very similar, as can be seen in Figure 4, which graphs the cumulative effects of the first 15 lags, by when the transmittal exceeds 95%. These graphs show the existence of asymmetries in diesel, although, as already indicated, the result is week in econometric terms.

Figure 3. Cumulative adjustment functions during the first three periods of ECM (2)´ for diesel



Source: prepared in house from the ECM results

Figure 4. Cumulative adjustment functions during the first 15 periods of the ECM (2)´ for diesel



Source: prepared in house from the ECM results

28. When the past dynamic of the retail prices (the dependent variable of the preceding period, $\Delta y_{t-1)}$ is introduced in the model as explanatory variable, the main results are unchanged. The model with the lowest Schwarz information criterion value is selected, which includes the increases and decreases in the import price until two periods after they occur, and the change in the retail prices from the preceding period. So the estimation equation is:

$$\Delta p_t = \theta \varepsilon_{t-1} + \beta_0^+ \Delta x_t^+ + \beta_1^+ \Delta x_{t-1}^+ + \beta_1^- \Delta x_{t-1}^- + \beta_1^- \Delta x_{t-2}^- + \gamma_1 \Delta p_{t-1} + u_t (3)´$$

29. As with the previous model, this one also presents heteroskedasticity, but it also has problems of autocorrelation of the residuals, so the standard errors have been calculated using the Newey-West heteroskedasticity and autocorrelation-robust variance-covariance matrix. The adjusted R^2 is fairly high, over 76%, so the model explains the behaviour of retail prices rather precisely. The coefficient associated with the deviation from the long-term equilibrium (θ) is also significant at 1% and negative and has a similar absolute value (0.0816) to the previous model. The coefficient that reflects the effect of end prices lagged one period is significant at 5% and has a value of 0.1254. Therefore, there is some dependence of retail prices on

past retail prices.[7] Table 8 contains the results of the equation (3)´ estimation.

Table 8. Results of the ECM (3)´estimation for diesel. Model with "momentum effect"

Variables	Coefficients
Deviation from long-term (θ)	-0.0816
	(0.01780)***
Contemporaneous rise of import prices (β_0^+)	0.1008
	(0.0452)**
Contemporaneous decrease of import prices (β_0^-)	-0.0270
	(0.0546)
Rise after one period of import prices (β_1^+)	0.4546
	(0.0653)***
Decline after one period of import prices (β_1^-)	0.4869
	(0.0448)***
Rise after two periods of import prices (β_2^+)	0.0762
	(0.0549)
Decline after two periods of import prices (β_2^-)	0.1657
	(0.0657)**
Past variation retail price (γ_1)	0.1781
	(0.0551)**
Adjusted R^2	76.42%
Number of observations	281

Newey-White heteroskedasticity and autocorrelation-robust standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%.

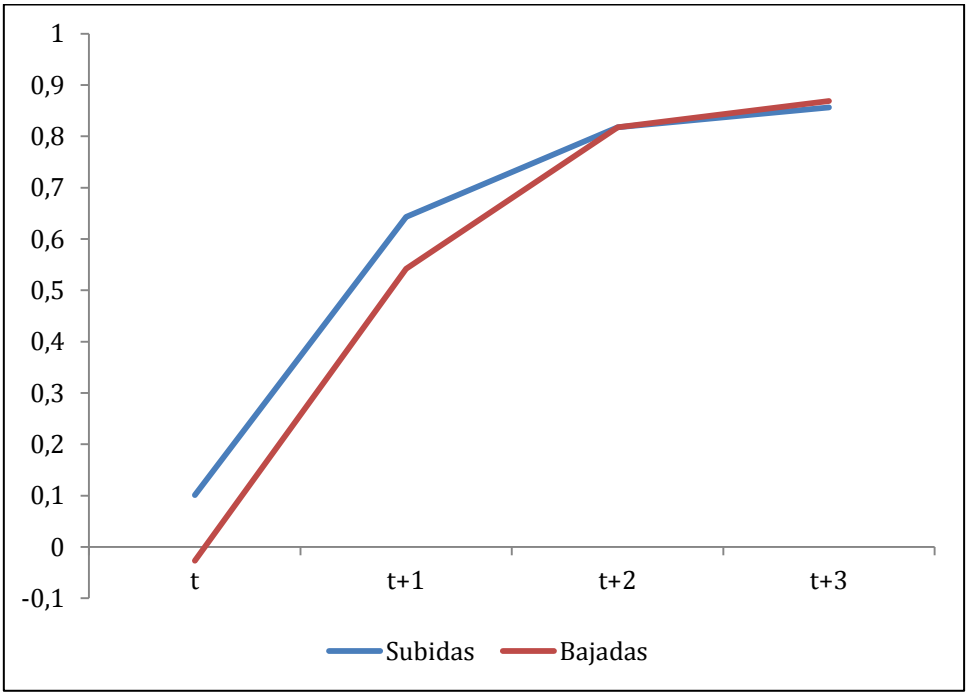
30. In this case, the contemporaneous effects of the increases in the import price are significant at 5%, although close to 1% (p-value of 0.0267) and the contemporaneous effects of the decreases are not a significant variable that explains the behaviour of the end prices. That is, once again, a rise in the import price has effects on the retail price in the same period as it occurs, whereas a decrease does not. When the import price goes up one euro, the retail price rises €0.1008 in the same period, practically the same amount as estimated in the previous model, whereas when the import price goes down, the retail price does not move. After one period, both the increase and the decrease are significant at 1%, and the magnitude of their effects is similar. A one euro increase in the import price drives the retail price €0.4546 higher after one period, while a

[7] Which could be due to "menu costs", information processing costs or stock management costs in the service stations, amongst other factors.

decrease of one euro in the retail price reduces the retail price by €0.4869 one period later, very similar values to those estimated with the previous model. After two periods, the effect of the price rise is no longer significant, whereas the effect of the decrease remains significant, although not at 1% as in the previous model, but at 5%, and its effect (0.1657) is lower than in the previous model. That is to say, when the dynamic of the end prices themselves is introduced in the model, the effects of the import prices after two periods is lower. In any event, the same as with the preceding model, after two weeks the contemporaneous effect of the increase that did not occur when the price went down is offset. Here, too, the Wald test for this model does not allow the null hypothesis of equality of the coefficients (F=0.7565 and p-value of 0.5194) to be rejected, so that, even though asymmetries have been found, the result is weak for econometric purposes.

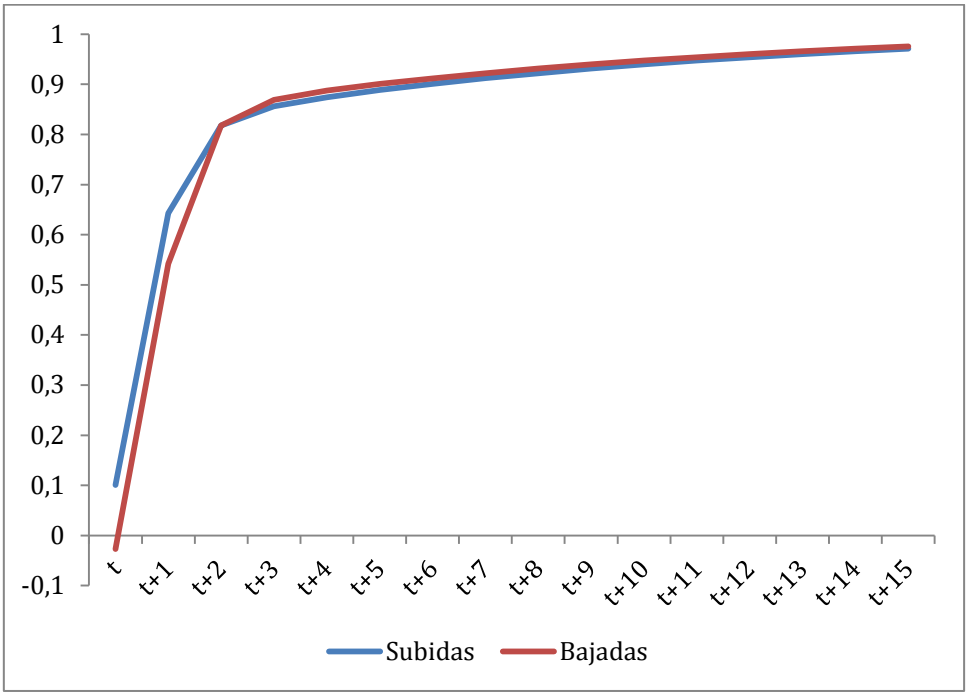
31. These conclusions can be seen in the cumulative adjustment functions after two periods graphed in Figures 5 and 6.

Figure 5. Cumulative adjustment functions during the first three periods of the ECM (3)´ for diesel. Model with "momentum effect"



Source: prepared in house from the ECM results.

Figure 6. Cumulative adjustment functions during the first 15 periods of the ECM (3)´ for diesel. Model with "momentum effect"



32. The main results of the first model (2)´ estimated are therefore confirmed by the results of this second model (3)´. The principal conclusion is that asymmetries exist in the transmission of changes in the import price to the retail price of diesel, as price increases have an impact in the contemporaneous period, while the price reductions do not. The difference in the greater effect of increases with respect to decreases lasts two weeks, after which time the accumulated effects of the price increases and decreases are very similar. However, the result is weak in an econometric sense according to the Wald test.

IV. RESULTS FOR PETROL

33. Table 9 presents the estimations of the long-term relationship (equation 1) between the retail price of 95 octane unleaded petrol and its import price. As in the case of diesel, the effect of the petrol import price on the end price is significant at 1% and its value is very close to one, so that, once again, all changes in the import price are eventually transmitted, even more proportionately in this case, to the service station retail price in the long run. Also, the adjusted R^2 of the model is very high, close to 94%, so the import price has great explanatory power for the end price of the petrol.

Table 9. Results of the long-term estimation for petrol

Variables	Coefficients
Constant (α)	10.614
	(0.590)***
Import price (β)	1.042
	(0.0145)***
R^2	93.90%
Number of observations	335

Standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%, * 10%.

34. Exactly the same as in the case of diesel, the second stage of the ECM is estimated, that is, equation (2), after checking the stationarity of the first stage estimation errors. Also, estimations are made for different numbers of lags of the increases and decreases in the import price and the model is chosen with the lowest Schwarz information criterion value, in which, as with diesel, the increases and decreases have significant effects on the end price up to two periods after their occurrence. So the estimation equation is:

$$\Delta p_t = \theta \varepsilon_{t-1} + \beta_0^+ \Delta x_t^+ + \beta_0^- \Delta x_t^- + \beta_1^+ \Delta x_{t-1}^+ + \beta_1^- \Delta x_{t-1}^- + \beta_2^+ \Delta x_{t-2}^+ + \beta_1^- \Delta x_{t-2}^- + u_t \quad (2)'$$

35. The principal characteristics of the model for petrol are very similar to those of the model for diesel. The model displays heteroskedasticity, so the standard errors of the coefficients have been calculated using the White heteroskedasticity-robust variance-covariance matrix. The model does not present autocorrelation problems according to the Breusch and Godfrey test (the LM test). The explanatory power of the model is fairly high, as its adjusted R^2 is over 75%. The coefficient associated with the deviation from the long-term equilibrium (θ) is significant at 1% and negative, but its magnitude (0.155) is greater than in the diesel model, which tells us that the proportion of the disequilibrium that is corrected in the current period is larger in this case. Table 10 shows the results of the equation (2)´ estimation.

Table 10. Results of the ECM (2)´estimation for petrol

Variables	Coefficients
Deviation from long-term (θ)	-0.1557
	(0.0228)***
Contemporaneous rise of import prices (β_0^+)	0.1002
	(0.0437)**
Contemporaneous decrease of import prices (β_0^-)	0.026960
	(0.044635)
Rise after one period of import prices (β_1^+)	0.4353
	(0.0502)***
Decline after one period of import prices (β_1^-)	0.3155
	(0.0443)***
Rise after two periods of import prices (β_2^+)	0.075518
	(0.0392)*
Decline after two periods of import prices (β_2^-)	0.2201
	(0.0443)***
Adjusted R^2	75.84%
Number of observations	281

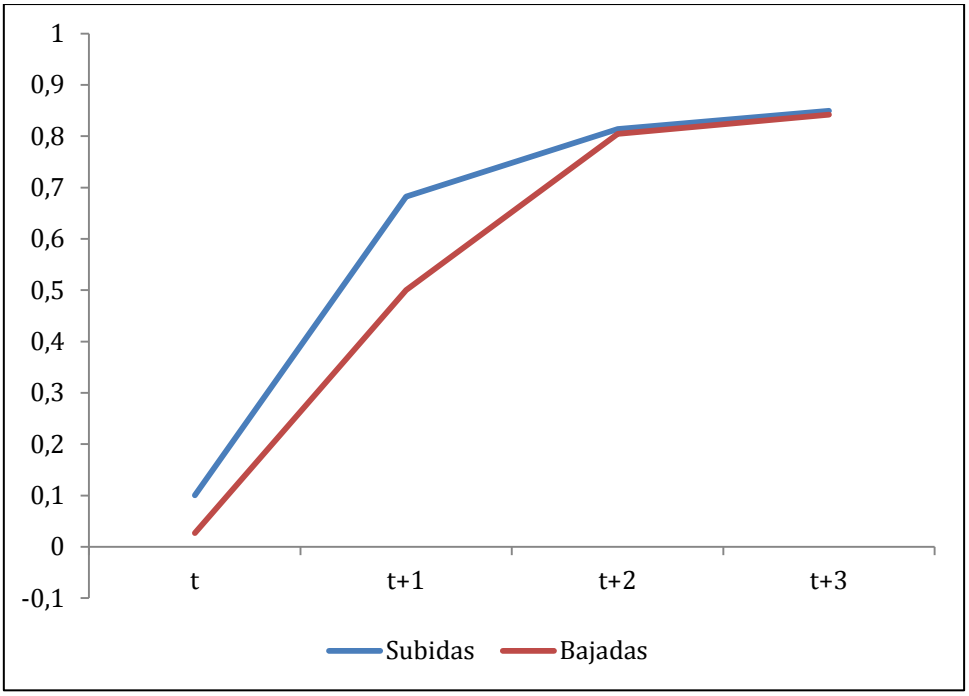
White heteroskedasticity-robust standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%.

36. The coefficient of the contemporaneous increase is significant at 5% although close to 1% (its p-value is 0.0227), whereas the contemporaneous decrease coefficient is not significant. That is, as in the case of diesel, an increase in the import price has effects on the retail price in the same period as it occurs, but a decrease does not. When the import price goes up one euro, the retail price rises €0.1002 in the same period, whereas when the import price drops, the retail price does not change. After one period, both the increase and the decrease are significant at 1%, and the magnitude of the effect of the increase is sharply larger than the magnitude of the effect of the decrease. A one euro increase in the import price drives the retail price higher by €0.4353 after one period, whereas a one euro decline reduces the retail price by €0.3155 one period later, so the pricing asymmetries are even greater. After two periods, the effect of the increase is significant at 10% (its p-value is 0.0549), whereas that of the decrease is significant at 1%. The effect of the one euro decrease is €0.2201, so that after two periods the greater effect of the increase in the two preceding periods is practically cancelled out, although not completely.

37. The same as for diesel, we apply the Wald test to check the null hypothesis of equality of the coefficients for increases and decrease in the import price, $\beta_i^+=\beta_i^-$. The rejection of this joint hypothesis would reveal a

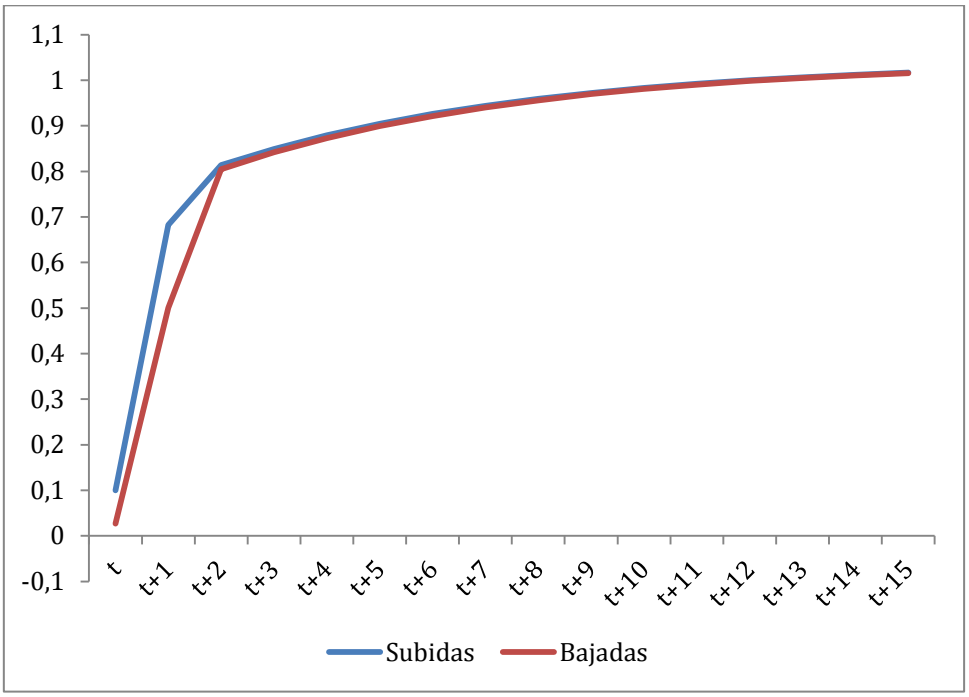
significantly asymmetrical response of pre-tax prices to changes in international prices. The results obtained allow us to reject the null hypothesis (F=2.7903 and p-value=0.0409), so the asymmetries may be said to be statistically significant for GNA95. Figure 7 presents the cumulative adjustment functions for the first three weeks. After that (t+3), as can be seen in Figure 8, the accumulated effects of the changes are very similar for the increases and for the decreases. The full transmittal of the effects to the long-term equilibrium is faster in the case of petrol, given that the absolute value of the coefficient (θ) associated with the deviation from the long-term equilibrium is larger. Figure 8, which reflects the cumulative adjustment function lagged 15 periods, shows how there has been transmitted a large part of the total effect (calculated in the first stage of the ECM: 1.042).

Figure 7. Cumulative adjustment functions during the first three periods of the ECM (2)´ for petrol



Source: prepared in house from the ECM results.

Figure 8. Cumulative adjustment functions during the first 10 periods of the ECM (2)´ for petrol



Source: prepared in house from the ECM results.

38. When the past dynamic of the retail prices themselves is introduced into the model as explanatory variable, the principal results are maintained. The model estimated in this exercise, which has the lowest Schwarz information criterion value, includes the increases and decreases in the import price up to t-2, and the changes in the retail prices for t-1:

$$\Delta p_t = \theta \varepsilon_{t-1} + \beta_0^+ \Delta x_t^+ + \beta_0^- \Delta x_t^- + \beta_1^+ \Delta x_{t-1}^+ + \beta_1^- \Delta x_{t-1}^- + \beta_2^+ \Delta x_{t-2}^+ + \beta_1^- \Delta x_{t-2}^- + \gamma_1 \Delta p_{t-1} + u_t \quad (3)'$$

39. When the dependent variable itself is introduced, lagged one period, the heteroskedasticity presented by the previous model is now joined by the presence of autocorrelation, so the standard errors are calculated using the Newey-West heteroskedasticity and autocorrelation-robust variance-covariance matrix. The adjusted R^2 remains rather high, over 76%, so the model affords a fairly precise explanation of the retail price behaviour. The coefficient θ is also significant at 1% and negative and has a similar absolute value (0.151) to the one from the previous model. The coefficient that reflects the effect of the end prices lagged one period is significant at 10% (its p-value is 0.0837) and is 0.118, indicating there is some dependence of retail prices on their own past levels. Table 11 contains the results of the equation (3)´ estimation.

Table 11. Results of the ECM (3)´estimation for petrol. Model with "momentum effect"

Variables	Coefficients
Deviation from long-term (θ)	-0.1513
	(0.0206)***
Contemporaneous rise of import prices (β_0^+)	0.1017
	(0.0437)**
Contemporaneous decrease of import prices (β_0^-)	0.0191
	(0.0422)
Rise after one period of import prices (β_1^+)	0.4306
	(0.0588)***
Decline after one period of import prices (β_1^-)	0.3151
	(0.0521)***
Rise after two periods of import prices (β_2^+)	0.0052
	(0.0610)
Decline after two periods of import prices (β_2^-)	0.1640
	(0.0647)**
Past variation retail price (γ_1)	0.1180
	(0.0680)*
Adjusted R^2	76.46%
Number of observations	281

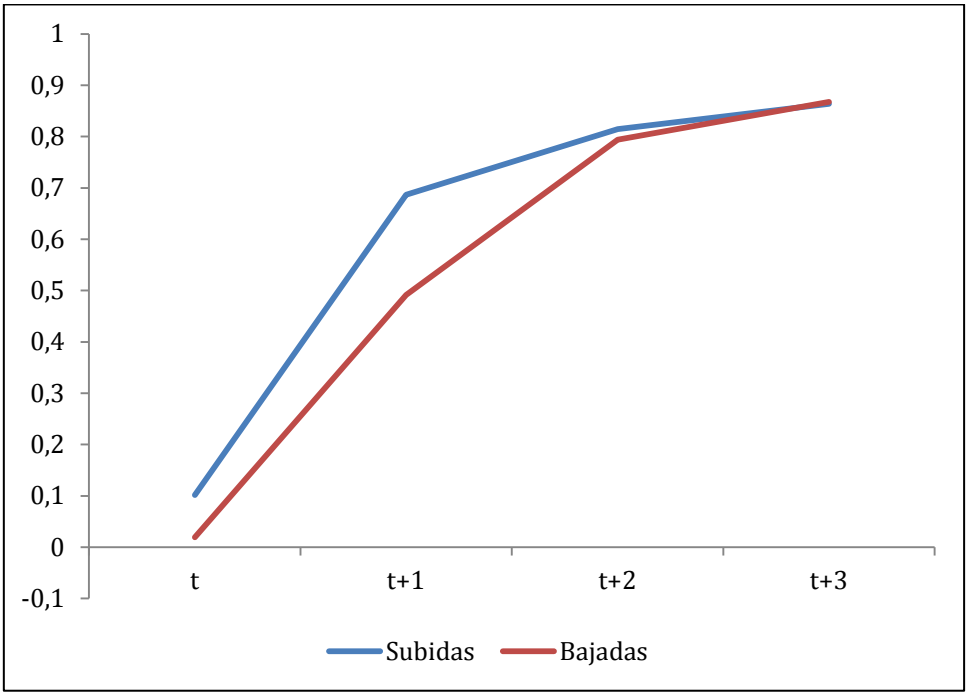
Newey-White heteroskedasticity and autocorrelation-robust standard errors in parentheses. Asterisks denote level of significance: *** 1%, ** 5%.

40. The same as in the model without the end prices as regressor, the contemporaneous effects of increases in the import price are significant at 5% (with a p-value of 0.0208) and the contemporaneous effects of the decreases are not significant. That is, in this model it is also seen that an increase in the import price has effects on the retail price in the same period as it occurs, but a decrease does not. When the import price rises one euro, the retail price goes up €0.1017 in the same period, practically the same amount as estimated in the previous model, whereas a decrease in the import price does not affect the retail price. After one period, both the increase and the decrease are significant at 1%, and the magnitude of the effect of the increase is once again significantly larger than the effect of the decrease. A one euro rise in the import price increases the retail price €0.4306 after one period, whereas a one euro drop reduces the retail price €0.3151 one period later, similar values to those estimated in the previous model. After two periods, the effect of the increase is no longer significant, whereas the effect of the decrease is significant at 5%, instead of at 1% as seen in the previous model. Moreover, its effect weakens with respect to the previous model down to 0.1640. That is to say, when the dynamic of the end prices themselves is introduced in the model, the effects of the import prices after two periods is lower. In any event, as

occurred with the previous model, the greater effect contemporaneously and during the first week of the increase is cancelled out after two weeks. Here, too, the Wald test for this model does not allow the null hypothesis of equality of the coefficients (F=0.7565 and p-value de 0.5194) to be rejected, so that, even though asymmetries have been found, the result is weak for econometric purposes.

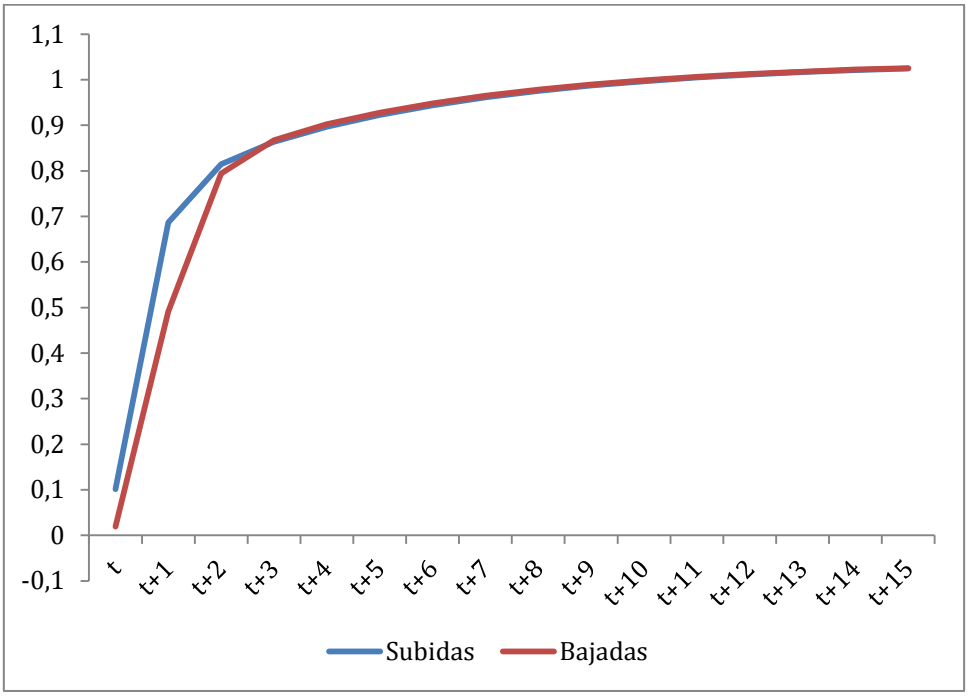
41. These conclusions can be seen in Figure 9. Also, as from this period, the accumulated effects of the increases and decreases are very similar, as can be observed in Figure 10, which depicts the cumulative adjustment functions of the first 15 periods, in which there has been transmitted a large part of the total effect (calculated in the first stage of the ECM: 1.042)

Figure 9. Cumulative adjustment functions during the first three periods of ECM (3)´ for petrol. Model with "momentum effect"



Source: prepared in house from the ECM results.

Figure 10. Cumulative adjustment functions during the first 10 periods of the ECM (3)´ for petrol. Model with "momentum effect"



Source: prepared in house from the ECM results.

42. Therefore, the results of the first model (2)´ are maintained in this second model (3)´. There are statistically significant asymmetries (according to the results of the Wald test) in the pass-through of the import price to the retail price of petrol, as increases have a contemporaneous effect, but decreases do not, and in the first period the effect of the increases is notably larger than the effect of the decreases. After three weeks, the accumulated effects offset each other and they remain equal until the long-term equilibrium is attained.

43. In summary, the empirical analysis of the weekly data on import prices and pre-tax retail prices of automotive diesel and unleaded petrol from 2005 to 2011 indicates there are asymmetries in the pass-through of changes in the import prices to the end prices. In the week of the import price rise, part of the increase is transmitted to the end price, whereas this does not occur when the import price declines. The asymmetries last two week for both automotive petrol and diesel, although for petrol the larger impact of the price increases is greater in the first week, whereas that difference is smaller for diesel. After two weeks, the accumulated effects of the increases and decreases are similar until there is full transmittal of the changes in the import prices to the end prices. However, the results for diesel are weak in econometric terms, whereas they are solid for GNA95.

BIBLIOGRAPHY

Asplund, M.; Erikson, R. and Friberg, R. (2000), *Price adjustments by a retail gasoline chain*, Scandinavian Journal of Economics, 102(1), 101-121.

Portuguese Competition Authority, *Análise aprofundada sobre os sectores dos combustiveis líquidos e do gas engarrafado em Portugal. Relatório Final*, 31 March 2009.

Bachmeier, L. J. and Griffin, J. M. (2003), *New evidence of asymmetric gasoline price responses*, Review of Economics and Statistics, 85(3), 772-776.

Bacon, R. W. (2001), *Rockets and feathers: the asymmetric speed of adjustment of UK retail gasoline prices to cost changes*, Energy Economics 13, 211-218.

Balke, N. S.; Brown, S. P. A. and Yücel, M. K. (1998), *Crude oil and gasoline prices: An asymmetric relationship*, Economic Review, first quarter, 2-11.

Bank of Spain (2008), Monthly Bulletin, November 2008.

Bettendorf, L.; Van der Geest, A. and Varkevisser, M. (2003), *Price asymmetry in the Dutch retail gasoline market*, Energy Economics, 25, 669-689.

Borenstein, S., Cameron, C. A. and R. Gilbert (1997), *Do Gasoline Prices Respond Asymmetrically to Crude Oil Price Changes?*, Quarterly Journal of Economics, 112(1): 305-339;

Borenstein, S. and Shephard, A. (2002), *Sticky prices, inventories, and market power in wholesale gasoline markets*, The RAND Journal of Economics, 33 (1), 116-139.

Cabral, L. & A. Fishman (2008), *Business as Usual: A Consumer Search Theory of Sticky Prices and Asymmetric Price Adjustment*, Working Paper Bar Ilan University.

Comisión Nacional de la Competencia (CNC) (2009), *Report on Competition within the Automotive Fuel Sector.*

Comisión Nacional de la Competencia (CNC) (2011), *Follow-up Report on the CNC's Automotive Fuel Report*.

Contín-Pilart, I., Correljé, A. and Palacios, M.B. (2008), *(A)Simetrías de precios y evolución de márgenes comerciales en el mercado español del gasóleo de automoción* [(A)Symmetries in prices and evolution of commercial margins in the Spanish automotive diesel market], Hacienda Pública Española / Revista de Economía Pública, 185 (2), 9-37.

Contín-Pilart, I., Correljé, A. and Palacios, M. B. (2009), *Competition, regulation and pricing behaviour in the Spanish retail gasoline market*, Energy Policy 37, 219-228.

Galeotti, M., Lanza, A. and M. Manera (2001), *Rockets and Feathers Revisited: An International Comparison on European Gasoline Markets*, Energy Economics 25, 175-190.

Geweke, J. (2004) *Issues in the "Rockets and Feathers" Gasoline Price Literature, Report to Federal Trade Commission*, University of Iowa, 16 March 2004; www.ftc.gov/bc/gasconf/comments2/geweke2.pdf

Golby, R.; Lintner, A. M.; Stengos, T. and Wyschneider, B. (2000), *Testing for asymmetric pricing in the Canadian retail gasoline market*, Energy Economics, 22, 349-368.

Johnson, R. N. (2002), *Search costs, lags, and prices at pump*, Review of Industrial Organization, 30, 33-50.

Kaufmann, R. K. and Laskowski, C. (2005), *Causes for an asymmetric relation between the price of crude oil and refined petroleum products*, Energy Policy, 33, 1587-1596.

Kirchgässner, G. and Kübler, K. (1992), *Symmetric or asymmetric price adjustment in the oil market*, Energy Economics 14, 171-185.

Peltzman, S. (2000), *Prices rise faster than they fall*, Journal of Political Economy, 108: 466-502;

Perdiguero, J. (2006), *Dinámica de precios en el mercado español de gasolina: un equilibrio de colusión tácita* (Pricing dynamics in the Spanish petrol market: an equilibrium of tacit collusion), Working Document no. 256. Fundación de las Cajas de Ahorros.

Really, B. and Witt, R. (1998), *Petrol price asymmetries revisite*d, Energy Economics, 20, 297-303.

Tappata, M. (2008), *Rockets & Feathers: Understanding Asymmetric Pricing*, The RAND Journal of Economics, 40 (4): 673–687.

Wlazlowski, S. (2003), *Petrol and Crude Oil Prices: Asymmetric Price Transmission*, Ekonomica – Cyprus Journal of Economics, 11: 1-25.

Yang, H. and L. Ye (2008), *Search with Learning: Understanding Asymmetric Price Adjustments*, The RAND Journal of Economics, 39(2): 547-564.

ANNEX 2

THEORETICAL EXPLANATIONS OF THE EXISTENCE OF ASYMMETRIES IN THE TRANSFER OF INTERNATIONAL PRICES TO RETAIL PRICES IN THE FUEL MARKET

THEORETICAL EXPLANATIONS OF THE EXISTENCE OF ASYMMETRIES IN THE TRANSFER OF INTERNATIONAL PRICES TO RETAIL PRICES IN THE FUEL MARKET

1. The academic literature offers diverse explanations for the rockets and feathers phenomenon in the automotive fuel market, running from tacit collusion between operators (part 1) or the existence of consumer search costs in the context of local market power (part 2), to explanations that are seemingly less worrisome from an antitrust standpoint, such as production lags combined with finite stocks (part 3). Lastly, there are other possible causes of the asymmetries involving certain accounting practices of the operators and how consumers respond to price changes (part 4).

2. These theories are analysed below, with a discussion of their principal characteristics.

I. TACIT COLLUSION IN AN OLIGOPOLISTIC ENVIRONMENT

3. The traditional explanation for the rockets and feathers phenomenon is that it arises from the interaction of oligopolistic operators with market power who collude, tacitly or explicitly, instead of competing with each other.

4. The traditional theory[8] postulates that when faced with decreases in the input price (the international price of the fuel), operators are initially hesitant to cut the output price for fear of triggering a price war. Operators only reduce their prices when they see significant falls in their sales, as that indicates their competitors have cut prices. So the price of the end product before a fall in the cost of import becomes a focal point for oligopolistic sellers and hence an equilibrium price, which will decline over time until the distribution margin narrows again. Faced with this behaviour, the oligopolists tend to pass through increases in international prices immediately to their selling prices, given that a reduction in margins could lead to a price war that would be harmful for all of the oligopolists, and calculate that their competitors will react in the same way and also pass the increased input cost onto their output price.

5. It is important to note that this explanation of asymmetrical reactions to fluctuations in international prices may occur both in the wholesale segment (between importers and operators with refining capacity) and in the retail segment of the automotive fuel distribution market.

[8] Borenstein, S., Cameron, A.C., and Gilbert, R. (1997), "Do gasoline prices respond asymmetrically to crude oil price changes?", *The Quarterly Journal of Economics*, Vol. 112, No. 1 (February, 1997), pgs. 305-339.

6. There are numerous studies that support this theoretical explanation of the rockets and feathers phenomenon, mainly based on the idea that in markets with bigger margins (and in which the operators may be expected to have greater market power as well), output prices react more slowly to changes in import prices.

- Borenstein and Shepard (2002)[9] found evidence that in the US wholesale petrol markets, operators with refining capacity adjust the selling price of the fuel in response to changes in the price of crude oil slower if the margins in the market are bigger, which is consistent with the idea that adjustments are slower when market power is greater in the wholesale segment.
- Deltas (2008)[10] studied market power in the retail segment, and showed how in those US States with the narrowest margins, increases in the wholesale price are transferred more rapidly to the retail price in order to avoid negative margins, whereas retail prices adjust more slowly to decreases in the wholesale price. But in the high-margin States, retail prices tend to be stickier in relation to increases and to decreases in the wholesale price and the asymmetries are smaller. The author believes that given that the marginal costs other than the wholesale price of the fuel are low (except in those areas where only full-service stations are allowed, and not self-service stations), they do not change in the short run and should be similar in different US States, the only difference between States that could explain this phenomenon would be the local market conditions, including the degree of retail competition.[11]
- Other recent studies focus on disaggregated data on individual service stations that are later pooled together according to common characteristics that reveal aspects relating to local market power.[12] Verlinda (2008)[13] considers numerous differentiating factors of a

[9] Borenstein, S. and Shepard, A., (2002), "Sticky prices, inventories, and market power in wholesale gasoline markets", *The RAND Journal of Economics*, Vol. 33, No 1 (Spring, 2002), pgs. 116-139.

[10] Deltas, G., (2008), "Retail gasoline Price dynamics and local market power", *The Journal of Industrial Economics*, Volume 56, Issue 3 (September 2008) pgs. 613-628.

[11] This approach is consistent with the measure of market power based on the Lerner index. The Lerner index indicates that the greater the market power, the more capacity companies will have to set prices above their marginal costs, so that larger retail distribution margins not originating in higher operator costs indicate greater market power.

[12] Local market power may be the consequence of multiple factors, from the absence of geographic competition from other service stations to product differentiation and the provision of complementary services in addition to selling fuel.

[13] Verlinda, J.A., (2008) "Do rockets rise faster and feathers fall slower in an atmosphere of local market power? Evidence from the retail gasoline market", *The Journal of Industrial Economics*, Volume LVI (September 2008), pgs. 581-612.

geographic and product differentiation nature that may indicate the existence of tacit collusion or consumer search costs, and found greater asymmetries for service stations isolated from competitors, flagged by the major brands and service stations with service zones and more complementary services in addition to refuelling. The author concluded that greater market power is consistent with greater asymmetries, although he also pointed out that the empirical evidence may support the existence of consumer search costs.

- Bello and Contín (2010)[14] conducted a recent study of the effect of local supplyside factors on the pricing of automotive fuels in service stations in Spain. Their results suggest imperfect competition and show how the existence of independent service stations in local markets intensifies competition.

7. It should be noted that the theory is based on certain assumptions that are usually observed in the fuel market.

8. One is that operators have no incentive to compete (initiate a price war) because demand for fuel is inelastic to price[15] due to the scarce substitutability of these fuels. The benefit an operator receives for starting a price war is relatively small, as the price cuts will neither attract many consumers nor significantly change individual purchasing decisions. The second assumption is that the oligopolists are relatively symmetric in their costs and in their level of market strength, so that no operator has a substantial advantage over the rest that can allow it to sustain a price war.[16] In general, this situation frequently occurs in the fuel distribution retail segment, given the local scope of the markets. Furthermore, the existence of large operators with refining capacity, vertically integrated in the downstream fuel supply and distribution businesses and with a strong presence in the latter that is heightened by high entry barriers, may contribute to reinforcing this situation. In this context, operators without refining capacity who mainly participate in the retail segment of the market may not have incentives to deviate from the retail prices set by the major operators, especially if there is a risk of reprisal by the latter, who are also dominant in the national wholesale segment of the market.

9. And third, that the agents can observe each other easily and react quickly to a change in a rival's selling price and modify their own prices. This

[14] Bello, A., and Contín-Pilart, I., (2010), "Influencia de los factores de localización en la fijación de los precios de los carburantes de automoción en España" (Influence of localisation factors in pricing automotive fuels in Spain), *Cuadernos Económicos de ICE*, Number 79 (June 2010), pgs. 45-68.

[15] Inelastic demand means that when the selling price changes, demand does not vary significantly.

[16] Deltas (2008, op cit.)

situation is frequently seen in the fuel market, given that the operators find it relatively easy to track their rivals' prices.

10. Therefore, the existence of an oligopolistic market structure may be one possible explanation for the rockets and feathers phenomenon. This situation does not necessarily imply that the players in the market coordinate their behaviour in violation of the Spanish Competition Act (LDC), but may be a “natural” reaction to limited competition, a situation which would in any event heighten the need to improve the market's design in order to lessen the level of oligopoly.

II. CONSUMER SEARCH COSTS

11. The theory of search costs explains asymmetries that take place in the retail segment of the market. It postulates that consumers face large costs of comparison between service stations that usually deter them from making the comparison each time they must fill the tank, or lead them to conduct very limited comparisons only. In a context of local market power or tacit collusion, an increment in prices makes it more worthwhile for consumers to compare prices between service stations and to pursue more active searches, which hinders operators from exerting their market power or colluding tacitly, thereby intensify competition between service stations. Service stations can therefore “only” pass through the increases in their fuel supply costs to their selling price, but not widen their margins. Conversely, when prices drops, consumers become less active in making inter-station comparisons, as the cost of filling the tank goes down, which tends to favour the appearance or strengthening of local market power and leads to declines in international prices not being immediately transmitted to the end prices.

12. It bears emphasis that this theory has two important particularities. First, it only explains asymmetries in the speed at which costs are transferred to prices in the retail segment of the market. Search costs are unlikely to have impact in the non-retail segments of the chain because the upstream demand consists of professional customers who know the market better and whose search costs are low in relation to the benefits, that is, in relation to the possibilities of finding lower-priced fuel supplies.

13. Second, it is not very reasonable to expect, even in the retail segment, that very short-term asymmetries (daily or weekly) in the speed of adjustment to changes in international prices such as those studied here can be explained by search costs, because consumers do not seem to change their behaviour on a daily or weekly basis. Rather, it seems that the search costs theory would apply to consumer behaviour in the medium term.

14. In fact, there are various empirical studies that support the existence of search costs as an explanation of medium-term consumer behaviour, when the consumer perceives during several weeks running that prices

are high or that they are low. In summary, these theories predict that in rising-price environments, consumers will search more actively and that competition between service stations will therefore increase, whereas when prices trend downward, consumers are less active in their searches, which tends to heighten local market power.

15. Borenstein, Cameron and Gilbert (1997, op cit.) believe, taking Bénabou and Gertner (1993)[17] as reference, that when there is more volatility in the retail fuel price or in the international trading price of crude oil (benchmarks for consumers), consumers are more likely to associate the changes they see in the retail price at their service station with the changes observed in the price of crude. Therefore, the expected benefits of the search are less when the changes in crude oil and fuel prices are large, whether upward or downward. And operators, in turn, take advantage of those large-volatility periods to widen their margins, passing through rises in the wholesale price of the fuel quickly and intensely to the retail price but making slower and less intense downward adjustments.

16. Lewis (2004)[18] studied petrol prices in individual service stations to construct a search model in which consumers use as reference the past values of the retail fuel prices and of the input cost. A consumer who believes the current retail price is low in relation to the benchmark will not search and compare, but if the current price seems high, then the consumer will search actively. Aware of this, operators set service station prices with the idea of avoiding consumer searches. In periods where the distribution margin is low, the operator must raise retail price when the wholesale price goes up to avoid selling at a loss, but will be hesitant to transfer drops in the wholesale price as quickly and as fully because they know the consumer will not conduct active searches. Also, in high-margin periods, operators avoid active searches and retail prices become less sensitive to changes in the wholesale price. According to this author, this approach is consistent with a market characterised by tacit collusion around focal prices. To distinguish between them, he studied the price dispersion behaviour of service stations in response to rises and falls in the wholesale prices, in the belief that if the equilibrium is collusive, there will be an increase in dispersion when the wholesale price drops consistent with a progressive breakdown in the coordination. When consumers engage in active searches, however, the price dispersion

[17] Bénabou, R.W., and Gertner, R., (1993), "Search with learning from prices – Does increased inflationary uncertainty lead to higher markups?", *Review of Economic Studies*, LX (1993), pgs. 63-93.

[18] Lewis, M., and (2004), "Asymmetric Price adjustment and consumer search: an examination of the retail gasoline market", *Competition Policy Center*, Working Paper No. CPC04-47 (July 2004).

should remain constant given that the searching starts approximately at the same time.

17. Lewis and Marvel (2007)[19] studied consumer searches in relation to variations in petrol prices. The analysis focused on measuring consumer searches directly by charting their Internet surfing. The results they obtained indicate that when retail prices go up, consumers search more actively, but their searches are less intense when those prices go down, facilitating asymmetries in a context of local market power of service stations. With respect to service station petrol price dispersion, the authors observed that when retail prices go up dispersion declines (due to greater searching, service stations tend to unify their pricing), whereas when prices fall the dispersion rises (with less searching by consumers, service stations are more capable of exerting local market power).

18. The explanatory power of this theory may be high in the case of asymmetries originating in the retail part of the market, especially as a complement to the effects of oligopolistic local markets analysed in part II above. Search costs favour the maintenance of a low level of competition in local markets and tend to boost retail margins.

III. PRODUCTION LAGS AND STORAGE COSTS

19. The coexistence of fuel refining lags together with finite fuel stocks may cause asymmetries. The theory rests on two assumptions:

- That average fuel storage costs trend downward to a certain level and then stabilise there (referred to as L-shaped average costs).
- That the production or import of fuels cannot be increased immediately, but takes time to adapt.

20. Starting with these two hypotheses, the theory postulates that when input prices drop in the international market and fuel demand rises accordingly, given that the refining process takes various weeks, agents increase their sales by reducing their fuel stocks, pushing up the average storage costs and counteracting the effect of the decline in the input price. Conversely, when international prices rise and demand declines, the resulting increase in stocks does not increase the average cost of storage. Therefore, asymmetries arise in the speed at which changes in international prices are passed through to domestic prices. There are several variants of this theory:

[19] Lewis, M., and Marvel, H., (2007), "When do consumers search?", *The Journal of Industrial Economics*, Vol. 59, Issue 3 (2011), pgs. 457-483.

- Brown and Yücel (2000)[20] focused on shocks in the supply of fuel, instead of on the demand side. These authors believe that a restriction on upstream supply may originate an aggressive price hike by petroleum operators in order to keep fuel stocks from decreasing to below certain levels.
- Borenstein and Shepard (2002) argued that the asymmetries seen in local wholesale markets may be related to the costs of supplyside adjustment for all market structures, but added that they do not have empirical evidence to support this hypothesis.
- Kaufmann and Laskowski (2005)[21] found that the asymmetrical relationship between the crude oil and automotive fuel prices is caused by the refining capacity utilisation levels and by the levels of domestic stocks, and that this is compatible with a properly functioning competitive market.
- Bacon and Kojima (2010)[22] argued that the asymmetries caused in limited inventory stocks can only arise where there exist non-competitive market structures and sufficient market power to influence in the end product price. Their study points out that in a competitive market, operators would not be able to control prices in response to variations in demand or in the cost of inputs.

21. The phenomenon analysed by this theory is more likely to occur upstream (crude-international fuel market or international fuel market-domestic wholesale market) and not in the retail segment of the market, given the characteristics of these stocks.

22. Nevertheless, a variant of this theory could explain asymmetries produced by rigidities in fuel imports, due to how the import contracts are structured or to the reception infrastructure in the destination country, that would render importers incapable of responding to price declines by increasing their fuel imports, while operators with refining capacity are able to respond quickly to increases in international prices and increase their exports, so that the domestic fuel demand drops faster and its price increases faster. In this case, L-shaped storage costs do not have to exist for there to be asymmetries, and it would be sufficient for there to arise bottlenecks or delays in fuel imports which, in the face of higher demand,

[20] Brown, S.P.A., and Yücel, M.K., (2000), "Gasoline and crude oil prices: why the asymmetry?", *Economic and Financial Review*, third quarter (2000), pgs. 23-29.

[21] Kaufmann, R.K., and Laskowski, C., (2005), "Causes of an asymmetric relation between the price of crude oil and refined petroleum products", *Energy Policy*, Vol. 33, pgs. 1587-1596.

[22] Bacon, R., and Kojima, M., (2010), Rockets and feathers: asymmetric petroleum product pricing in developing countries"*, World Bank. Oil, Gas, and Mining Policy Division Working Paper, Extractive Industries for Development*. Series 18 (June 2010).

would confer greater temporary market power on the entrenched operators with refining capacity.

IV. INVENTORY ACCOUNTING

23. Other possible causes of asymmetries cited by economists include certain accounting practices of the operators, particular consumer responses to price changes and the existence of menu costs. It should be noted that these explanations are not as amply supported in the academic literature.

24. Brown and Yücel (2000) argued that in environment with production lags, the way the value of fuel stocks is measured can cause asymmetries. If the companies use the FIFO ("first in first out")[23] inventory accounting method, when the international prices decline and fuel demand rises, companies meet the increased demand by reducing their stocks, which makes the latter more expensive and, given that stocks are the opportunity cost of the fuel, this effect offsets the decline in international prices so that the domestic prices do not drop as much. Conversely, when international prices go up, the companies do not change the size of their stocks, but the use of the FIFO method causes the value of the stocks to rise, given that the fuel purchased first and cheaper is replaced in the inventory accounting by more recent and more expensive purchases.

25. These same authors indicated that user refuelling patterns can contribute to the rockets and feathers phenomenon.[24] This would be the case when consumers move up their purchases when prices are rising in order to avoid having to refill at higher prices later on. This will drive up the price due to the upward demand pressure, whereas when the prices drop, consumers do not delay refuelling, for fear of running out of petrol, so the downward pressure on prices is less intense.

[23] This method assumes that the next item to be sold will be the one that has been in storage the longest. In a situation of rising prices, the FIFO method increases the average value of the stocks held by the company, as companies sell off the oldest items, which are the ones that cost less.

[24] It is important to point out that the authors do not say these decisions cause the asymmetries, but believe that they can only contribute to their existence.