



# *Pay cycles and gasoline price: when low-cost companies take advantage of the needy*

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# Introduction & Motivation

- The attention of the regulator is increasingly focused on the activities of the major brands oil companies that have a dominant position in the market.

In this study, we observe, that low-cost companies that take advantage of the poorest consumers.

- We analyse the causality effect between:

**consumer behaviour in the gasoline market and pay cycles.**

- This article seeks to see if, on the **10th of each month** in the period 2015-2016, smaller oil companies such as low-cost companies, supermarket petrol stations and independent retailers increase their prices. In fact, the public unemployment benefit for unemployed Spanish citizens, so called “*subsídio desempleo*”, is provided on the 10th of each month.
- The aim of this article is to analyse this subsidy, to investigate if the suspected increase in the prices is related to pay cycles issue.

# Outline

- Spanish Petrol Market
- Literature review
- Data
- Empirical strategy
- Results
- Concluding remarks
- Future research

# Spanish petrol market

- The economic crisis has profoundly affected fuel consumption in Spain. Bakhat et al. (2017), identify two different periods:
  - **1990 to 2007** gasoline and diesel *consumption grew* (at the average annual rate of 5% and 6.5% respectively);
  - **2008 to 2013**, diesel and gasoline *demand fell* (respectively at an average annual rate of 5% and 4.3%) while *prices continue to rise*.
- Bakhat et al. (2017) show the economic crisis has led consumers to increase their **reactions to price changes**.

# Spanish Petrol Market

- Presence of **big companies** that have always dominated the market (Correljé (1990), Perdiguero (2010)).

In 1997 **Repsol** group, increases its market power (58% of the national's service stations) strategic behaviour compatible with a tacit collusion price strategy.

- In 2000, grow the number of stations over than 70% due to new competitors: **low-cost companies, unbranded petrol stations** and **supermarket chains** (Bernardo (2017)).

- **Location of gas station** (Bello et al. (2008)):

- Big brand station: concentrated in urban centres and main roads;
- Independent stations and hypermarkets: in suburbs;
- On the *motorways*, almost all the companies present belong to the major brands.

This regional allocation pushes us to affirm how **the different companies choose to localize according to the target (and personal income) of the final consumers.**

# Literature review (1): income segmentation in the energy market

- **Gately et al. (2002)**, analyse for the 96 largest countries in the world, the effects on energy and oil demand when income and price change in per capita terms.
  - ✓ They find that for OECD countries, including Spain, an **increasing in the price** has a **greater impact on the demand** than a price reduction.
  - ✓ They find that **demand is more responsive to increases in income** than a reduction in income.
- **Bakhat et al. (2017)**, analyzing the fuel market in 16 different Spanish regions in the period from 1999-2015, show how an increase in income has a positive effect on gasoline demand.

The 2007 crisis effects have been more devastating for the poorer regions

  - ✓ The effects of the crisis have led to a response from consumers that is more elastic to price and inelastic to income than the previous period before the crisis.
  - ✓ The authors link this reduction in fuel consumption due to the crisis both for the effects on households (wage reductions, unemployment ...) and firms level (shrinking demand).

# Literature review (2): income segmentation in the energy market

- **Cayla et al.** (2011) analyse the role of income in energy consumption (heating and transport expenditures) using a French household's data.
  - poorest consumers, the expenses do not decrease as income decreases;
  - for richest people there is a level of saturation;
  - middling income people, have a level of consumption that increases when income increasing;
- **Eldestein and Kilian** (2009), identify four mechanisms by which consumers' energy expenditures can be influenced:
  1. high energy prices produce a reduction in disposable income;
  2. changing energy prices can create uncertainty about the future path of energy price (postponement of purchases of durable goods);
  3. if purchase decisions are reversible, consumption can decrease in response to energy price shocks;
  4. the consumption of durable goods (motor vehicles...) will diminish even more than other durable goods, such as families delay or buy durable goods that consume energy.
  - It is commonly accepted that **an increase in energy prices** will have **strong effects on production and employment**.

# Literature Review (3): pay cycles issue

An important article on pay cycles is written by **Ines Berniell** (2016) applied in the job market. In US, she shows:

- that those who are **paid recurrently** have flatter expenditure paths;
- “**low frequencies** lead to a within month business cycle, when many workers are paid in the same dates, which in turn generates costly congestion in sectors with capacity constraints”.
- frequencies of payment are important for two reasons:
  1. affect the consumption pattern;
  2. impact in the market.

Pay cycles issue to the fuel market has not yet been studied, but we believe that there is a big relation among these two phenomena.



# Literature Review (4): the role of low cost gasoline companies

- **Bernardo** (2017) demonstrates the average prices in Spain:
  - decreases with the entrance of low-cost companies;
  - decrease in free entry areas (variation in spatial regulatory policies).
- **Hastings** (2004), analyses the impact on gasoline prices for different types of brands classified based on their market share
  - (sample of 20% of service stations of San Diego and Los Angeles areas).
  - Their results show that the low-cost petrol stations compete more intensively than independent stations (with a high market share).
- Two other concepts:
  - **search costs** (PNG and Reitman, 1995) and the **role of accessibility** (Jimenez and Perdiguero, 2010) in the definition of fuel prices.

# Data

- Data were collected from the 1<sup>st</sup> January 2015 to 31 December 2016.
- **Diesel's prices** have been chosen to be analysed, since the high percentage of diesel's consumption by consumers compared to other types of fuel.
- The reference area is the entire **Spain** (except the Canary Islands).
- Data from the different gas stations have been downloaded from the *Ministry of Energy* website, which provides daily prices for each service station.

Data is not historically usable, so they are downloaded daily and organized into a single dataset. The various fuel distribution plants are identified by the Ministry through geolocation (latitude and longitude).
- Software used: Google Earth, Matlab, Stata.

Data have been organized into 4 categories:

- GROUP 1: **large companies** such as Repsol, Cepsa and BP (including the various subsidiaries);
- GROUP 2: “**traditional oil companies**” like Shell, Petrocat, Galp...;
- GROUP 3: “**independent companies**” (individual, family, non-affiliated companies);
- GROUP 4: fuel stations in **supermarket areas** (Carrefour, Eroski,...), **low-cost** independent plants and **cooperative societies**.
- Motorway’s stations: gasoline stations located on spanish motorway.

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### Market share of oil companies in Spain (2015-2016)

<b>Group 1</b>	57,25%
<b>Group 2</b>	12,48%
<b>Group 3</b>	24,45%
<b>Group 4</b>	5,82%

Source: Own Estimation

# Empirical Strategy

- The first approach:

## 1° Model

- $Pit = \beta_0 + \beta_1 \text{ dummy } 10th + \beta_2 \text{ Tuesday} + \beta_3 \text{ Wednesday} + \beta_4 \text{ Thursday} + \beta_5 \text{ Friday} + \beta_6 \text{ Saturday} + \beta_7 \text{ Sunday} + \beta_8 \text{ Brent} + \varepsilon$

Where:

- ✓ *Dummy10*: is a dummy variable equal to 1 for the day of unemployed benefits and 0 otherwise, for all the petrol stations

But, because our exogenous variables (subsidy), is delivered not in the weekends, we include, in these cases, the next Monday price, if available. With this kind of analysis, we investigate the different weight of the days of the week in the formation of the price.

- ✓ Days of the week: dummy variables equal to 1 for this day of the week and 0 otherwise.
- ✓ The “*Brent*” variable is the price of the brent oil per litre.

## 2° Model

- $Pit = \beta_0 + \beta_1 \text{ dummy 10th} + \beta_2 \text{ Tuesday} + \beta_3 \text{ Wednesday} + \beta_4 \text{ Thursday} + \beta_5 \text{ Friday} + \beta_6 \text{ Saturday} + \beta_7 \text{ Sunday} + \beta_8 \text{ Brent} + \varepsilon$

❖ Without considering motorways' gas station ( $motorway==0$ ).

## 3° Model

- $Pit = \beta_0 + \beta_1 \text{ dummy 10th} + \beta_2 \text{ Tuesday} + \beta_3 \text{ Wednesday} + \beta_4 \text{ Thursday} + \beta_5 \text{ Friday} + \beta_6 \text{ Saturday} + \beta_7 \text{ Sunday} + \beta_8 \text{ Brent} + \varepsilon$

❖ Considering only gas stations located on motorways ( $motorway==1$ )

- The second approach:

#### 4° Model (full model)

$$\begin{aligned}
 Pit = & \beta_0 + \beta_1 \mathbf{DidGroup1} + \beta_2 \mathbf{DidGroup2} + \beta_3 \mathbf{DidGroup3} + \beta_4 \mathbf{DidGroup4} + \\
 & \beta_5 \mathbf{DummyGroup1} + \beta_6 \mathbf{DummyGroup2} + \beta_7 \mathbf{DummyGroup3} + \\
 & \beta_8 \mathbf{DummyGroup4} + \beta_9 \mathbf{Dummy10} + \beta_{10} \mathbf{Tuesday} + \beta_{11} \mathbf{Wednesday} + \\
 & \beta_{12} \mathbf{Thursday} + \beta_{13} \mathbf{Friday} + \beta_{14} \mathbf{Saturday} + \beta_{15} \mathbf{Sunday} + \beta_{16} \mathbf{Brent} + \varepsilon
 \end{aligned}$$

- where:

- ✓ *Dummygroup1, dummygroup2, dummygroup3, dummygroup4*: are dummy variables equal to 1 if the petrol station is for the group 1, 2, 3 or 4 and are not located on motorway. The sum of these four variables is equal to the affected group.
- ✓ *Didgroup1, didgroup2, didgroup3, didgroup4*: represents the interaction between dummy10 and the dummy groups variables.

#### 5°Model

$$\begin{aligned}
 Pit = & \beta_0 + \beta_1 \mathbf{DidGroup1} + \beta_2 \mathbf{DidGroup2} + \beta_3 \mathbf{DidGroup3} + \beta_4 \mathbf{DidGroup4} + \\
 & \beta_5 \mathbf{Tuesday} + \beta_6 \mathbf{Wednesday} + \beta_7 \mathbf{Thursday} + \beta_8 \mathbf{Friday} + \beta_9 \mathbf{Saturday} + \\
 & \beta_{10} \mathbf{Sunday} + \beta_{11} \mathbf{Brent} + \underline{\varepsilon}
 \end{aligned}$$

- ✓ Without considering motorways' gas station (*motorway==0*).

# Results

## Structure of Spanish prices in the gasoline market

Group	Mean price	Min	Max
Group 1	1,08382	0,796	1,347
Group 2	1,061941	0,796	1,34
Group 3	1,039002	0,768	1,384
Group 4	1,006919	0,76	1,336

Source: Own Elaboration

The difference between the largest oil companies and the low-cost companies, in average, is 0,077cents.!

# 1° approach

We can observe:

- that **all the days** of the week affect positively the price
- this effect is bigger in the first part of the week and it becomes smaller in the weekend (except Friday).
- Monday is the cheapest day in the week. (see Perdiguero (2013) on the Monday effect).
- The **dummy10th** variable is negative and significant (model 1&2).
- Brent variable affect positively the price.

	Model 1	Model 2	Model 3
<b>dummy10</b>	<b>-.0000866***</b> (.000015)	<b>-.0000844***</b> (.0000152)	<b>-.0001366</b> (.0000859)
<b>tuesday</b>	<b>.0002962***</b> (8.62e-06)	<b>.0002937***</b> (8.75e-06)	<b>.0003721***</b> (.0000494)
<b>wednesday</b>	<b>.0002782***</b> (.0000108)	<b>.0002807***</b> (.000011)	<b>.0002035***</b> (.0000618)
<b>thursday</b>	<b>.0002665***</b> (.0000113)	<b>.0002624***</b> (.0000115)	<b>.0003877***</b> (.0000648)
<b>friday</b>	<b>.0003069***</b> (.0000112)	<b>.0002942***</b> (.0000114)	<b>.0006844***</b> (.000064)
<b>saturday</b>	<b>.0002421***</b> (.0000111)	<b>.0002375***</b> (.0000113)	<b>.0003749***</b> (.0000635)
<b>sunday</b>	<b>.00014***</b> (9.04e-06)	<b>.0001367***</b> (9.18e-06)	<b>.0002265***</b> (.0000518)
<b>brentlitro</b>	<b>.0084762***</b> (.0004874)	<b>.0091468***</b> (.0004951)	<b>-.0068222***</b> (.0027912)
<b>Constant</b>	<b>1.094479***</b> (3.77e-06)	<b>1.093636***</b> (3.83e-06)	<b>1.134983***</b> (.0000217)
<b>Obs</b>	4843162	4688649	154485
<b>R-sq overall</b>	0.6039	0.6039	0.5783
<b>F-test</b>	246.63	246.63	21.66



## 2° approach

**Natural experiment** (Lafontaine and Slade, 2008):

1. exogenous change in the market (dummy 10<sup>th</sup>);
2. a group of variables affected by the change -treatment group- (sum of 4 dummy groups);
3. unaffected group -control group- (gas stations on motorways).

	<i>Model 4</i>	<i>Model 5</i>
Obs	4843162	4688649
R-sq overall	0.0493	0.5943
F-test	501.96	201.42

	<i>Model 4</i>	<i>Model 5</i>
<b>Constant</b>	.9040001*** (.0000136)	1093636*** (3.83e-06)
<b>Didgroup1</b>	-.0001756** (.0000851)	-.0002845*** (.00002)
<b>Didgroup2</b>	.0002214*** (.0000928)	.0001159*** (.0000421)
<b>Didgroup3</b>	.000323*** (.0000883)	.0002167*** (.0000307)
<b>Didgroup4</b>	.0003101*** (.0001039)	.0002029*** (.0000628)
<b>Tuesday</b>	.0002969*** (8.61e-06)	.0002937*** (8.75e-06)
<b>Wednesday</b>	.0002794*** (.0000108)	.0002807*** (.000011)
<b>Thursday</b>	.0002675*** (.0000113)	.0002624*** (.0000115)
<b>Friday</b>	.000308*** (.0000112)	.0002942*** (.0000114)
<b>Saturday</b>	.0002428*** (.0000111)	.0002375*** (.0000113)
<b>Sunday</b>	.0001402*** (9.03e-06)	.0001367*** (9.18e-06)
<b>Brentlitro</b>	.0082044*** (.0004872)	.0091456*** (.0004951)
<b>Dummy10</b>	-.0001094 (.0000828)	
<b>Dummygroup1</b>	.0002586* (.0001475)	
<b>Dummygroup2</b>	.2629243*** (.0095095)	
<b>Dummygroup3</b>	.5969642*** (.0087148)	
<b>Dummygroup4</b>	.2637458*** (.0155753)	

# Main Results

- We found that the independent retailers and low-cost companies **increase the prices** in the 10th of each month;
- Big companies decrease the prices in this day;
- Monday is the cheapest day of the week;
- Prices increasing in the first part of the week and decreasing during weekend;
- Dummy the 10<sup>th</sup> does not affect the price on motorways;
- Pay cycle affect gasoline market: there is a segmentation of the market according to the income;
- **Individual characteristics, value of time, prices** are fundamentals in the petrols stations choice.

- Relationship between **market power** and **value of time**?

The unemployed people, choose the independent and low-cost companies for two reasons:

1. Price reason;

2. Value of time: The time variable influences heavily the behaviour of the consumers. In fact, commonly, the independent and **low-cost petrol stations are not well located** in the city.

- "Strange reduction of prices" adopted by big companies (-0.0002845) a kind of incentive to attract people with low income!
- A credible thesis lies in the "demand-supply law", where, with an increase in demand, firms tend to increase prices. A sort of pay cycle.

# Conclusions

We can state that gasoline market in Spain is segmented by income:

- Consumers with a ***satisficing income***:

- ✓ observe the quality of the product,
- ✓ they don't have a lot of time.

They refuel in the big oil companies, that are more present and accessible than the other one.

- People with ***low income***:

- ✓ price is more important than other services characteristics.

- We can observe evidence of pay cycle. When people change their behaviour, gasoline companies change their price according to economic theory.

# Future Research

- 1. Increase the number of years of observations in the analysis (according to the available data) to have more robust estimation.
- 2. A further confirmation of this analysis can be made by taking into account individual regions of Spain which have different rates of unemployment among themselves and observe the heterogeneity in unemployment rate how affect people behavior.
- 3. A last interesting analysis could be that on the behaviour of unemployed people since 2009 (where the crisis effect was worse than now) where the unemployment rate was higher and where the Low cost companies were not real distributed in the country.

Thank you for your attention