How Do Governments Engage in Price Discrimination? Evidence from a Large-Scale Nationalization *

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Abstract

State-owned enterprises (SOEs) have the potential to correct market failures, but they are also subject to the influence of politics and interest groups. We examine this trade-off in the context of the nationalization of the leading gasoline company in Argentina. Descriptive analysis suggests that pricing patterns changed after the nationalization. First, the government exerted less market power, charging lower prices on average and benefiting consumers. Second, it engaged in less *economic price discrimination*, reducing the correlation between prices and consumers' willingness to pay. Third, it engaged in *political price discrimination*, charging lower prices in provinces with political connexions with the state-owned firm. Motivated by these findings, we develop and estimate a model of gasoline supply and demand under market power and recover the government's objective function. We find that public provision lead to welfare gains but is also associated with redistributive motives. Compared to a benevolent planner that internalizes the welfare of all consumers and firms equally, the government set prices as if it only cares about favoring middle-income consumers and consumers in provinces that have political ties with the firm. Lastly, we use the model to assess the company's response to policy alternatives, including pricing rules that align government actions with the public interest and are in place in government agencies worldwide. Our findings show that rules effectively reduce the influence of politics in pricing but are associated with higher costs: they mitigate half of the welfare gains generated by the nationalization and increase the taxpayers' burden by 10%. These findings emphasize the importance of politics and interest groups in shaping governments' decision-making process and the role of SOEs as instruments for redistribution.

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1 Introduction

State-owned enterprises (SOEs) are prevalent across different industries. They account for 10% of the world's GDP and have doubled their presence among the world's largest corporations in the past decade [IMF, 2020]. Recently, SOEs have been subject to policy debate across the world. Many governments have proposed the creation of SOEs to address problems the market fails to resolve. Others have discussed how to enhance the performance of existing state-owned firms through different forms of regulation and reform. Many societies are considering privatization to boost efficiency and alleviate the burden on taxpayers. Overall, it remains unclear in what contexts SOEs are necessary and how they respond to different institutional arrangements.

In this paper, we explore a key tradeoff around state ownership: SOEs have the potential to correct market failures, but they might be subject to the influence of politics and interest groups, thereby diverting their actions from the public interest [Stigler, 1971]. Political interventions can manifest in various ways. For example, politicians may leverage SOEs for patronage, cross-subsidizing towards specific groups, and aiming for electoral gains. Alternatively, external parties like competitors or suppliers might lobby for favorable terms, escalating the firm's deficit and, by extension, the burden on taxpayers. In essence, the government's commitment to correct market failures is uncertain. Even in scenarios where SOEs enhance social welfare, there remains a significant risk that certain groups may disproportionately appropriate these gains, leading to an inequitable distribution of benefits. While the tradeoff between potential welfare gains and political capture is understood in the theoretical literature, empirical evidence is limited. Researchers often lack data and quasi-experimental variation to identify the effects of state ownership on market outcomes.

To fill this gap, we examine the nationalization of YPF, the leading gasoline company in Argentina. We estimate an oligopoly model of gasoline supply and demand and employ it to quantify the effects of the nationalization on welfare and distributional outcomes. Using elements from the conduct estimation literature in Industrial Organization, we develop an empirical strategy to estimate the government's objective function, which reflects the underlying preferences for redistribution based on political and demographic characteristics. We use our framework to inform policy design. In particular, we study the equilibrium responses of the SOE to pricing rules imposed by Congress that aimed to align the government's decisions with social welfare. We also use the model to analyze the effects of privatization.

The setting provides a unique opportunity to understand the effects of state ownership. Regarding data, we have access to a panel of monthly gasoline prices and sales for all gasoline stations in Argentina before and after the nationalization. In terms of quasi-experimental

variation, the nationalization allows us to observe how a firm set prices as a privately-owned company and compare that to how the *same firm* set prices when the government runs it.

Our descriptive analysis reveals that the government sets prices differently than a profit-maximizing firm in three dimensions. First, the government set lower prices on average. Gasoline prices decreased by 5%, and sales increased by 4% in the year following nationalization, with nearly 90% of this surge attributed to a rise in YPF's regular gasoline sales. Second, YPF implemented larger price cuts for products that had less elastic demand and were likely to have higher markups. Evidence for this claim includes: regular gasoline prices fell relatively more in higher-income areas within a province; the prices of premium gasoline decreased more than those of regular gasoline; and markets where YPF held more market shares before the nationalization experienced larger price drops. Third, YPF changed the relative prices of gasoline products across regions and provinces. In particular, gasoline became more affordable in provinces that cooperated with the federal government during the expropriation process and were allowed to retain 25% of YPF's stocks after the nationalization (henceforth referred to as *shareholder provinces* or *provinces with political ties*).

Collectively, these findings underline a fundamental tradeoff inherent in public ownership. On the one hand, the firm takes measures benefiting consumers and boosting allocative efficiency. After the nationalization, the firm exercises reduced market power, lowering prices and expanding consumption. Moreover, it engages in price discrimination differently than a profit-maximizing firm. A profit-maximizing firm engages in price discrimination by charging higher prices to consumers with a higher willingness to pay. In contrast, the nationalized firm charges prices that are less correlated with consumers' willingness to pay, generating a better alignment between prices and costs. We refer to this as a reduction in *economic price discrimination*. On the other hand, the state-owned company engages in price discrimination based on consumers' political characteristics. In our study, this arises from the differential influence of consumer representatives (e.g., governors) on the firm's decision-making process. We refer to this as *political price discrimination*.

Based on the main descriptive facts, we formulate and estimate an oligopoly model of gasoline supply and demand. On the demand side, consumers purchase gasoline products. Gasoline products are differentiated based on geographic location, station-specific, and product-specific attributes. Location is the key dimension of differentiation since consumers dislike traveling to purchase gasoline. On the supply side, companies choose gasoline prices for different geographic locations. After the nationalization, we assume all firms except the SOEs maximize profits. The SOE maximizes a welfare function that is unobservable to the econometrician, which we estimate from the data. The parameterization of the objective function encompasses both the profit-maximization case and the total surplus maximization

case. It also allows for an array of intermediate cases in which the SOE has preferences for some groups of consumers and firms over others, reflecting different possible political motives behind the government intervention.

Through the lens of our model, the nationalization of YPF represents a shock to the objective function of the firm. However, prices might have also changed due to changes in their underlying determinants, such as changes in crude oil prices or consumers' willingness to pay for gasoline products. To understand the effects of the nationalization, we need to account for changes in costs and consumer preferences that have been contemporaneous with the nationalization. Disentangling between demand-side explanations, cost-side factors, and changes in objective functions poses an identification challenge. However, the nationalization provides a unique variation to disentangle these forces.[1]

Our identification strategy exploits the fact that individuals from different demographic groups have different consumption patterns. They consume gasoline at different locations (usually close to where they live or work) and varying qualities of gasoline (higher-income households consume more premium gasoline). This gives the government various tools to target specific consumers and *reveal* preferences for some groups over others by charging lower prices. Similar arguments apply to preferences for firms. We use this variation to construct an instrument that shifts the government's objective function in the post-nationalization period Berry and Haile [2014]. Following Miller and Weinberg [2017], we leverage pre-nationalization data and the fact that most market participants are profit-maximizing firms to recover marginal costs for all companies in the pre-nationalization period and for all firms except YPF in the post-nationalization period. Using this information, we project YPF's costs in the post-nationalization period. After identifying costs and demand primitives, we compute the prices that a profit-maximizing firm would have charged under the same conditions and compare them to the prices set by the state-owned firm. Finally, the difference between *observed* and *profit-maximizing prices*, and specifically, how this difference changes across products of different qualities and in different geographic zones, allow us to identify the government's preferences.

Our estimates of the objective function reveal political motives behind the nationalization.

[1]The nationalization might have also affected YPF's productive efficiency in producing or marketing gasoline. We argue that this is unlikely to have occurred during our sample period for two reasons. First, we study effects in the short run. We restrict our sample to 12 months after the nationalization. During this period, we do not expect to see the impact of any changes in investments in crude oil extraction or refining technologies. Second, incentives for stationers are unlikely to have changed due to the nationalization. Third parties operate 90% gasoline stations, and contracts between stationers and YPF have not changed due to the nationalization. According to these contracts (*contratos de consignacion*) the refinery is responsible for choosing prices, and business owners receive a fee for each liter of gasoline sold. Given the gasoline price the refinery set, we expect gasoline station operators to have the same incentives as in the pre-nationalization period. Finally, we showed that none of the reported effects are explained by changes in transportation costs.

In comparison to a benevolent planner that internalizes the welfare of all consumers and firms equally, we find higher internalization of middle-income consumers in all provinces—who benefit from lower economic price discrimination——and higher internalization of consumers in provinces with political ties with the firm ——who benefit from political price discrimination. The objective function estimation also indicates that YPF does not internalize the effect of its pricing on rivals' profits.

Using our model, we find that, compared to a profit-maximizing firm, the SOEs charge 6% lower prices on average, increasing gasoline sales by 4% and consumer welfare by 12%. YPF's rivals also reduced prices, especially for lower-quality products, making the impact on sales even larger. As previously documented in the literature, equilibrium effects play an essential role. Consistent with descriptive evidence, the nationalization is associated with more homogenous markups within provinces. This means more homogeneity between markups in high and low-income zones and between more and less concentrated markets. However, the nationalization also led to more dispersion in markups across provinces. In particular, the nationalization led to relatively lower markups in shareholder provinces, which are politically connected with the firm. Overall, the nationalization increased overall welfare by 6% [2], but its gains are unequally distributed across different members of society.

In the last part of the paper, we explore different policy tools to align government actions with social preferences, limiting the influence of politics and interest groups in government decision-making. In many countries, state-owned enterprises are subject to regulations that reduce government discretion in setting prices. Common examples are uniform pricing rules that require the firm to charge the same price for the same product (or the same wage for the same position); Additional examples are price rules that tie prices to observable variables (typically, costs or price indexes).[3]

To evaluate the effects of the proposed policies, we solve YPF's pricing problem considering their preferences —denoted by our estimates of its objective function— yet restricting YPF's choice set by the price rule. We examine the effects of three regulatory approaches. The first regulatory approach, *uniform pricing*, involves setting equal prices for identical products at every gasoline station. The second regulatory approach, referred to as *uniform markup*, requires YPF to apply identical unit markups for each product type nationwide. The third policy alternative is *privatization*, which, in the context of our model, implies giving the firm a profit-maximizing mandate. We compare these policies against the current status quo in which the nationalized firm has complete discretion over pricing decisions.

[2]We define total welfare as the sum of consumer and producer surplus. We abstract for considering the marginal value of public funds.

[3]In the Argentinian context, representatives from both major political parties have advocated enacting price regulations for YPF by law to curtail regional pricing disparities

Our analysis reveals that an optimal policy depends on how society trades off different dimensions, such as taxpayer costs, efficacy in curbing political price discrimination, impact on total consumer surplus, and overall welfare implications. We find that privatization is the best policy for the government's budget but reverts all the gains in consumer welfare generated by nationalization. Additionally, we find that uniform markups do not correct distributional concerns since targeted consumers are associated with relatively lower marginal costs (they face lower prices under the rule) and because the government can still target middle-income households by setting relatively low markups for premium gasoline. Moreover, it generates lower overall efficiency than nationalization under discretion, since markups are higher on average. Finally, our findings show that uniform pricing rules effectively reduce the influence of politics in pricing but are associated with higher costs: they mitigate half of the welfare gains generated by the nationalization and increase the burden on taxpayers by 10%.

Contribution To the best of our knowledge, this is the first study to examine the influence of interest groups on state-owned enterprises in an empirical application. Our contribution is twofold. First, we contribute by highlighting redistributive motives behind public provisions and by proposing an empirical strategy to recover the primitives that govern redistributive motives. Second, we add to the literature by examining the costs and benefits of different forms of price regulations on SOEs. Thus, it contribute to the literature on interest groups [Stigler, 1971, Peltzman, 1976, Laffont and Tirole, 1991, Dal Bó, 2006, Kang and Silveira, 2021] and public vs. private provision [Krueger, 1990, Shleifer, 1998, La Porta and Lopez de Silanes, 1999].

This study also adds to the literature that compares public and private provision in empirical industrial organization [Illanes and Moshary, 2020, Seim and Waldfogel, 2013]. Within this literature, this research is closely related to recent studies examining the effects of public provision in oligopoly markets such as Jiménez-Hernández and Seira [2021], Neilson et al. [2020] and Atal et al. [2021].

This paper showcases modern empirical IO tools to recover preferences underlying government decision-making. By doing this, we contribute to early attempts to recover preferences underlying government decision-making which focus on regulator [Timmins, 2002, Kang and Silveira, 2021], and literature on conduct testing and estimation in empirical IO [Porter, 1983, Bresnahan, 1987, Nevo, 2001, Miller and Weinberg, 2017, Backus et al., 2021, Duarte et al., 2020]. We add to that literature by allowing for heterogeneity in how different groups of consumers and firms are internalized (based on demographic and political characteristics) and by applying these tools to the estimation of the objective function of a state-owned firm.

Finally, the paper is connected to the literature on price discrimination. While researchers point out that firms can charge different prices based on non-economic attributes [Ayres and Siegelman, 1995, List, 2004, Goldsmith-Pinkham and Shue, 2023, Moshary et al., 2023], we show that the government can engage in price discrimination based on economic and political attributes for redistribution.

Paper Organization The rest of the paper is organized as follows. Section 2 describes our data and the retail gasoline market before the nationalization of YPF. Section 3 presents descriptive evidence on the effects of nationalization on pricing and market outcomes. Section 4 introduces our model of demand and supply for gasoline. Section 5 discusses how the primitives of our model are identified; we describe how we estimate the model and present the results. In Section 6, we evaluate the effects of the nationalization by comparing it to what a profit-maximizing firm would have done. This exercise is also helpful in understanding the effects of privatization. Section discusses the effects of price rules, and Section 8 concludes.

2 Data and instiutional background

2.1 The retail gasoline market in Argentina

In this study, we examine the impact of the nationalization of YPF on the retail gasoline market in Argentina. In this market, non-commercial consumers purchase fuel at gasoline stations.[4] 90% of gasoline stations are contractually related to specific refineries (henceforth, vertically integrated). In contrast, the remaining 10% are independent (i.e., non- vertically-integrated).

When gasoline stations are vertically integrated with a refiner, the station displays the refiner's brand (i.e., Shell) and exclusively sells gasoline of that brand. Only 10% of gasoline stations are operated directly by refiners (company-operated stations), while most are owned and operated by third parties – usually individuals or small firms. When third parties operate branded gasoline stations, brands typically delegate the management to station owners but retain pricing decisions. [5] Station owners receive a commission for every liter of gasoline sold

[4]Note that we exclude commercial buyers as well as other types of fuel such as diesel or natural gas

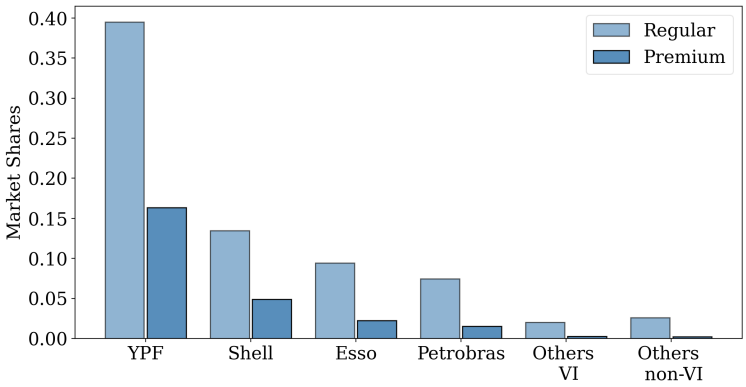
[5]For non-company-operated stations, two types of contracts were prevalent during our sample period. The first type of contract, used in all YPF stations, is called *consignacion*. In this type of contract, the refiner provides the gasoline to the gasoline station and has complete control over the price. The stationer received a fixed commission for every liter of gasoline sold. The second type of contract, used by the rest of the brands, is called *reventa*. In this contractual scheme, the refiner sets every day a wholesale price and a retail price for every product at every location. The difference between the list price and the wholesale price must be big enough to guarantee a given unit margin for the stationery. According to the contract, the stationer is mandated to purchase the product at the wholesale price. However, the stationer is not legally

– between 10% and 20% of the retail price, depending on the brand and product type – plus additional payments based on performance. In contrast, non-vertically integrated stations acquire gasoline in the spot market and have complete control over pricing.

During our sample period, gasoline stations offered two types of gasoline: regular and premium. These products differ in their octane rating (RON), which affects engine performance. To market a product as premium gasoline, the law establishes that the product should have a RON rating above a certain threshold.[6] Manufacturers usually recommend the use of premium gasoline for high-end cars. 70% of all premium gasoline is consumed by individuals in the fourth and fifth quintiles of the income distribution.

The retail gasoline market was concentrated among a limited number of firms during our sample period (describe sample or include footnote). YPF was the leading firm in regular and premium gasoline, accounting for 55% of all gasoline sales. YPF was followed by international brands such as SHELL, ESSO, and Petrobras. These four brands combined controlled 95% of all the gasoline sold. The dominance of YPF in both products can be attributed to a combination of having a more extensive network of gasoline stations and providing low-priced products. Figures 1 and 2 summarize each brand's market shares and average prices before the nationalization.

Figure 1. Market shares by firm and Product Type

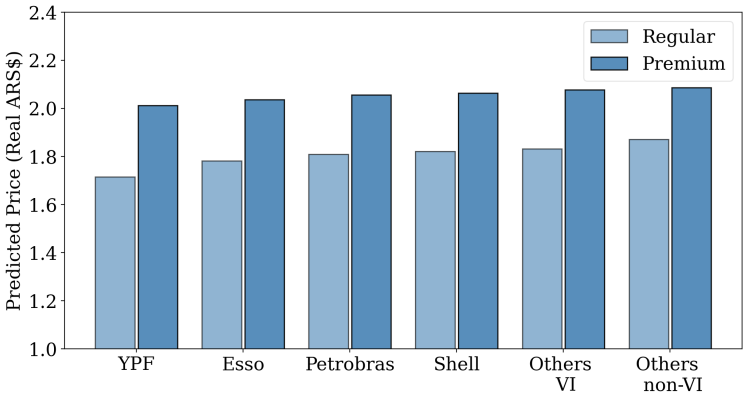


This figure depicts the market share of each firm in the calendar year prior to the nationalization (Jan-2011 to Dec-2011).

obligated to charge the list price and can deviate from that based on market conditions

[6]Gasoline characteristics are regulated by law (Resolution 1283/2006. The RON rating of regular gasoline ranges between 93 and 97, while the RON rating of premium gasoline is above 97. The law also establishes the maximum level of sulfur.

Figure 2. Pricing by Firm and Product Type



This figure illustrates the predicted price by brand and product type for the year leading up to the nationalization (Jan-2011 to Dec-2011), expressed in CPI-adjusted pesos. Prices are projected onto brand dummy variables and market-time fixed effects using separate regressions for regular and premium gasoline. The displayed plot represents the coefficient of the brand dummy variable.

2.2 Data

This subsection describes the data used in this paper.

Gasoline stations data The first data source is the gasoline stations dataset. Since 2008, gasoline stations have been obligated to report the volumes of fuel sold to the Secretariat of Energy, categorized by fuel type and customer type (Resolucion S.E. 1104/2004). They must also report the average selling prices with and without taxes and the current pump prices on the last day of the month. The database also includes information on the gasoline station address, brand, and identity of its owner (name and tax code). Our sample covers the period from January 2010 to December 2015.

Refineries and terminals data The refineries and terminals dataset includes monthly observations of prices and quantities of gasoline sold by refineries, aggregated by type of client (such as own stations or third parties) and regions, as well as information on refineries and terminals addresses. This dataset was obtained from the Argentinian Secretary of Energy and covers the same period as the gasoline stations dataset.

Census and Expenditure data To identify the location of households across the space and their main demographic characteristics, we use census data from the 2010 Census. We expanded this data by combining it with expenditure surveys obtained from the Argentina Census and Statistics Bureau (INDEC), which covered the period from August 2017 to July

2018. The expenditure surveys provide information on the spending habits of households, including their spending on gasoline and whether or not they have cars.

Electoral data To evaluate the relationship between pricing and electoral outcomes, we utilize data from the 2011 presidential and legislative elections provided by the National Electoral Directorate.

2.3 Market definition

We define geographic markets as sets of gasoline stations and census blocks. Markets are mutually exclusive sets, meaning each gasoline station (and each census block) belongs to only one market. By doing this, we guarantee that gasoline stations that share customers belong to the same market.

We define markets using the following algorithm.

1. For each census block, consider stations that are 10 km from its centroid.
2. Combine census blocks that have at least one station in common into a single cluster.
3. Combine clusters that have at least one station in common until all clusters are mutually exclusive sets of stations and census blocks.
4. Exclude markets in which YPF is a monopolist.[7]

Summarize market definition results After running the algorithm, we end up with 272 markets distributed across 23 provinces. Tables 7 present summary statistics of markets. See Table 8 for additional summary statistics. Figure 15 depicts markets for the province of Mendoza.

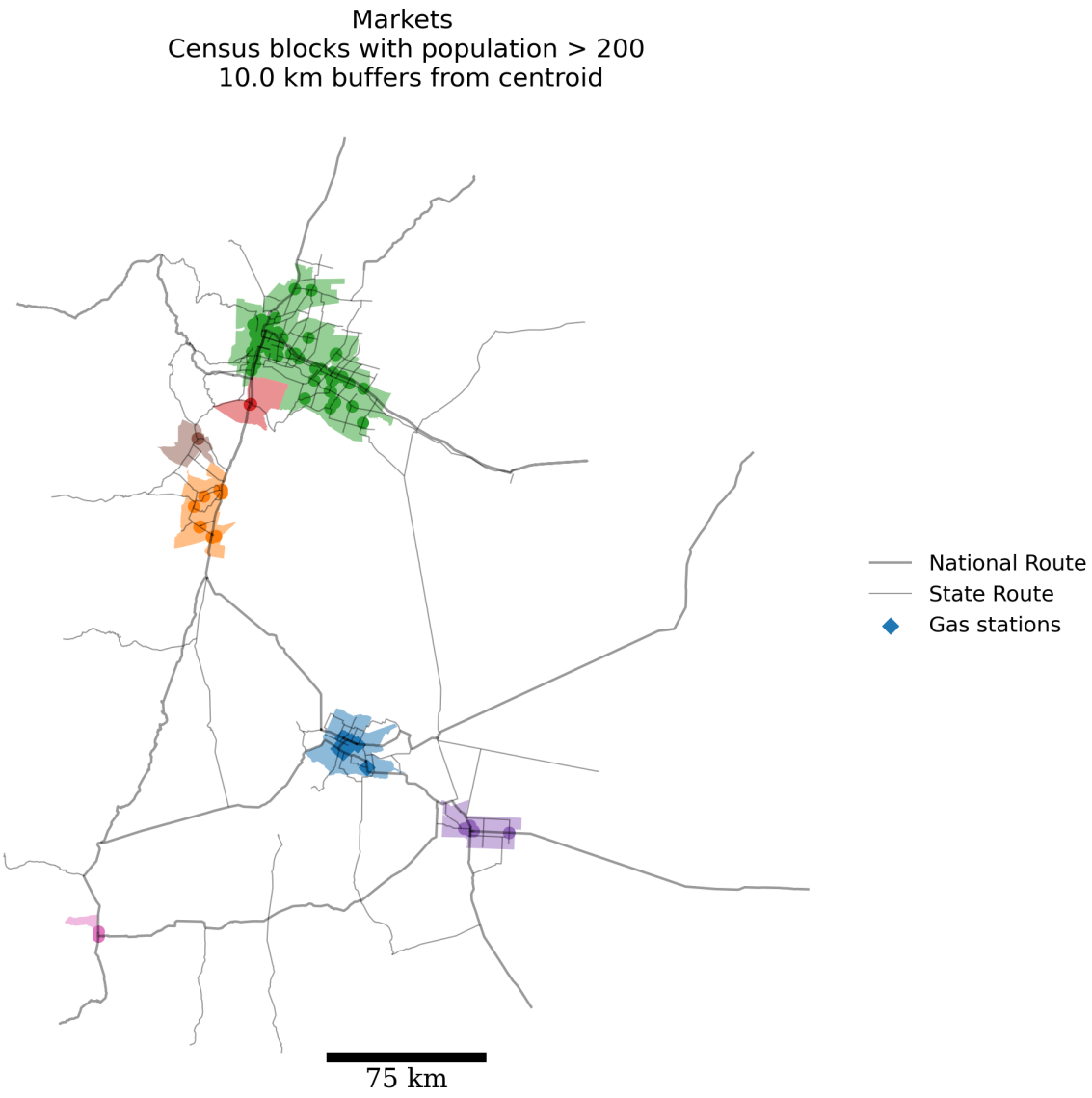
[7] We will not be able to identify the effects of the nationalization in markets in which YPF is a monopolist. See Section 5.3.2 for a discussion.

Table 1. Summary Statistics - Sample

	All	**Sample**
# Markets	404	272
# Stations		
p25	1	2
p50	2	4
p75	5	6
p90	9	11
Total	2,787	2,655
Price		
p25	1.72	1.75
p50	1.76	1.78
p75	1.81	1.84
p90	1.87	1.89
Volume (Th. m3)		
p25	80	175
p50	185	325
p75	461	759
p90	1258	1822
Total	407,776	397,548

Note: This table presents the summary statistics of the markets created using the algorithm described in the text. The first column describes the market. The second column describes the markets in which YPF is not a monopolist.

Figure 3. Market Definition Example - Mendoza



Note: This figure shows the markets located in the province of Mendoza using our market definition algorithm. The colored dots represent gasoline stations, and the colored areas represent census blocks. Census blocks and stations in the same color belong to the same market.

2.4 The nationalization of YPF

The Argentinian government took control of YPF in April 2012 through a Decree of Necessity and Urgency, and two months later, an expropriation law was passed to make the intervention permanent. The expropriation law was approved by a broad majority in both chambers of

Congress, with the support of most opposition members.[8][9] As part of the expropriation law, Argentina acquired 51% of YPF's shares. These shares were distributed between the federal government (who ended up getting 26% of the shares). A group of oil-producing provinces received 24.99% of the shares– which we refer to as the *shareholder provinces* or *provinces with political ties*or *oil-producing provinces*.[10] The remaining 49% of the shares remained in the hands of private investors.

As we document in the next section, the nationalization was followed by a change in relative prices across geographic markets and products. Since YPF was nationalized, different market participants have suggested the influence of politics in pricing. Below, we present illustrative quotes from different market participants:

> "The city of Buenos Aires has lower prices than [the Province of] Mendoza not because of economic matters but for political decisions" Oscar Diaz, Chamber of Gas Stations President. July 2015.

> "[The province of] Misiones asked [YPF authorities] to pay the same gasoline prices that are paid in the rest of Argentina." Misiones Province Governor, March 2022

In the next section, we provide descriptive evidence of the connection between pricing and politics after the nationalization.

3 Descriptive Evidence

This section provides descriptive evidence of the impact of YPF's nationalization on gasoline prices. This will also motivate the modeling assumptions we present in the subsequent section. The evidence suggests that the government sets prices differently than a profit-maximizing firm in three dimensions. Firstly, it exerts less market power, charging lower prices on average. Secondly, it engages in less price discrimination *based on economic factors*. Lastly, it engages in price discrimination *based on political factors*.

[8] A Decree of necessity and urgency (*Decreto de necesidad y urgencia*) is a legal instrument used in Argentina and other Latin American countries to allow the President or other executive authority to enact urgent measures without going through the usual legislative process.

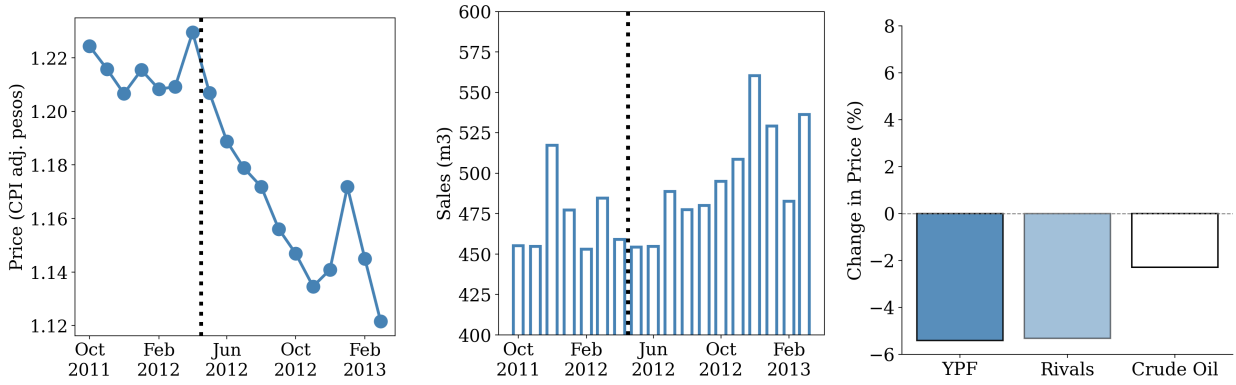
[9] 208 out of 240 members of the chamber of deputies voted favorably for the law but only 130 of them were affiliated with the ruling party (Frente Para la Victoria). While 63 out of 70 votes favorably in the Senate. See https://www.lanacion.com.ar/economia/ypf-legisladores-votaron-favor-expropiacion-2012-nid2261068/

[10] According to the constitution, these oil-producing provinces own hydrocarbon resources and receive royalties from their extraction. Thus, they have a vested interest in YPF's increased production. Before the nationalization, the federal government negotiated with the former owner, REPSOL. To compel REPSOL to ramp up oil and gas production, the shareholder provinces, in alliance with the federal government, threatened to revoke REPSOL's exploitation concessions

3.1 Fact 1: Prices Dropped and Gasoline Consumption Increased

Figure 4 displays the trends in gasoline prices and sales pre and post-nationalization. In comparison to the last month before the nationalization, gasoline prices dropped by 5%, and gasoline sales increased by 4%. Panel c shows that price drops were similar in magnitude for both YPF and rival firms and that price changes were not explained by a drop in crude oil prices.[11] The overall surge in sales was primarily attributed to the increase in consumption of YPF's regular gasoline. This fact suggests that the nationalization was associated with lower gasoline prices for YPF and that it generated an expansion in the market. Refer to Figure 19 in the appendix for additional descriptive statistics regarding gasoline sales.

Figure 4. Evolution of gasoline prices and sales



(a) Gasoline Prices (b) Gasoline Sales (c) YPF vs. Rivals vs. Crude Oil

Note: Panels a and b display the evolution of prices (panel a) and gasoline sales (panel b) for the period Oct-2011 to Feb-2013. The dotted line represents the date of the nationalization. Prices are expressed in CPI-adjusted pesos and do not include federal taxes. Panel c shows a comparison between the change in gasoline prices and crude oil prices. It compares the post-nationalization period (May 2012 to February 2013) vs. the last month before the nationalization (April 2012). Refer to Appendix B for additional descriptive statistics.

3.2 Fact 2: Larger Price Drops for More Inelastic Products

A profit-maximizing firm engages in price discrimination by charging higher prices to consumers with a higher willingness to pay (i.e., more inelastic consumers). Three patterns in the data indicate that price reductions were more significant in more inelastic products after the nationalization, suggesting the government engaged in less price discrimination based

[11] Gasoline prices dropped more than crude oil prices. This observation holds when compared to the month just before nationalization and the two years leading up to it. Further details are available in Figure 18 in the appendix.

on economic attributes. First, the price of regular gasoline dropped relatively more in middle and high-income neighborhoods compared to low-income neighborhoods. Second, YPF reduced the price of premium gasoline relatively more than regular gasoline. Third, YPF gasoline prices experienced larger drops in markets in which YPF had higher market shares. We explained these three patterns in turn.

Price drops by location's income We examine whether YPF changed prices differently among different locations after the nationalization based on the income level of the population living near the gasoline station's location. In our setting, higher-income consumers are shown to be more inelastic.[12]

We regress YPF gasoline prices on whether the station is in a low, middle, or high-income neighborhood and interactions between the post-nationalization period and the station's associated income level.

$$price_{i,t} = \alpha_{\text{inc}(i)} + \sum_{j \in \{\text{ M, H}\}} \beta_j \times post_t \times \mathbf{1}\{\text{inc}(i) = j\} + \tau_{\text{prov}(i)} + \gamma_t \tag{1}$$

In the equation above, $\alpha_{\text{income}(i)}$ are fixed effects for the income of the median household located in the same census block as the station; $\tau_{\text{province}(i)}$ are province fixed-effects (capturing differences in both transportation, and costs among provinces), and γ_t are time fixed-effects; β_j is the coefficient associated with the interaction between station's neighborhood income and a post-nationalization indicator variable. Figure 5 (a) presents the estimates of $\alpha_{\text{inc}(i)}$ and β_j, the coefficients of interest. Stations located in low-income neighborhoods are the control group. We refer the reader to Appendix B.2 for regression tables and alternative specifications.

The results indicate that, before the nationalization, YPF charged 2% higher gasoline prices in middle and high-income areas compared to lower-income areas. Under the assumption that marginal costs are the same within a province, this suggests that YPF charged higher markups to more inelastic consumers before the nationalization. However, after the nationalization, the price gaps between zones with different income levels within a province became more subtle, suggesting YPF is charging relatively lower markups to more inelastic consumers.

[12]This is confirmed by our demand estimates (see Table 2) and is consistent with demand estimates in other countries [Houde, 2012, Wadud et al., 2010]. Furthermore, expenditure survey data shows that higher-income households pay higher gasoline prices, controlling for location and product type (See Appendix A.1). Also, as we show next, pre-nationalization gasoline prices were higher in locations with higher income controlling for province fixed-effects.

Price drops by product's quality We study if YPF changed relative prices between regular and premium gasoline after the nationalization. Premium gasoline is a more expensive product (20% more than regular gasoline in the pre-nationalization period), and according to expenditure survey data, it is consumed almost exclusively by middle-income and high-income households. So, we expect premium gasoline to have a more inelastic demand.[13] We regress YPF prices on an indicator of whether the product is premium gasoline (premium_i) and an interaction between an indicator of whether the product is premium gasoline and an indicator of the post-nationalization period. We included time and station fixed effects ($\tau_{\text{station}(i)}$).

$$price_{i,t} = \alpha \times \text{premium}_i + \beta \times \text{post}_t \times \text{premium}_i + \tau_{\text{station}(i)} + \gamma_t \tag{2}$$

α and β, the coefficients of interest. Figure 5 (b) presents a visualization of the results. We refer the reader to Appendix B.2 for regression tables. Before the nationalization, YPF's premium gasoline was 22% more expensive than regular gasoline. After the nationalization, the price difference decreased to approximately 10%. Under the assumption that there were no changes in the relative costs between producing regular and premium gasoline after the nationalization, this result also suggests that YPF reduced prices of products with a more inelastic demand relatively more.

Price drops by market concentration We test if YPF changed relative prices between areas with different market shares after the nationalization. Assuming demand is more inelastic in markets with larger YPF market shares (because consumers have fewer options to switch to), a profit-maximizing firm will charge relatively higher prices in more concentrated markets. We regress YPF prices on a variable capturing YPF's market share in that market before the nationalization (share $\text{ypf}_{(i)}^{\text{pre-nac}}$), and an interaction between YPF's market share in that market before the nationalization and an indicator of the post-nationalization period. We included province-fixed effects to capture cost differences among different provinces and time-fixed effects.

$$price_{i,t} = \alpha \times \text{share ypf}_{(i)}^{\text{pre-nac}} + \beta \times \text{post}_t \times \text{share ypf}_{(i)}^{\text{pre-nac}} + \tau_{\text{province}(i)} + \gamma_t \tag{3}$$

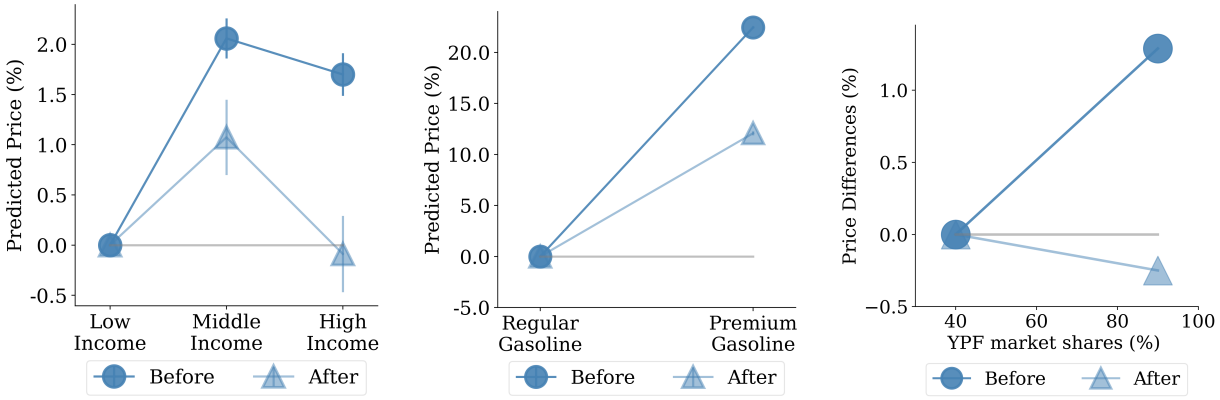
In the equation above, α and β are the coefficients of interest. Figure 5 (c) presents a visualization of the results. We refer the reader to Appendix B.2 for regression tables and alternative specifications. This exercise reveals that, before nationalization, YPF charged higher prices in markets in which it had higher market shares. However, this pattern dis-

[13] We confirm this hypothesis with our demand estimates. See Table 16 in Appendix C.1

appeared after the nationalization. Under the assumption that marginal cost is the same within a province, this suggests a correlation between markups and YPF market shares before the nationalization. Under the assumption that marginal cost didn't decrease relatively more in places in which YPF had more market shares, this suggests that nationalization was associated with a reduction in markups in markets in which YPF had more market shares.[14]

These three facts suggest that YPF exerted less *economic* price discrimination after the nationalization.

Figure 5. Regressions Results: Visualization



(a) Relative Prices by Income (b) Regular vs. Premium (c) By YPF Market Share

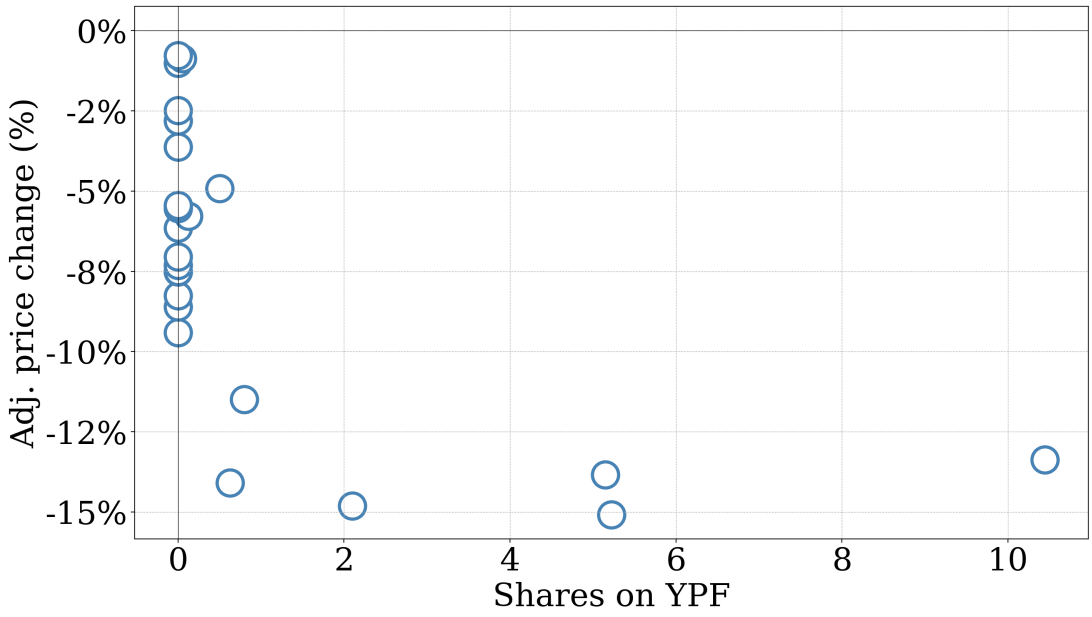
This graph displays the results of regressions 1, 2, and 3. Refer to Table 10 on Appendix B.2 for regression tables. Panel (a) shows the correlation between YPF's prices and the station's location income level pre- and post-nationalization, controlling for time and province fixed-effects (equation (1)). The dark blue line (*before*) presents the value of $\alpha_{\text{inc}(i)}$ and the light blue line (*after*) presents the value of $\alpha_{\text{inc}(i)} + \beta_j$. The station's location income is defined as the median income of households within the census block of the station's location. Stations in low-income neighborhoods are the control group, so its coefficient is normalized to zero in the plot. We use data for all product qualities, but results are similar when restricting the sample to regular gasoline. See Appendix B.2. Panel (b) shows predicted prices by product type in the pre and post-nationalization periods, controlling for station and time fixed-effects (equation (2)). The dark blue line (*before*) presents the value of α and the light blue line (*after*) presents the value of $\alpha + \beta$. Panel (c) shows the correlation between YPF's market shares pre-nationalization and prices pre- and post-nationalization, controlling for province fixed effects (equation (3)). For illustration purposes, the regression line plot spans from the 10th percentile to the 90th percentile of YPF's observed market share distribution. The dark blue line (*before*) presents a regression line for α and the light blue line (*after*) presents a regression line for $\alpha + \beta$.

[14]Regressing prices on market shares will typically suffer from endogeneity problems, so we cannot give a causal interpretation to the coefficients of this regression. The goal of the exercise is to show that in markets in which we expect YPF to have more market power, prices decrease relatively more after the nationalization. In Appendix B.3, we show that this result holds under alternative specifications.

3.3 Fact 3: Larger Price Drops in Politically Connected Provinces

The nationalization was associated with lower prices in provinces with political connections with the firm. As part of the expropriation law, Argentina acquired 51% of YPF's shares. These shares were distributed between the federal government, which kept 26% of the shares, and a group of oil-producing provinces (*shareholder provinces*) received 24.99% of the shares. According to the Argentine Constitution, provinces own natural resources and are entitled to both concede exploitation rights and receive royalties from exploitation. We found that gasoline prices dropped 7% percentage points more in the provinces that acquired shares during the post-nationalization period. Figure 6 illustrates the relation between province's shares on YPF and price drops (adjusted by changes in crude oil prices).

Figure 6. YPF's Prices Changes a Function of Province's Share - Before vs. After



This graph illustrates the average change in YPF's prices as a function of the province's shares in YPF, comparing the periods before and after nationalization. Prices are adjusted for the evolution of crude oil prices and exclude taxes. The pre-nationalization period spans from Jan-2010 to Mar-2012, while the post-nationalization period covers Apr-2012 to Feb-2013.

Following Peltzman [1976], we provide a simple rationale for the heterogeneity in prices between shareholder and non-shareholder provinces. From a politician's perspective, there are benefits and costs to lowering gasoline prices. On the one hand, lower gasoline prices are associated with better electoral outcomes. Indeed, recent empirical evidence using data from different countries showed that higher gasoline prices are associated with a lower probability of incumbents being re-elected [Arezki et al., 2022]. On the other hand, lower gasoline prices

translate into lower revenues for the federal government and shareholder provinces through YPF's profits. This reduces resources available for public goods and transfers, potentially affecting re-election chances. Lower YPF prices also lead to lower industry revenues, meaning lower opportunities for financing political campaigns.

However, different politicians will have different preferences for the distribution of gasoline prices across the country. While the federal government internalizes the political benefits and cost of lowering prices in all provinces, governors only internalize the political benefits of reducing prices in their provinces but not elsewhere. As a consequence of these, each governor will typically prefer lower prices for their province and higher prices for other provinces. Under the assumption that having shares in the firm gives governors influence over pricing decisions, we expect to observe relatively lower prices in shareholder provinces. This intuition is consistent with the pricing patterns we observe in the data.

Robustness Checks We performed a set of checks to rule out the possibility that province-level costs or demand shocks explained the heterogeneity in price changes between shareholder and non-shareholder provinces.

First, we explore the possibility that efficiencies in crude oil production might be driving the relative price changes. We find evidence contrary to this hypothesis. Crude oil needs to be refined before it can be sold as gasoline, so any efficiency or inefficiency in crude oil production itself would translate into lower gasoline costs for all provinces and not exclusively to shareholder provinces

Additionally, we checked if the change in relative prices is explained by changes in YPF transportation costs that were contemporaneous with the nationalization. We found evidence contrary to this hypothesis. First, stations in shareholder provinces vary widely in their distance from refineries. While some stations in shareholder provinces are close to a refinery, others are far away. Second, there is almost no correlation between the distance to a refinery and the effects of nationalization (see Appendix B.4). Considering these facts, we rule out the possibility that a reduction in transportation costs contemporaneous with the nationalization can explain lower prices in shareholder provinces.

Third, we compared the evolution of YPF gasoline sales in oil-producing and non-oil-producing provinces to rule out the possibility that lower prices in shareholder provinces are explained by lower demand for gasoline in shareholder provinces. We found that gasoline sales increase slightly more in shareholder provinces than in the rest of the country (See Figure 23 in the appendix).

Fourth, we use a difference-in-differences design to rule out the possibility that price drops in shareholder provinces are explained by unobserved cost or demand shocks that

affect all stations in each province. In particular, we compare prices of rivals' stations (i.e., Shell stations) located near a YPF station with prices of rivals' stations of the same brand located far away from a YPF station in a similar province. If price differences observed after the nationalization were caused by shocks that affect all stations in a given province, prices of rivals located near a YPF station should trend similarly to prices of rivals that are far away. However, if the price changes were driven by changes in YPF's conduct, we should observe more pronounced price reductions in rivals close to a YPF station compared to those located far away.[15] We find that rivals' stations located near a YPF station in shareholder provinces experienced a 7% larger price drop than rival stations located at 10km aways or further from a YPF station. Moreover, we observed that price trends were similar before the nationalization. We refer the reader to Appendix **??** for details.

Finally, we examined whether the observed price reduction in oil-producing provinces stemmed from a national-level uniform pricing policy implemented after the nationalization. We found evidence contrary to this hypothesis. In particular, we found that prices were more dispersed after the nationalization and not more uniform. The price differences between shareholder and non-shareholder provinces explain the bulk of the additional dispersion.

Overall, provinces that acquired YPF's stocks experienced greater price reductions. This finding is consistent with cross-subsidization across consumers of different regions driven by political connections between the SOE and provincial governors.

3.4 Discussion

In this section, we provide evidence suggesting that YPF's pricing strategy shifted post-nationalization. First, we documented that the nationalization was associated with lower prices and increased YPF sales. This is consistent with the state-owned firm exerting less market power than a profit-maximizing firm and benefiting consumers. Second, we documented that price discrimination patterns changed after the nationalization. On the one hand, the evidence suggests that YPF is exerting less *economic price discrimination*. This means that YPF does not charge higher prices to consumers with a greater willingness to pay, seemingly favoring middle and high-income consumers. On the other hand, there's evidence to suggest that YPF engages in *political price discrimination*, setting prices based on governors' political affiliations with the SOE in different provinces.

Price changes are consistent with a change in the objective function of YPF after the

[15]The identifying assumption is that if the nationalization did not affect YPF's conduct and all price changes were explained by changes in the province's specific demand or cost shocks, the evolution of prices of a rival station located near a YPF station after the nationalization should be similar to the evolution of a rival station of the same brand located in the same province but less exposed to YPF competition

nationalization. When shifting from privately owned to state-owned, the firm might have started internalizing the effects of prices on other participants' welfare, such as consumers and firms. It might also internalize the effects of prices on the political outcomes of the federal government and governors of shareholder provinces.

However, other factors could also have influenced the pricing. In our descriptive analysis, we provide evidence against province-specific cost or demand-side explanations. We also provide evidence against YPF-specific transportation costs' explanations. Nevertheless, we cannot rule out more involved demand or cost-side explanations. For instance, prices might have changed because consumers changed their preferences for YPF products after the nationalization. Moreover, prices might have changed due to shifts in gasoline costs specific to some areas within a province.

To fully disentangle between *objective function*, *cost side*, and *demand side* explanations, we need to compare the prices that YPF charged after the nationalization with the prices that *profit-maximizing* YPF would have charged under the same demand and supply conditions on every gasoline station and product. In the following section, we introduce a structural model of supply and demand for gasoline that allows us to perform this comparison.

4 A Model of the Retail Gasoline Market

This section describes a model of demand and supply for gasoline. On the supply side, firms choose gasoline prices for all gasoline stations under their control. On the demand side, consumers decide where to buy gasoline. Gasoline products are differentiated based on location (consumers dislike traveling to get gasoline) and brand, product-specific, and station-specific characteristics. We divide time into two periods: *Before the nationalization*, where all firms are profit-maximizers, and *after the nationalization*, where YPF maximizes a flexible objective function, and rival firms maximize profits.

4.1 Demand Side

Each consumer living in a geographic market m can choose among a set of $j = 1, \dots J_m$ gasoline products or select the outside option (which means using an alternative mode of transportation).[16]. Any given product j is defined by its location (the geographic coordinates of the gasoline station where that product is sold) and octane rating. If the octane rating is below 95 RON, it is marketed as regular gasoline; If it is above 95 RON, it is marketed as

[16] A market is a collection of gasoline stations and census blocks. See section 2.3 for a description of the market definition we use

premium gasoline). Consumers are heterogeneous in two dimensions. The first dimension is their location (defined by the centroid of the census block where she lives), and the second is their income level (low-income, middle-income, or high-income). The indirect utility of buying product j for consumer i is given by:

$$u_{ijt} = \alpha_i p_{jt} + \gamma D(l_i, l_j) + \beta_i \mathbf{X}_{j,t} + \xi_j + \xi_t + \Delta\xi_{jt} + \epsilon_{ijt} \tag{4}$$

where p_{jt} is the retail price of product j at month t, $D(l_i, l_j)$ is the distance between consumer's location and station's location and $\mathbf{X}_{j,t}$ is a vector including product characteristics. ξ_j is an index of station-product attributes that are constant across time (such as station characteristics and brand), and ξ_t captures trends in valuation for all inside goods in each month. The indirect utility function's specification includes time varying product attributes observed by consumers but unobserved by the econometrician: $\Delta\xi_{jt}$. This parameter captures product-specific deviations from both ξ_j and ξ_t (such as changes in brand valuation at specific periods or changes in station characteristics that are unobservable for the econometrician). In this model, consumers have heterogeneous preferences for gasoline products. First, consumers rank products differently based on the distance between their location and the gasoline station's location (captured by $\gamma \times D(l_i, l_j)$). Second, consumers are more or less sensitive to high prices based on their income (captured by α_i). Third, different consumers have different preferences for buying gasoline vs. choosing the outside good (captured by $\beta_i \mathbf{X}_{j,t}$). Finally, we assume consumers have idiosyncratic preferences for products ϵ_{ijt} that follow an i.i.d. type 1 extreme value distribution. The utility of choosing the outside option is normalized to zero.

According to the model, market shares for product j at time t are given by

$$s_{jt} = \sum_{i \in I_m} \frac{exp(u_{ijt})}{1 + \sum_{k \in J_m} exp(u_{ikt})} w_i \tag{5}$$

where I_m refers to the set of households living in market m, and wi captures the weight of each household on that market.

4.2 Supply Side

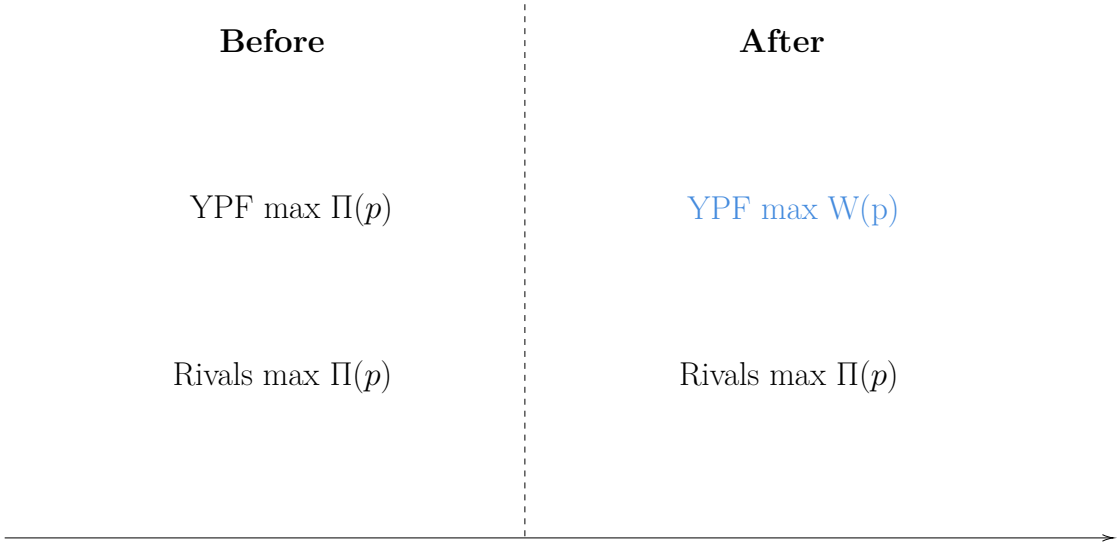
Firms simultaneously choose prices for each product under their control, for each market and month m. By a firm, we mean a refinery controlling the prices of all gasoline stations under the refinery's brand. So, all SHELL stations in a given market constitute a firm,

and all ESSO stations in that market are part of a different firm [17]. We define products as combinations of geographic location and product type (regular or premium gasoline). For instance, premium gasoline at Shell station 'A' is a product, and regular gasoline at that station is a different product.

Product j at time t has a marginal cost mc_{jt}. For stations that are vertically integrated with a refinery, which constitute 97% of the market, this represents the cost of buying crude oil, refining and mixing it with other components to obtain gasoline, transporting gasoline to the gasoline station at which product j is sold, and paying all type of marketing costs (including fees to station owners). For non-vertically integrated firms (unbranded stations and small brands), this is the cost of buying gasoline at a terminal, transporting it to the gasoline station, and marketing it.

We divide our sample into two periods: before and after the nationalization. Figure 7 presents a schematic description of the supply side model.

Figure 7. Description of the supply side model



We assume all firms (including YPF) simultaneously choose prices for each product under their control to maximize profits. That means

Assumption 1 *Competition in the pre-nationalization period*
In each geographical market and month and conditional on rivals' prices $\boldsymbol{p}_{-f}$*, firm* f *choose a set of prices* $\boldsymbol{p}_f$ *such that:*

[17] Sometimes, a set of unbranded stations is controlled by the same individual. In those cases, we define that set of unbranded stations as a firm

$$\max_{\boldsymbol{p}_f} \Pi(\boldsymbol{p}_f, \boldsymbol{p}_{-f}) \equiv \max_{\boldsymbol{p}_f} \sum_{j \in \mathcal{J}_f^m} (p_j - mc_j)\, Q_j\left(\boldsymbol{p}_f, \boldsymbol{p}_{-f}\right)$$

We assume all firms except YPF choose prices simultaneously after the nationalization. While all firm but YPF maximize profits (as in the pre-nationalization period), we assume YPF maximize its objective function $W(\mathbf{p})$ (which is unobservable for the econometrician).

Assumption 2 *Competition in the post-nationalization period*
On each geographical market and month and conditional on rivals' prices $\boldsymbol{p}_{-YPF}$, firm YPF choose a set of prices $\boldsymbol{p}_f$ such that:

$$\max_{\boldsymbol{p}_{YPF}} W(\boldsymbol{p}_{YPF}, \boldsymbol{p}_{-YPF}) \tag{6}$$

and for all firms except YPF, the problem of firm f on market m is:

$$\max_{\boldsymbol{p}_f} \Pi(\boldsymbol{p}_f, \boldsymbol{p}_{-f}) \tag{7}$$

Equation 8 presents our benchmark specification for YPF's objective function $W(p)$. The first term captures the effect that YPF pricing has on its profits. The second group of terms captures the effect that YPF pricing has on consumers. To do that, we divide the universe of consumers into G groups $g = 1, \ldots, G$. A consumer group is a combination of a province and an income level. So, a low-income consumer located in the province of Santa Fe belongs to one group, and a middle-income consumer in Salta belongs to a different group. Finally, the consumer surplus of different consumer groups enters as arguments of $W(p)$, weighted by λ_g parameters. By including different λ_g parameters, the model is flexible enough to capture that the consumer surplus of different groups might be weighted differently. The third group of terms captures the effect that YPF pricing has on rival brands' profits. Since different firms' profits are weighted by different κ_j, we allow YPF to internalize different effects on different brands differently.

Assumption 3 *YPF's objective function specification*

$$W(\boldsymbol{p}) = \underbrace{\Pi(\boldsymbol{p})}_{\text{YPF's own profits}} + \sum_{g=1}^{G} \lambda_g \times \underbrace{CS_g(\boldsymbol{p})}_{\text{group } g \text{ consumer surplus}} + \sum_{f=1}^{F} \kappa_f \times \underbrace{\Pi_f(\boldsymbol{p})}_{\text{brand } f \text{ profits}} \tag{8}$$

4.3 Discussion

We conclude this section by discussing the main simplifying assumptions we introduced in the model.

On the demand side, we assume that consumers prefer gasoline stations closer to their households over those farther away. In practice, a proportion of consumers regularly commute to work (or do any other activity), so they might be indifferent between purchasing gasoline at a station that is one block away from their home and a station that is one block away from work [Houde, 2012]. Note that not accounting for the fact that consumers might rank stations based on distance from commuting paths instead of distance from where they might result in underestimating the parameter γ. This assumption might be problematic for big cities (where consumers might live far away from their work). We address this issue by removing from our sample the three main metropolitan areas in Argentina (Buenos Aires, Cordoba, and Rosario). Assessing the effect of the nationalization in those areas is left as future work.

In terms of the vertical structure of the market, we made two assumptions. First, we assume that refiners affect market outcomes only through the prices of their station network. This assumption might be problematic if refineries could affect market outcomes significantly through the gasoline they sell to independent and unbranded stations. In the Argentina gasoline market, 97% of gasoline is sold via vertically integrated stations. Second, we assume that station owners cannot deviate from the retail prices set by refineries. While this is true for YPF stations and company-operated stations of other brand, stationers owners non-affiliated with YPF are usually contractually able to deviate from list prices. However, deviations are not common and they are penalized by refineries. This was confirmed in conversations with station owners and executives of gasoline companies.

The second simplification on the supply side is that firms compete Bertrand-Nash before the nationalization (Assumption 1). We use this assumption make use of all the pre-nationalization period data. Absent this assumption, we require an alternative set of instruments to identify YPF's conduct after the nationalization. Intuitively, the less structure we put into the problem, the more we require from instrumental variables regarding relevance and validity.

The third simplification is that YPF's objective function is linear in an array of consumer surplus measures for different groups of consumers, YPF's profits, and rivals' profits. The arguments of the objective function we choose have two benefits. First, they allow us to capture most patterns we observe in the data. By allowing heterogeneity in consumer surplus according to province (or province type), it allows us to capture the fact that price reductions might be larger in oil-producing than in non-oil-producing provinces. By allowing heterogeneity in consumer surplus according to income, it allows us to capture different pricing patterns for regular and premium gasoline and different pricing patterns for different geographic locations within a province (or a group of provinces). Moreover, this specification

can generate the type of economic and political price discrimination patterns that we observe in the data. In our model, economic and political price discrimination patterns are outcomes generated by the government's preference for different groups of consumers.

Also, the objective function specification encompasses objective functions that prior theoretical research used to characterize mixed oligopolies. These include total surplus maximization, profit maximization, or different weights for consumer surplus and rival's profits.

The last simplification is that the game is static. A potential concern is that the nationalization might induce gasoline stations to exit the market, making the entry/exit margin relevant for the analysis. This simplification is based on the fact that the number of gasoline stations remained unchanged after the nationalization.

5 Estimation, Identification and Results

5.1 Demand Side: Estimation and Identification

Estimation We estimate the demand primitives using the generalized method of moments. We use different sets of moment conditions following Berry et al. [1995] and Petrin [2002] . The first set of moment conditions matches the market shares predicted by the model $sjt(\theta)$ with those observed in the data, such that:

$$sjt(\theta) - s_{jt} = 0 \; \forall j, t$$

The second set of moment conditions captures the assumption that unobserved disturbances on product valuations are uncorrelated with observed demand-side variables (except for prices) ($\mathbf{X^d}$) and demand-side instruments ($\mathbf{Z^d}$), such that:

$$E\left[\Delta\xi_{jt}|\mathbf{X^d}, \mathbf{Z^d}\right] = 0$$

We supplement standard BLP-type moment conditions with micro-moments [Petrin, 2002]. First, we match the average probability of consuming gasoline, conditional on the income level generated by the model, with what is observed in the expenditure survey.

$$E[\text{i purchase gasoline}|\text{income}_i = I] \quad \forall I$$

Second, we matched the probability of consuming premium gasoline conditional on income level:

$$E[\text{i purchase premium gasoline}|\text{income}_i = I] \quad \forall I$$

The two sets of moment conditions entering the GMM objective function are $\mathbf{G}_1(\theta)$ (the BLP type moments) and $\mathbf{G}_2(\theta)$ the micro-moments associated with the expenditure survey data. Thus,

$$E\left[\mathbf{G}\left(\boldsymbol{\theta}_0\right)\right] = E\left[\begin{array}{c} \mathbf{G}_1\left(\boldsymbol{\theta}_0\right) \\ \mathbf{G}_2\left(\boldsymbol{\theta}_0\right) \end{array}\right] = 0$$

The GMM estimator is given by

$$\hat{\theta}^{GMM} = \arg\min_{\theta \in \Theta} \hat{\mathbf{G}}(\theta)' W \hat{\mathbf{G}}(\theta)$$

where $\hat{\mathbf{G}}(\theta)$ is the sample analog of $\mathbf{G}(\theta)$ and W is the weighting matrix. We implement the standard two-step procedure for GMM estimation. In the first step, we set $W = (\frac{Z'Z}{N})^{-1}$. In the second step, W is updated according to $W = S^{-1}$, where $S = \frac{1}{N}\sum_{j,t} G_{jt} G_{jt}'$.

Identification Three sets of parameters exist on the demand side: price sensitivity (α), demographic-specific valuation for product characteristics (β), and travel cost parameters γ. Identifying price sensitivity α requires instrumental variables correlated with prices yet conditionally independent of unobserved disturbances on product valuations $\Delta\xi_{jt}$. We exploit the variation in gasoline tax rates that occurred after the nationalization as an instrument to identify α.[18] The federal government and the province of Cordoba both introduced or modified gasoline taxes between 2013 and 2017, resulting in variations in prices. This variation is arguably uncorrelated with unobserved disturbances at the gasoline station level.

Identification of demographic-specific valuation for product characteristics β is achieved through micro-moments that match the probabilities of purchasing different products by distinct demographic groups. Specifically, micro-moments that match the probability of buying gasoline conditional on the household's income level enable us to determine how individuals from different income groups value goods inside the market compared to the outside option. Likewise, micro-moments that match the probability of purchasing premium gasoline conditional on the household's income level allow us to ascertain how individuals from different income groups balance quality and prices.

Finally, the travel cost parameter γ is identified by analyzing observed substitution patterns triggered by price changes or the entry (exit) of stations in the market. Consider a scenario where travel costs are zero ($\gamma = 0$) and a particular station raises its prices. In that situation, we would observe that the substitution toward geographically proximate stations closely resembles the substitution toward more distant stations. Conversely, if travel costs

[18] Tax changes happened after the end of the sample period we use to assess the effects of the nationalization. To exploit this variation, we use a more extended sample spanning from 2010 to 2017.

are high, we should observe substitution concentrated around geographically close stations following a price increase, with minimal impact on remote stations.

5.2 Demand Side: Results

Results for demand estimation are presented in Table 2. The unit of observation is geographical markets and months. The coefficients exhibit the anticipated signs. The interactions between price and household income indicate that higher-income consumers are less price-elastic. As expected, consumers dislike traveling to get gasoline. Our estimates suggest that a lower-income consumer is willing to travel an additional kilometer to access more affordable gasoline of the same quality, provided the discount exceeds 1.2%

Table 2. Baseline demand estimates

	coeff	**s.e.**
price (α)	-0.69	(0.17)
distance (γ)	-1.54	(0.74)
Demographic Interactions (β)		
constant × M	0.27	(0.77)
constant × L	25.39	(2.94)
price × M	-1.73	(0.43)
price × L	-12.27	(1.52)
Own-price Elasticity (p50)	-3.52	
Median Market Elasticity	-0.53	
1 km cost (% of P) for L	1.2%	
1 km cost (% of P) for M	6.4%	
1 km cost (% of P) for H	22.4%	
Number of markets	26776	

Note: The above table presents estimates and standard error for demand parameters corresponding to (4). The omitted category is high-income households. Time and station-product fixed effects are included. Observations are weighted by market size. Standard errors are clustered by region.

Our estimates can capture expected substitution patterns across stations. To characterize the substitution patterns indicated by our demand estimates, we regress the estimated cross-price elasticities for each pair of products k and l within the same market on whether both products are of the same quality (both regular or both premium gasoline); whether both

products are of the same brand; and whether both products are on the same station; whether l is the closest rival of k, the second closest rival of k, etc. First, greater substitution is linked to nearby stations, while substitution becomes nearly negligible for more distant stations. Additionally, substitution is more pronounced among stations of the same brand, products within the same station, and products of the same quality (for instance, premium Shell is a closer substitute to premium ESSO than regular ESSO). We refer the reader to Table 17 in the appendix for regression tables.

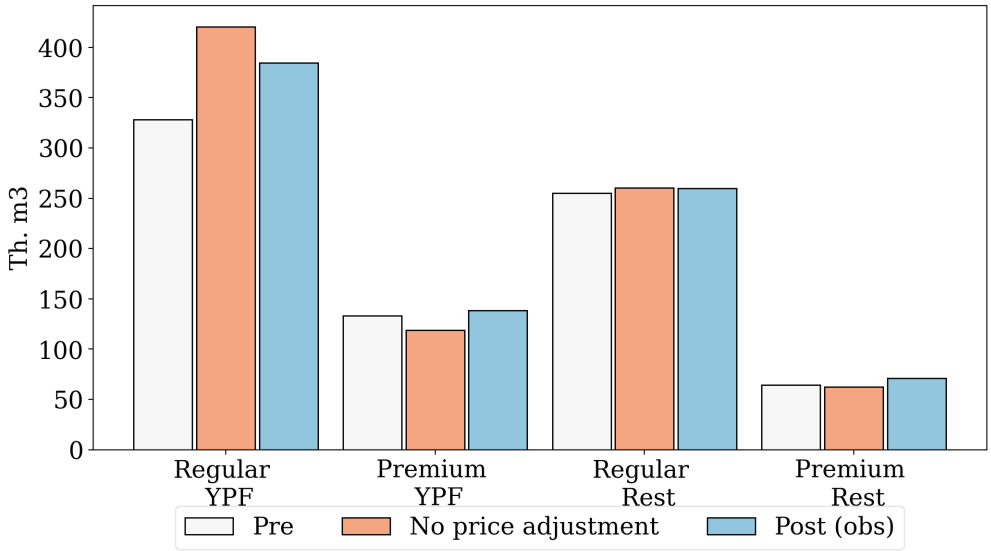
Own-price elasticities display the expected patterns and magnitudes. The elasticity with respect to the outside option is considerably lower (-0.52) than the median own-price elasticity, meaning that most of the substitution occurs within gasoline products. Our median own-price elasticities are below the estimates on Houde [2012]. We attribute the discrepancies to the fact that while most of our sample consists of towns and small cities, Houde [2012] estimates demand for the Quebec Metropolitan Area. Once we adjust for differences in market size, our estimates are similar. We refer the reader to Table 15 in the appendix for a comparison to other available estimates in the literature.

To characterize the observed heterogeneity in own-price elasticities, we regress own-price elasticities on the product's brand, whether the product is premium or regular, and market size. Regular gasoline products exhibit greater elasticity than premium gasoline products: the predicted elasticity decreases by two percentage points when moving to a premium product compared to a regular product at the same location. Compared to branded products, products available at unbranded stations and stations associated with small brands exhibit a more elastic demand. Additionally, elasticities are higher in bigger markets, where more options are available. Specifically, transitioning from a market at the 10th quantile of market size to a market at the 90th is linked with an additional own-price elasticity of -1.46. We refer the reader to Table 16 in the appendix for regression tables.

As discussed in section 3, there was a pronounced increase in YPF's market shares following the nationalization. Demand estimates allow us to disentangle the changes in consumption that arose due to changes in prices from those changes in consumption attributed to changes in preferences for gasoline products. Figure 8 presents the observed consumption in the year after the nationalization, the consumption observed in the year preceding the nationalization, and the *counterfactual* consumption that we would have observed had prices remained fixed at pre-nationalization levels in the year after the nationalization. The figure shows that, after the nationalization, consumers increased their valuation for gasoline overall—reflected by the higher consumption when prices remain fixed—specifically for YPF's regular gasoline. To assess if similar changes in consumption would have occurred absent the nationalization, we need to employ the supply-side estimates to model how a profit-

maximizing firm would have determined pricing. We explore this aspect in the subsequent section.

Figure 8. Demand Estimation - Change in WTP for YPF products



Notes: This figure shows how changes in willingness to pay for gasoline products affected gasoline consumption after the nationalization. The white bar (*Pre*) shows observed consumption 12 months before the nationalization. The light blue bar (*Post*) shows observed consumption 12 months after the nationalization. The orange bar (*Post (No price adjustment)*) shows consumption at post-nationalization observed prices in the 12 months after the nationalization

5.3 Supply Side

5.3.1 Supply Side - Estimation

We employ a three-step procedure to estimate the supply-side primitives. In the first step, we recovered marginal costs for each product before nationalization and for every non-YPF product following nationalization. In the second step, we utilize the marginal costs from all firms in the pre-nationalization phase and the marginal costs of YPF's competitors in the post-nationalization phase to estimate YPF's projected marginal costs ($\tilde{mc}_{j,t}$). Lastly, using YPF's projected marginal costs, we derive YPF's objective function and identify unobserved cost shocks for YPF in the post-nationalization period.

First step: Recover Marginal costs for all products before the nationalization and for non-YPF products after the nationalization We recover marginal costs for all products before the nationalization and for all non-YPF products post-nationalization by imposing that each firm maximizes profits non-cooperatively and that firms set prices

simultaneously (assumptions 1 and 2). Following this, we can invert the first-order conditions to recover marginal costs.[19]

$$mc_{j,t} = p_{j,t} - \left[\frac{\partial Q^j}{\partial p_{mj}^{ypf}}\right]^{-1} \left[Q(p_j^{ypf})\right]$$

Second step: Recover YPF's Projected Marginal Costs Without loss of generality, we can express the marginal costs of a given product j in any market at time t as the sum of the projected marginal costs and an unobservable cost shock. Formally:

$$mc_{j,t} = \underbrace{\tilde{mc}(X_t, j)}_{\text{Projected marginal cost}} + \underbrace{\varepsilon_{j,t}}_{\text{unobserved cost shock}} \tag{9}$$

We parametrize the projected marginal cost for product j in market $m(j)$ during period t as follows:

Assumption 4 (Additive local cost shocks)

$$\tilde{mc}_{j,t} = \underbrace{f(X_t, j)}_{\textit{marginal cost function}} + \underbrace{\nu_{m(j),t}}_{\textit{local costs shocks}} \tag{10}$$

In our baseline specification, we parametrize the projected marginal costs as the sum of a marginal cost function and an additive cost shock that affects all products within a specific market and time period (i.e., local cost shock), as depicted in (10). The marginal cost function accounts for variations in costs that arise from variables we either (i) observed (e.g., crude oil prices, distance to the refinery, brand, and product); (ii) recognize as constant across station and product (e.g., station-product specific cost differentials, such variations across different stations in labor or utility costs); or (iii) do not observe but affect all products over time (like fluctuations in crude oil prices or labor costs when we exclude them as explanatory variables). The local cost shock enables us to identify shifts in marginal costs common to all products within a particular market and time frame. Examples include the introduction of a new highway that diminishes transportation costs for all products in a specific market, changes in electricity prices in a particular market, or escalated municipal fees affecting markets in that municipality but not in others.

[19] For clarity, we present the equations for scenarios where each firm sells only one product in each market (i.e., no cannibalization).

Assumption 5 (Parametrization of marginal costs function)

$$f(X_t, j) \quad = \quad \underbrace{\omega_{type(j),t}}_{\textit{Time and Prod-Type FE}} \quad + \quad \underbrace{\eta_j}_{\textit{Station-Product FE}} \tag{11}$$

Equation (11) outlines the parametrization of the marginal cost function in our baseline specification. The first term encompasses time and product type (i.e., premium and regular gasoline) fixed effects, capturing the shared components of gasoline refining across different brands. This includes factors such as crude oil prices, energy costs integral to the refining process, and the expenses associated with integrating bioethanol into the gasoline mix. The second term represents station-product fixed effects, capturing cost differences unique to specific stations and product types that remain constant over time. This encompasses variations in the marginal costs of gasoline from different refineries, disparities in local taxes and fees, labor or utility variations across stations, and differential transportation costs from the refinery to the station.

Third step: Recover YPF's Objective Function In the third step, we derive YPF's objective function based on our initial computation of YPF's marginal costs for the post-period. Specifically, we compute moment conditions by taking first-order conditions of YPF's objective function (equation (6)) relative to the price of each product under YPF's control:

$$Q(p_j^{ypf}) + \frac{\partial Q^j}{\partial p_{mj}^{ypf}} \times \left(p_j^{ypf} - mc_{j,t}^{ypf}\right) + \sum_{n=1}^{N} \lambda_N \times \frac{\partial CS_n}{\partial p_j^{YPF}} + \sum_{f=1}^{F} \kappa_f \times \frac{\partial \Pi_{jf}}{\partial p_j^{YPF}} = 0$$

Substituting for $mc_{j,t}$ using 9, imposing (11) and taking expectations conditioning on instruments (Z), we derive:

$$\underbrace{E\left[(p_j^{ypf} - f(X_t, j) + \nu_{m(j),t}) \mid Z\right]}_{\text{"Observed" Markup given Z}} =$$

$$\underbrace{E\left[\left(-\frac{\partial Q^j}{\partial p_{mj}^{ypf}}\right)^{-1}\left(Q(p_j^{ypf}) + \sum_{n=1}^{N} \lambda_N \times \frac{\partial CS_n}{\partial_j^{YPF}} + \sum_{f=1}^{F} \kappa_f \times \frac{\partial \Pi_{jf}}{\partial p_j^{YPF}}\right) \mid Z\right]}_{\text{Predicted Markup given Z}} + \underbrace{E\left[\varepsilon_{j,t} \mid Z\right]}_{\text{Expected idiosyncratic error given Z}} \tag{12}$$

The fundamental assumption that underpins our identification strategy is that, after controlling for the projected marginal costs, the unobservable component of the marginal cost is uncorrelated with the instrument vector Z. We employ two categories of instruments:

1. Demographic characteristics at the provincial level, specifically the combination of income level and province.

2. YPF's market shares in the period before nationalization, denoted by S, for each market.

Formally, our assumption is as follows:

Assumption 6 (Conditional Independence of Idiosyncratic Cost Shocks)

$$\begin{aligned} &E\left[\varepsilon_{j,t} \mid \textit{product type} = p, \textit{income} = inc, \textit{province type} = prov\right] = 0 \quad \forall\, inc,\, p,\, prov \\ &E\left[\varepsilon_{j,t} \mid \textit{product type} = p, \textit{YPF's shares in the pre-period} = s_{m(j)}\right] = 0 \quad \forall\, p,\, m(j) \end{aligned} \tag{13}$$

Each moment condition l depends on observed prices ($\mathbf{p_l}$), a vector of projected marginal costs ($\mathbf{\hat{mc}}_l$), instruments ($\mathbf{Z}_l$), and the conduct parameters λ to be estimated.

$$\begin{aligned} E\left[\varepsilon_{j,t} \mid Z\right] &= 0 \\ E\left[(p_j^{ypf} - \tilde{mc}_{j,t}^{ypf}) \mid Z\right] - E\left[\left(-\frac{\partial Q^j}{\partial p_{mj}^{ypf}}\right)^{-1}\left(Q(p_j^{ypf}) - \sum_{n=1}^{N}\lambda_N \times \frac{\partial CS_n}{\partial p_j^{YPF}} + \sum_{f=1}^{F}\kappa_f \times \frac{\partial \Pi_{jf}}{\partial p_j^{YPF}}\right) \mid Z\right] &= 0 \\ g(\lambda, \mathbf{p_l}, \mathbf{\hat{mc}_l}, \mathbf{Z_l}) &= 0 \end{aligned} \tag{14}$$

Define the stacked vector of all moment conditions as $\mathbf{g}(\lambda; \mathbf{p}, \mathbf{\hat{mc}}, \mathbf{Z})$. The GMM estimator is then given by:

$$\hat{\lambda}^{GMM} = \arg\min_{\lambda \in \Lambda} \mathbf{g}(\lambda; \mathbf{p}, \mathbf{\hat{mc}}, \mathbf{Z})' W \mathbf{g}(\lambda; \mathbf{p}, \mathbf{\hat{mc}}, \mathbf{Z})$$

where W is a weighting matrix.

5.3.2 Supply Side: Identification

After recovering the demand primitives and the projected marginal costs for each YPF station, the parameters for YPF's objective function are pinned down. Identification is achieved by instruments that shift the marginal welfare function but are uncorrelated with the unobservable cost shocks [Berry and Haile, 2014]. In our case, the instruments are the demographic characteristics of the area in which the station is located.

We divide our discussion of the identification of supply-side parameters into two main steps. First, we discuss why our instruments are uncorrelated with unobservable cost shocks (*validity*). Second, we discuss why they shift the marginal revenue function (*relevance*).

Instrument Validity Identification requires valid instruments. This means that once we account for the marginal cost components that are universally applicable to all gasoline products, the fixed effects unique to each station and product, and the cost shocks that are common across all products in a distinct market, the unobserved costs associated with YPF stations are uncorrelated with station's location demographic characteristics.

The pre-nationalization data and our conduct assumptions play a significant role. It allows us to understand how the marginal cost of YPF correlates with both observables (crude oil prices, fix-effects) and unobservables common to all stations in a given market (local cost shocks). In particular, we can assess how costs are correlated with the demographic characteristics of the area in which the station is located.

A potential violation of this assumption could arise, for instance, if post-nationalization, the costs associated with YPF products experienced a surge in areas with a denser population of high-income individuals, and this cost increase is not parallel by competitors' products in the same area (otherwise, this would be accounted by local cost shocks).

Instrument relevance The core of the identification strategy lies in contrasting the observed average markups after nationalization with what would have been the markups set by a profit-maximizing firm under identical circumstances. Differences in markups are informative about the objective function of the SOE.

From equation (12), re-arranging the terms yields:

$$\underbrace{E\left[\left(-\frac{\partial Q^j}{\partial p_{mj}^{ypf}}\right)^{-1}\left(\sum_{n=1}^{N}\lambda_n \times \frac{\partial CS_n}{\partial p_j^{YPF}} + \sum_{f=1}^{F}\kappa_f \times \frac{\partial \Pi_{jf}}{\partial p_j^{YPF}}\right) \mid Z\right]}_{\text{Mark-up Differences}} =$$

$$\underbrace{E\left[(p_j^{ypf} - \tilde{mc}_{j,t}^{ypf}) \mid Z\right]}_{\text{Expected Mark-ups (Actual)}} - \underbrace{E\left[\left(-\frac{\partial Q^j}{\partial p_{mj}^{ypf}}\right)^{-1}\left(Q(p_j^{ypf})\right) \mid Z\right]}_{\text{Predicted Mark - ups (Profit Max)}}$$

which is a system of linear equations, where the only unknowns are $\lambda = [\lambda_1, \lambda_2, \ldots \lambda_N, \kappa_1, \kappa_2, \ldots, \kappa_F]$ parameters. Identification requires that $\text{rank}(g(\lambda)) = \dim(\lambda)$.[20]

The intuition behind our rank condition is as follows. Several models can justify markups of regular gasoline that are below what a profit-maximizing YPF would have chosen. For

[20] If the objective function is linear in parameters, we can rearrange terms and write it as $E[P - A(P) \mid Z] = E[h(Z,P) \times \lambda \mid Z] + E[\varepsilon \mid Z]$. Imposing conditional independence ($E[\varepsilon \mid Z] = 0$), identification requires the system of equations to have a unique solution. This condition is guaranteed if the matrix $E[h(P,X) \mid Z]^T \times E[h(P,X) \mid Z]$ is invertible, meaning that we need $\text{rank}(E[h(P,X) \mid X]^T \times E[h(P,X) \mid Z]) \geq \dim(\lambda)$.

instance, consider two rival models. In one, the government solely focuses on the consumer surplus of middle-income consumers, while in the other, the government only internalizes the surplus of low-income consumers. If there is only one gasoline station selling one type of gasoline, and that gasoline station is accessible to both low and high-income consumers, distinguishing between these two models is impossible. However, the scenario changes if there are two separate gasoline stations - one in a low-income area and the other in a high-income area. Assuming consumers dislike traveling between areas for gasoline, we can differentiate these models by comparing the expected markups of both stations, employing two moment conditions, one for each gasoline station.

In practice, even if we have two gasoline stations, identification might be challenging if both stations have the same proportion of low-income and middle-income consumers nearby. Intuitively, the government will charge similar prices in both stations if it targets either low-income or high-income households, and we will not be able to tell apart the two rival models. The fact that YPF has an extended network of stations and variation in how consumers are distributed across the space allows us to distinguish between different models.

Another critical feature of the setting that allows identification is that YPF offers two products (i.e., regular and premium gasoline) and that consumers with different income levels are willing to pay different amounts for these products. In particular, low-income consumers are unlikely to purchase premium gasoline. So, any differential price discount between regular and premium gasoline that differs from what a profit-maximizing firm would have done is informative about YPF internalization of consumer surplus of low-income consumers vs. internalization of middle and high-income consumers.

A last potential concern is how to tell a government that cares about consumer surplus from a government that wants to induce firm exit (which, in our specification, should be captured by a negative weight on rivals' firms). The kind of variation we use to distinguish between these two is the correlation between expected markups and rival's presence. For instance, suppose we compare two markets with similar demographic distributions: in one of these markets, YPF is a monopolist; in the other, it faces competition from a rival firm. If YPF were negatively internalizing rival's profits but not subsidizing consumers, YPF should charge markups that are below what a profit-maximizing firm would have charge, only in the market in which YPF faces competition but not in the market in which YPF is a monopolist. On the contrary, if YPF were subsidizing consumers, YPF should charge markups that are below what a profit-maximizing firm would have charged in both markets and independently of the level of competition.[21]

[21] Once we account for differences in consumer surplus gains of charging lower prices in the more concentrated market

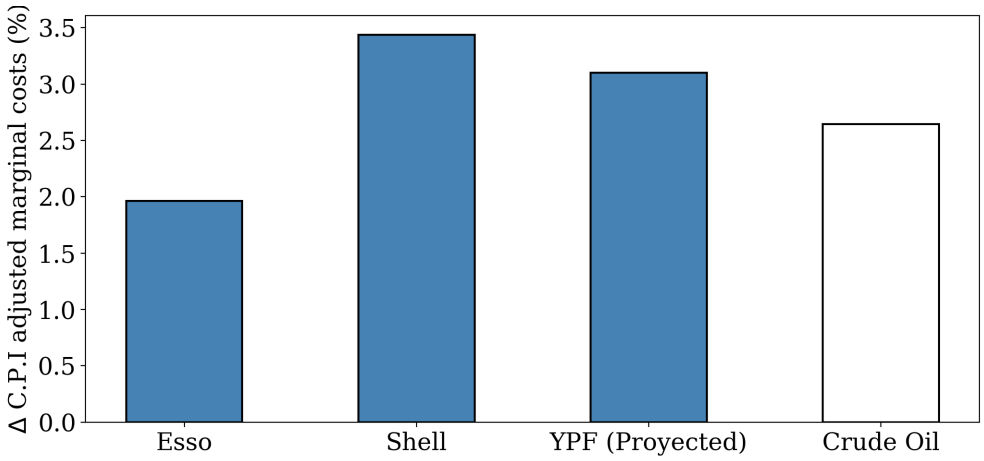
At the end of this section, we complete this discussion by showing how actual markups vary with different demographic groups, how this compares to simulated parametrizations of the objective function, and how this allows us to identify YPF's objective function in our setting. We refer the reader to Appendix D for an illustration of how different models generate different patterns of markups across different regions and products.

5.4 Supply Side: Results

Marginal Costs We regress the marginal costs of gasoline on their main gradients using only pre-nationalization estimates. Coefficients have expected signs and magnitudes. For instance, we observed a direct correlation between higher crude oil prices and increased marginal costs for gasoline. Also, Premium gasoline is associated with 3% higher marginal costs than regular gasoline, consistent with high-octane premium fuel being more expensive to produce.Marginal costs are higher for stations located in remote locations. In particular, a 300km increase in distance to the refinery is associated with a marginal cost increase of 1.2 cents (1% of median marginal cost). Non-vertically integrated gasoline stations that are unbranded or affiliated with small brands- exhibit higher marginal costs. Among the first group, unbranded stations have the highest marginal costs (which is consistent with the fact that they purchase gasoline from distributors or at spot markets). Finally, we find that YPF stations have lower marginal costs than competitors, consistent with YPF operating at a larger scale and participating in crude oil extraction and transportation. We refer the reader to Table 18 in the appendix for regression tables.

Using marginal cost estimates, we project YPF's marginal costs in the post-period. Figure 9 illustrates the results. Our projection of YPF's costs is in line with rival's costs and slightly above the evolution of crude oil prices. However, after removing the effect of local cost shocks, the median YPF station exhibited a rise in marginal cost.

Figure 9. Changes in Marginal Costs of Gasoline - By Brand



Notes: This figure shows the changes in marginal costs for different firms and crude oil price (Medanito) when comparing the post-nationalization period (05-2012 to 03-2013) with the pre-nationalization period (01-2010 to 12-2012). For YPF, the figure displays estimates of projected marginal costs according to our baseline specification (see equation (9)). Values are expressed in CPI-adjusted pesos.

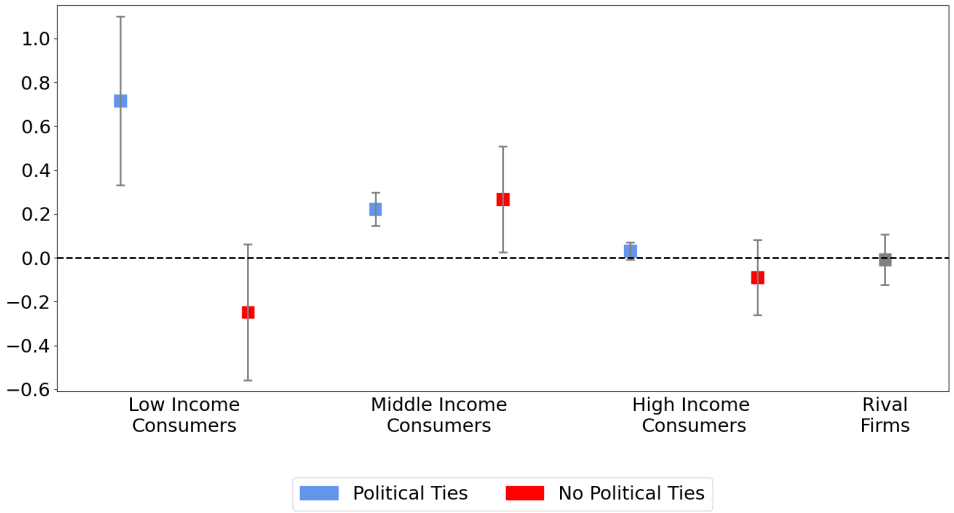
YPF Objective function Figure 10 plots estimates and standard errors of YPF's objective function parameters, corresponding to equation 8. Table 19 presents the same information in a table version. In our baseline specification, we group consumers by income levels—low, medium, and high—and by province type: shareholder and non-shareholder. We also include a parameter capturing the internalization of all firms' profits. As a result, we end up with seven different parameters to be estimated (we normalize YPF's valuation of its profits to be equal to 1).

The results show that YPF internalizes the effects of its pricing on consumer surplus. However, not all consumers are weighted equally. YPF weights consumer surplus of consumers differently based on their income level and location. The estimates highlight significant differences in low-income categories between shareholder and non-shareholder provinces. YPF was willing to trade 1 dollar of its profits to increase the consumer surplus of low-income groups in shareholder provinces by around 0.7 dollars. However, we cannot reject that YPF does not internalize the consumer surplus of these groups.

Differences are minor for middle-income and high-income consumers. For the former, YPF is willing to trade off one dollar of profits to increase the consumer surplus of these groups by around 25 cents (with slightly higher estimates for those located in non-shareholder provinces). For high-income consumers, we cannot reject that YPF does not internalize its consumer surplus.

Lastly, our findings indicate that YPF doesn't account for the impact of its pricing decisions on its competitors.

Figure 10. Estimates of SOE's Objective Function Parameters



Note: This figure displays estimates and their 95% confidence intervals for the parameters of the SOEs' objective function based on our baseline specification (refer to equation (3)). Estimates are grouped by agent type: consumers (blue and red) and firms (in grey). Additionally, they are categorized by province type: oil-producing (in blue) and other provinces (in red). We refer the reader to Table 19 in the appendix for a table version of the results.

To rationalize our results, we compare the actual markups that YPF charged (based on our cost estimates) with (1) the expected markups that a profit-maximizing firm would have charged and (2) the markups that firms with different parametrizations would have charged. This exercise illustrates the discussion of subsection 5.3.2. We present this exercise in detail in Appendix D and summarize here the main results.

We defined a *subsidy* as a difference between the markups a profit-maximizing firm would have charged and those that the SOE charged. Subsidies are different in oil-producing provinces and other provinces in three dimensions. First, the magnitude of the subsidy is higher on average in oil-producing provinces, pinning down higher preferences for consumers in those provinces. Second, subsidies for premium gasoline are relatively lower in oil-producing provinces, consistent with a higher internalization of low-income households. Third, the correlation between markups and income is more pronounced in oil-producing provinces (and almost flat in the latter), consistent with a higher internalization of low and middle-income households.

Finally, we reject the possibility that lower prices are due to the government trying to

induce a rival's exit. While a model that generates a rival's exit would generate lower prices in markets with higher rivals' presence, we find no correlation between subsidies and rival's presence.

5.4.1 Model Fit

Table 3 presents the results for model fit. The measure of model fit we use is based on predicting prices for each gasoline station without considering the idiosyncratic error term.[22] The model fits the data well. Differences are below one cent for the average price of regular and premium gasoline and for the average prices at shareholders and non-shareholder provinces. The model also has a good fit of the correlation between prices and income for regular and premium gasoline at different province types and the correlation between prices and YPF's market shares in the pre-nationalization period for different products, with most differences being below 1 cent. A noticeable exception is the predicted premium gasoline prices in shareholder provinces in middle and high-income locations. In particular, the model predicts prices that are 3 to 4 cents lower.

[22] Once we include idiosyncratic errors, the model fits the data perfectly by construction

Table 3. Model Fit

Moment	Data	Model
E[price | regular,]	1.73	1.73
E[price | premium,]	1.93	1.93
E[price | S]	1.46	1.45
E[price | NS]	1.87	1.87
E[price | regular, low income, S]	1.63	1.63
E[price | regular, medium income, S]	1.47	1.47
E[price | regular, high income, S]	1.38	1.38
E[price | premium, low income, S]	1.84	1.84
E[price | premium, medium income, S]	1.71	1.67
E[price | premium, high income, S]	1.63	1.59
E[price | regular, low income, NS]	1.83	1.83
E[price | regular, medium income, NS]	1.82	1.82
E[price | regular, high income, NS]	1.82	1.82
E[price | premium, low income, NS]	1.99	2.00
E[price | premium, medium income, NS]	1.99	1.99
E[price | premium, high income, NS]	1.99	2.00
E[price | regular, ypf shares $< 33\%$]	1.85	1.85
E[price | regular, ypf shares $\in (33\%;66\%)$]	1.77	1.76
E[price | regular, ypf shares $> 66\%$]	1.66	1.66
E[price | premium, ypf shares $< 33\%$]	1.99	1.97
E[price | premium, ypf shares $\in (33\%;66\%)$]	1.95	1.94
E[price | premium, ypf shares $> 66\%$]	1.89	1.91

Note: This table shows moments used for estimation and model fit

6 Effects of the Nationalization

In this section, we use our estimates of demand and marginal costs to evaluate the effects of the nationalization in the downstream gasoline market. Throughout this section, we compare (i) the prices we observe in the data (*actual scenario*) vs. (ii) counterfactual prices that we simulate, assuming that YPF would have been a profit-maximizing firm after the nationalization (*privatization scenario*). By comparing these two scenarios, we isolate changes in the objective function from changes in consumer preferences or costs.

Aggregate Effects The nationalization led to an expansion of the gasoline market and increased total surplus. As we previously showed, the post-nationalization period was associated with higher demand for gasoline and higher costs -primarily due to higher crude oil prices—. YPF responded by increasing prices by approximately one percent, two percentage points below the changes in crude oil prices, and six percentage points below what a profit-maximizing firm would have done in a similar scenario. Consequently, the amount of gasoline sold increased by 7% compared to the pre-nationalization period and by 4% more than what a profit-maximizing firm would have sold. See Figure 35 (panel b).

Price discounts are more significant in regular (7.5%) than in premium gasoline (%4.2). This results from both YPF's direct action -reducing prices of regular gasoline more than premium gasoline in comparison to a counterfactual scenario- and also because rival's responses were more pronounced in regular than in premium gasoline -due to the lower cross-price elasticity between YPF's and rivals' premium gasoline products-. Consistent with the descriptive evidence, market expansion was led by regular gasoline, which increased by 7%.

Effect on markups Figure 38 presents the distribution of markups in both the observed and profit-maximizing scenarios. Interestingly, by not taking advantage of a higher willingness to pay for gasoline (especially in non-oil-producing provinces), the nationalization results in a more compressed markup distribution, particularly truncating the right tail.

Distribution and Welfare Effects As our previous estimates suggest, the state-owned enterprise exerts price discrimination differently than a profit-maximizing firm. The nationalization's effects on prices varied depending on product quality and location, which led to heterogeneous impacts on consumers. First, the effects on sales are more significant in shareholder provinces. Effects are more prominent not only on average but also when comparing individuals of the same income group (**??**). This is a direct consequence of YPF generating a price reduction on regular gasoline twice as large as the one observed in the rest of the country. Second, the group that increased consumption the most across the country is middle-income households (5 %). Despite not being actively targeted, high-income groups also benefited from the policy and responded by increasing their consumption of premium (6.2%) and regular gasoline (2%). Interestingly, the effect of the policy in low-income households varies heavily depending on whether they live in an oil-producing province and is consistent with the SOE internalizing consumer surplus of low-income consumers exclusively in shareholder provinces.

Aggregate consumer surplus increased by 12.5% (Table 4). Firms are negatively affected by the nationalization. Compared to the profit-maximizing case, firms sell more gasoline at

lower prices. Moreover, rivals' profits are the most affected (-12.3% vs. -2.7%). Overall, by charging lower markups on its products and forcing rivals to reduce prices, the nationalization offsets part of the distortion generated by the existence of market power and increases the total surplus by 6.2%.

Benchmarking We use two counterfactual scenarios to benchmark the effects of the nationalization. The first alternative benchmark corresponds to a scenario where YPF maximizes total surplus. This means that the SOE fully internalizes consumer surplus and rival firms, and the consumer surplus of all consumers received the same weight as YPF's profits (*Full CS* in Table 4). Intuitively, this is the best the firm can do by operating through the firms. This policy would have increased consumer surplus by 62% (vs. 12.5% in the actual case), more than doubled the increase in total welfare generated by the nationalization, reduced rivals' profits by 35%, and made YPF's profits to zero (since the SOE is doing marginal cost pricing). Additionally, we benchmark the nationalization against the case in which all firms in the industry do marginal cost pricing (see $p = mc$ in Table 4). This is the best a planner can do, absent any consideration regarding fixed costs.

Table 4. Welfare effects. Different scenarios vs. Profit Maximization

	Actual	Full CS	p = mc
Panel 1: Oil-Producing			
CS	16.8%	85.9%	110.7%
Profits YPF	-2.5%	-100.0%	-100.0%
Profits rest	-13.0%	-37.3%	-100.0%
Total Surplus	7.4%	16.5%	22.8%
Panel 2: Other Provinces			
CS	11.5%	56.4%	77.1%
Profits YPF	-2.8%	-100.0%	-100.0%
Profits rest	-11.8%	-34.4%	-100.0%
Total Surplus	5.7%	12.0%	18.1%
Panel 3: All Provinces			
CS	12.5%	62.1%	83.7%
Profits YPF	-2.7%	-100.0%	-100.0%
Profits rest	-12.1%	-35.1%	-100.0%
Total Surplus	6.0%	13.0%	19.1%

Note: This table presents the changes in consumer surplus, profits, and total surplus by comparing four scenarios against the profit-maximizing case. The values are computed for the period from Jun-2012 to Dec-2012. The *actual* column contrasts the nationalization scenario with the profit-maximizing case. The *Full CS* column describes a scenario where YPF fully internalizes consumer surplus, treating the consumer surplus of all consumers with the same weight as YPF's profits. The $p = mc$ column corresponds to a scenario where all firms do marginal cost pricing. Lastly, the *Low Income* column represents a case where the SOE focuses exclusively on the low-income population. For the actual values, refer to Table 23.

7 Policy Design

We showed that YPF affected distributional outcomes by discretionally charging different prices at different gasoline stations. Although the nationalization increased consumer surplus and overall welfare, it has two potentially undesirable effects from a distributional perspective. First, the SOE charges lower markups to consumers in shareholder provinces compared to consumers of the same level of income in non-shareholder provinces due to political price discrimination. Second, the bulk of the markup reduction ends up in the hands of middle

and high-income consumers due to the lower economic price discrimination that the firm exerts.

At the time of writing this paper, a heated debate surrounds YPF. The leading presidential candidate and several party members propose the privatization of YPF, arguing that YPF is being used *to do partisan politics* and that the state cannot manage firms efficiently. Conversely, representatives from both major political parties in Congress advocate enacting price regulations for YPF by law to curtail regional pricing disparities.[23][24]

We use our model to study optimal policy design. Specifically, we explore the consequences of imposing rules that limit SOEs' discretion in price-setting, echoing existing regulations in various countries in which Public Enterprises are limited -by law or by regulatory agencies- in their discretion in actions, such as pricing or contracting IMF [2020]. There is a trade-off in these policies. While they can effectively limit the influence of lobbying and political pressure on firms' decisions, they can also be detrimental to the firm's mission.

To evaluate the effects of the proposed policies, we solve YPF's pricing problem considering YPF's preferences - denoted by our estimates of its objective function - yet restricting YPF's choice set by the price rule. We study the effects of two regulatory approaches. The first regulatory approach, *uniform pricing*, involves setting equal prices for identical products at every gasoline station. The second regulatory approach, referred to as *uniform markup*, requires YPF to apply identical unit markups for each product type nationwide. We compare these policies to the current status quo of nationalization under discretion and the proposed privatization.

We model this situation as a constrained optimization problem for the SOE. The SOE chooses prices based on their preferences but is constrained by the set of prices (or markups) it can choose. Given a price rule $\bar{f}(p)$ imposed by the congress, the SOE solves:

$$\begin{aligned} \underset{\boldsymbol{p}_{YPF}}{\text{maximize}} \quad & W(\hat{\lambda}, \hat{\kappa}, \boldsymbol{p}_{YPF}) \\ \text{subject to} \quad & f(\boldsymbol{p}_{YPF}) = \bar{f}(\boldsymbol{p}_{YPF}) \end{aligned}$$

where $W(\hat{\lambda}, \hat{\kappa}, \boldsymbol{p}_{YPF})$ is the objective function we estimate in section 5.

Our analysis reveals that none of these policies dominates the others in all dimensions. Trade-offs exist concerning taxpayer costs, efficacy in curbing political price discrimination, impact on total consumer surplus, and overall welfare implications.

[23] See Dalmacio Enrique Mera Figueroa's project https://www.infotyl.com.ar/precio-unico-para-el-combustible/

[24] See Luis Naidenof's project https://www.iprofesional.com/economia/371585-oposicion-busca-unificar-precios-de-combustibles-en-todo-el-pais

Privatization From taxpayers' perspective, privatization is the best policy since, by construction, it maximizes YPF profits. It is also preferred for rival firms and, by construction, reverts all distributional outcomes generated by the nationalization. However, it is the worst policy for consumers and overall welfare (See Table 4 column a).

Uniform Pricing Nationalization under uniform pricing is the most effective policy to reduce the gap between consumers in oil-producing and non-oil-producing provinces and also for low-income households in non-oil-producing provinces. The policy increased overall welfare since the SOE charged even lower markups than in the nationalization under discretion.

Uniform Markups Finally, uniform markup emerges as the most efficient policy due to the SOE's propensity to adopt lower average markups and the enhanced alignment of prices with costs. Nevertheless, it generates undesirable distributional outcomes. It exacerbates the political price discrimination effect, increasing the price gap between oil-producing and non-oil-producing provinces, and it is regressive since it increases the disparities between low and high-income households in both types of provinces.

There are two different reasons why the uniform markup policy generates these distributional outcomes. First, it is due to the negative correlation between marginal costs and SOE's preferences for specific consumer groups. Since cities with a higher proportion of middle-income consumers are located relatively near the refineries, they access products with lower marginal costs, and therefore, the uniform markup policy makes them even better off. A similar effect is observed for consumers in oil-producing provinces due to having lower taxes. Second, the government can use two instruments: regular and premium gasoline. Since the government has preferences for middle-income consumers, it can use premium gasoline to target them, limiting the potential of the policy to increase the welfare of low-income consumers.

Table 5. Effects of Price Rules on Welfare: Comparing Rules to the Actual Case

	Uniform Pricing	Uniform Mark-ups	Full CS
Panel 1: Oil-Producing			
CS	-13.5%	2.3%	59.2%
Profits YPF	-3.7%	-5.6%	-100.0%
Profits rest	16.9%	6.0%	-28.0%
Total Surplus	-7.8%	0.6%	8.5%
Panel 2: Other Provinces			
CS	9.7%	6.4%	56.4%
Profits YPF	-6.6%	-8.2%	-100.0%
Profits rest	-6.4%	0.7%	-34.4%
Total Surplus	4.3%	2.6%	12.0%
Panel 3: All Provinces			
CS	-4.0%	-3.1%	44.1%
Profits YPF	-3.9%	-5.6%	-100.0%
Profits rest	8.6%	12.2%	-26.2%
Total Surplus	-2.7%	-2.1%	6.6%

Note: This table displays changes in consumer surplus, profits, and total surplus by comparing three different scenarios against the actual case (nationalization under discretion) from June 2012 to December 2012. The *Uniform Pricing* column shows the effects of the uniform pricing policy in contrast to the actual scenario (nationalization under discretion); *Uniform Markups* column shows the effects of applying the uniform markups policy; *Full CS* column outlines the effects of a scenario where YPF fully internalizes consumer surplus, treating the consumer surplus of all consumers equivalently to YPF's profits. Refer to Table 23 in the appendix for detailed values.

Table 6. Effects of Price Rules on Consumer Surplus: Comparing Rules to the Actual Case

	Uniform Pricing	Uniform Mark-ups	Full CS
Panel 1: Oil-Producing			
CS	-13.5%	2.3%	59.2%
High Income	-14.4%	2.5%	40.6%
Middle Income	-28.2%	-9.6%	320.9%
Low Income	44.4%	19.4%	170.3%
Panel 2: Other Provinces			
CS	9.7%	6.4%	56.4%
High Income	8.1%	7.6%	30.6%
Middle Income	21.4%	-1.0%	273.4%
Low Income	21.6%	-7.1%	159.0%
Panel 3: All Provinces			
CS	-4.0%	-3.1%	44.1%
High Income	-4.7%	-1.5%	22.9%
Middle Income	-6.1%	-19.7%	212.4%
Low Income	29.7%	1.1%	168.0%

Note: This table presents changes in consumer surplus by income group and province type when comparing three different scenarios against the actual case (nationalization under discretion) for the period Jun-2012 to Dec-2012. The *Uniform Pricing* represents the effects of applying the uniform pricing policy; *Uniform Markups* represents the effects of applying the uniform markups policy; *Full CS* describes a scenario where YPF fully internalizes consumer surplus, equating the consumer surplus of all consumers to YPF's profits. For detailed values, refer to Table 23 in the appendix.

8 Conclusion

We study the nationalization of Argentina's leading oil and gas company and assess its effects on the retail gasoline market. We showed how to use microdata and modern empirical tools to isolate the effect of the nationalization from confounding factors such as changes in demand and costs and recover the firm's objective function.

Our analysis uncovers a fundamental trade-off inherent in public provision. On the one hand, the SOE's actions benefit consumers on average and enhance allocative efficiency by charging lower markups. Moreover, the state-owned firm engages in less economic price

discrimination. These two actions lead to a closer alignment between prices and costs. On the other hand, the firm imposes varied prices based on consumers' political ties, leading to undesirable distributional outcomes.

We also explore the effects of different policy tools that aim to align government and social preferences. Our analysis reveals that none of these policies dominates the others in all dimensions. Trade-offs exist concerning taxpayer costs, efficacy in curbing political price discrimination, impact on total consumer surplus, and overall welfare implications. Who are the groups with the most influence on the firm, how much (or less) costly the products they consume are in comparison to the rest of the population, how many instruments does the government have to discriminate among consumers, and how does the congress trade-off taxpayer costs, efficiency, and equity are essential factors in determining the optimal policy.

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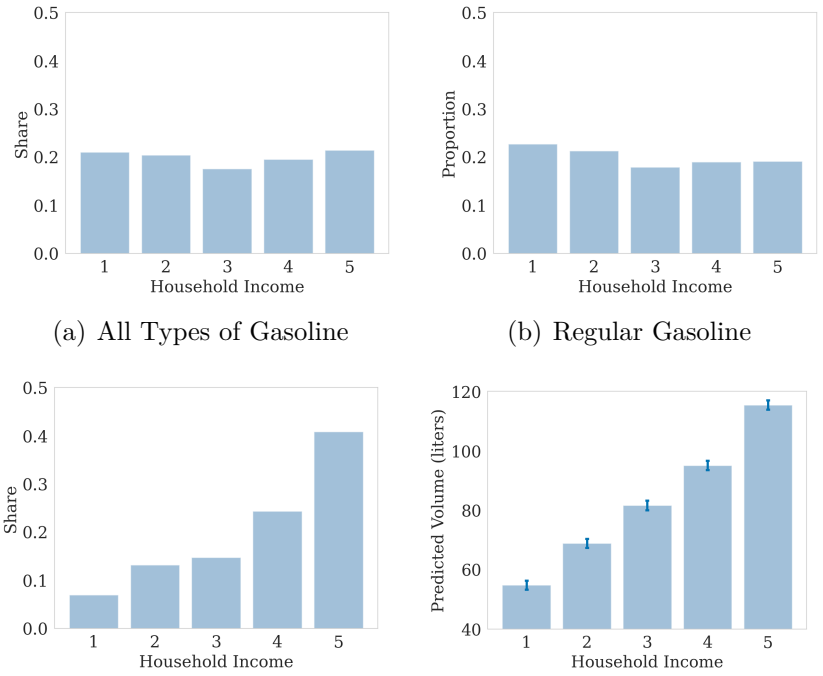
A Appendix to Section 2

A.1 Consumption Patterns by Income Group

Figures 11 and summarize gasoline consumption patterns of Argentinan households based on their income. Consumers of gasoline are uniformly distributed across income groups However, households of differnt income groups show different consumption patters. First, richer households consume more gasoline. In particular, households in the 5th quintile double the consumption of households in the first quintile. Second, high income households consume more premium gasoline. Finally, high-income households also consume more expensive regular and premium gasoline.

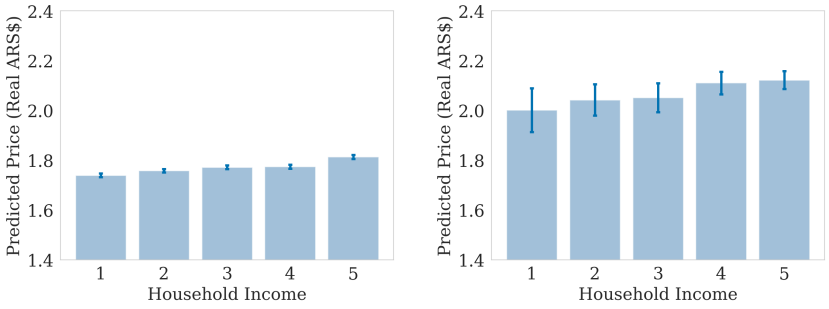
Figure 11. Consumption Patterns by Income group and Gasoline Type: Quantities



(a) All Types of Gasoline (b) Regular Gasoline

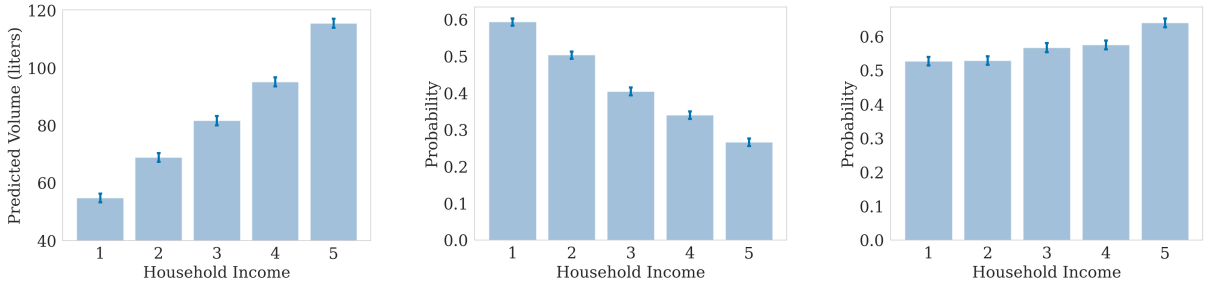
(c) Premium Gasoline (d) Volume of Gasoline Consumed

Figure 12. Consumption Patterns by Income group and Gasoline Type: Average Price Paid



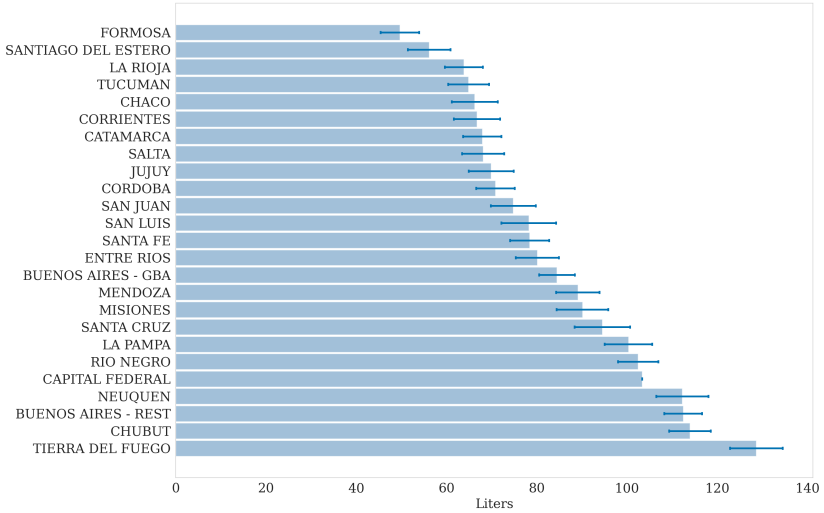
(a) Mean Price - Regular (b) Mean Price - Premium

Figure 13. Consumption Patterns by Income group. Quantities



(a) Volume (b) Pr(motorcycle) (c) Pr(travel more than 50km)

Figure 14. Consumption Patterns by Province



(a) Volume by Province

A.2 Market definition

Table 7. Summary Statistics - Sample

	All	**Sample**
# Markets	404	272
# Stations		
p25	1	2
p50	2	4
p75	5	6
p90	9	11
Total	2,787	2,655
Price		
p25	1.72	1.75
p50	1.76	1.78
p75	1.81	1.84
p90	1.87	1.89
Volume (Th. m3)		
p25	80	175
p50	185	325
p75	461	759
p90	1258	1822
Total	407,776	397,548

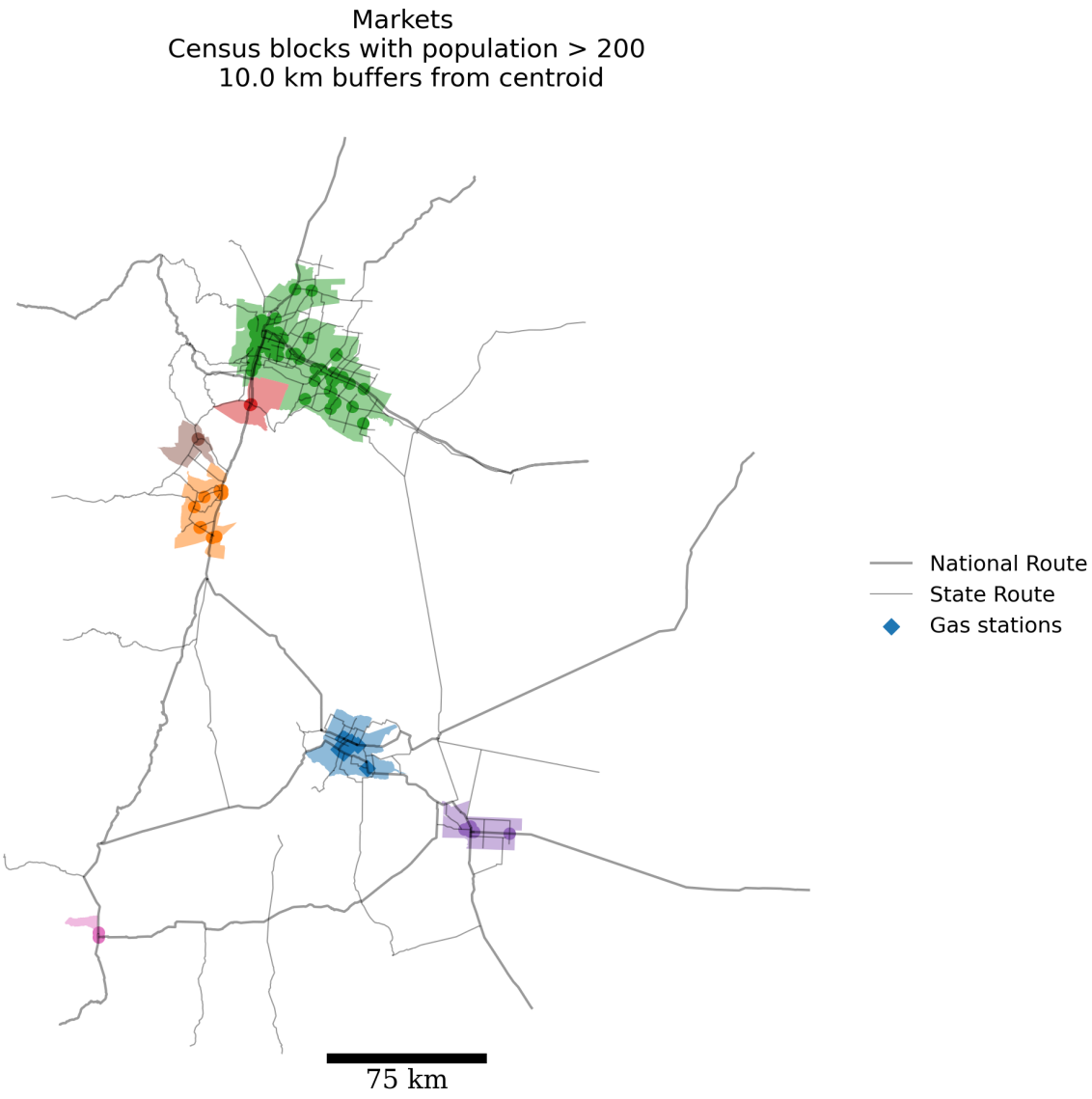
Note: This table presents the summary statistics of the markets created using the algorithm described in the text. The first colum describes all the market. The second columm describes the markets in which YPF is not a monopolist.

Table 8. Summary Statistics of Market Definition Process

	p10	**p25**	**p50**	**p75**	**p90**
Market Size					
Population	5,942	11,057	23,754	48,037	112,508
# Stations	2	2	4	6	11
Volume - All Type	158	226	413	997	2,389
Market Shares					
Premium	19%	20%	25%	28%	33%
YPF	40%	51%	62%	76%	94%
Prices					
Regular - All	1.64	1.75	1.78	1.84	1.89
Regular - YPF	1.64	1.72	1.75	1.75	1.77
Premium - All	1.94	2.06	2.08	2.11	2.15
Premium - YPF	1.94	2.06	2.07	2.07	2.09
# Markets per Province	2	4	7	11	42

Note: This table presents descriptive statistics for our sample. *Premum* means the market share of all premium products. *YPF* means the market share fo all YPF products. Prices are expresed in CPI adjusted pesos and include taxes.

Figure 15. Market Definition Example - Mendoza



Note: This figure the markets located in the province of Mendoza, using our market definition algorithm. The color dots represent gasoline stations, and the colored areas represent census blocks. Census blocks and stations in the same color belong to the same market. We ended up with 7 markets.

B Appendix section 3

B.1 Appendix to fact 1

Figure 16. Gasoline Prices and Gasoline Sales

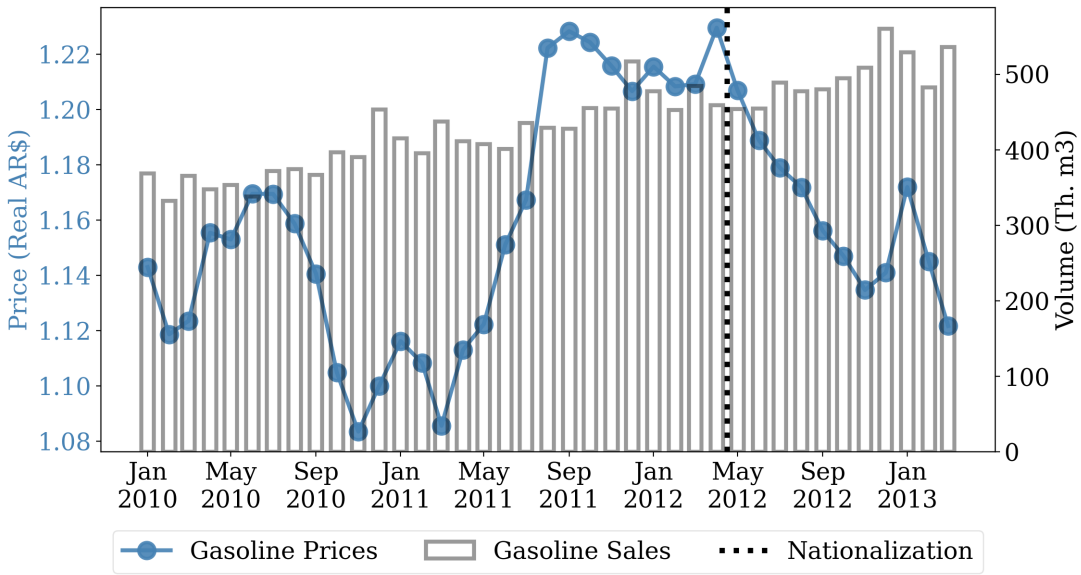


Figure 17. Effects on Regular Gasoline Prices (a) Regular (b) Premium Gasoline - **version 2**

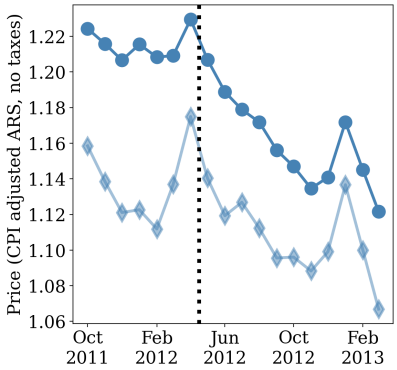
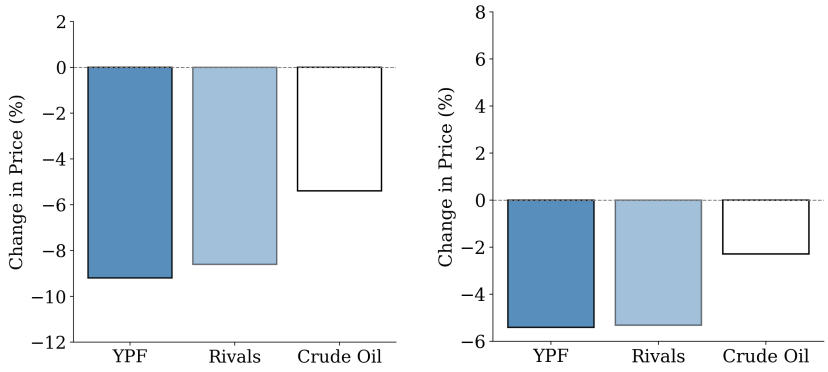
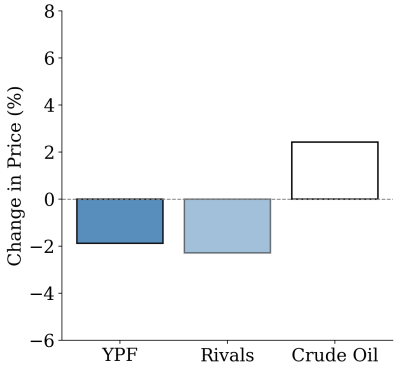


Figure 18. Change in Gasoline Prices vs Change in Crude Oil Prices



(a) last month vs. last month

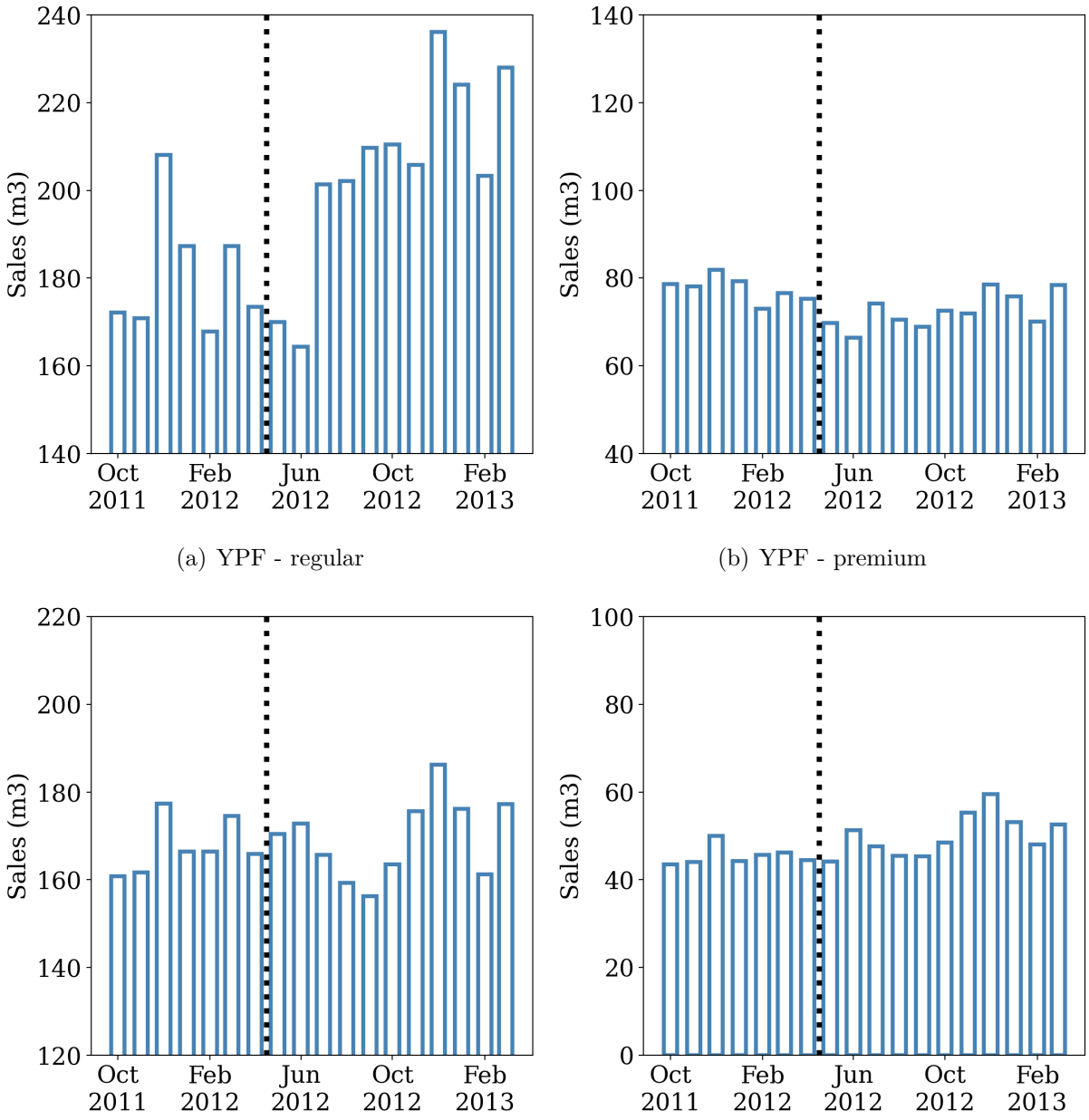
(b) average post vs last month



(c) vs all pre-period

This graph shows the change in YPF gasoline prices, non-YPF gasoline prices, and local Crude-Oil prices (Medanito). All prices are expressed in CPI adjusted pesos per liter and do not include taxes. Figure (a) compares the prices during the last month of our sample (February 2013) vs. the last month before nationalization (April 2012). Figure (b) compares the average prices of the post-nationalization period (May 2012 to February 2013) vs. the last month before nationalization (April 2012). Figure (c) compares average prices in the pre-nationalization period (January 2010 to December 2011) to the post-nationalization period (May 2012 to Feb 2013)

Figure 19. Evolution of Gasoline Sales by Product and Firm Type



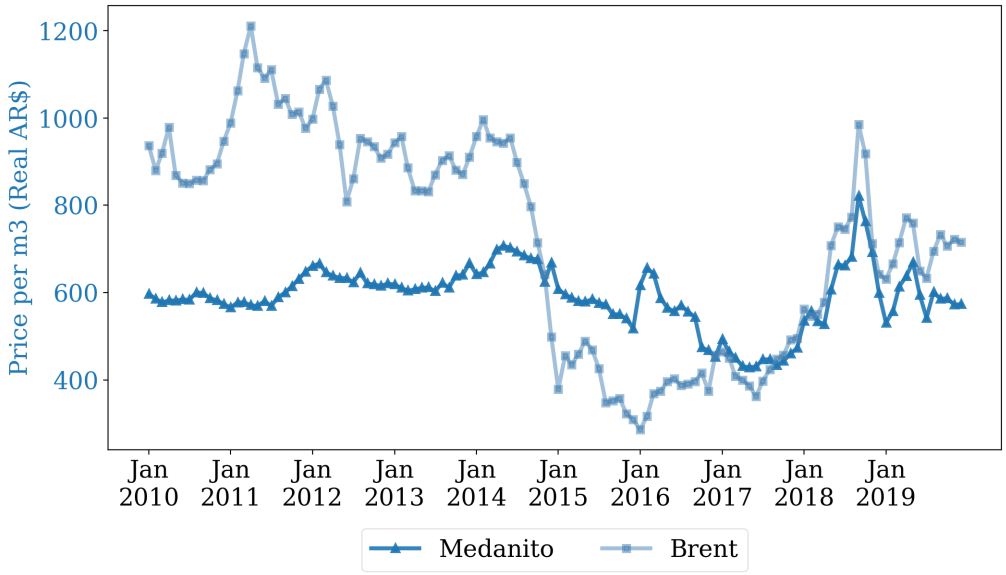
(a) YPF - regular

(b) YPF - premium

(c) Rivals - regular

(d) Rivals - premium

Figure 20. Crude Oil Prices - Local vs International



B.2 Appendix to fact 2

Figure 21. Gasoline Prices. YPF Premium and Regular Gasoline

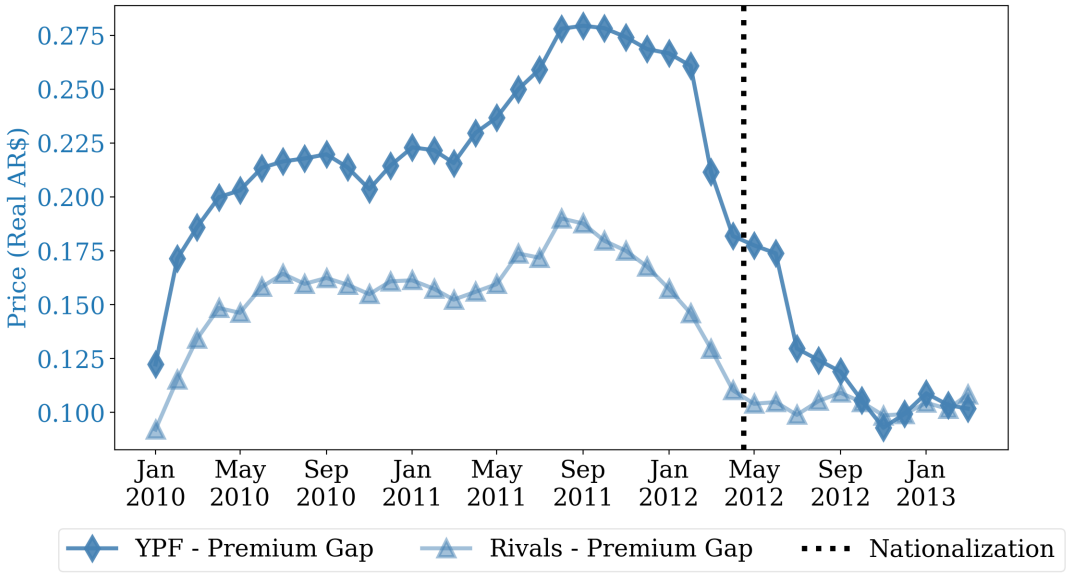


Table 9. Change in YPF relative prices between low ,middle and high income areas after the nationalization

	(1)	(2)	(3)
Intercept	1.102***	1.102***	1.115***
	(0.002)	(0.002)	(0.003)
Middle Income HH	0.026***	0.026***	
	(0.002)	(0.002)	
High Income HH	0.022***	0.022***	
	(0.002)	(0.002)	
Post × Middle Income	-0.014***	-0.014***	
	(0.004)	(0.004)	
Post × High Income	-0.021***	-0.021***	
	(0.004)	(0.004)	
YPF Market Share			0.011**
			(0.005)
Post × YPF Market Share			-0.021**
			(0.009)
Time FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
R^2	0.07	0.07	0.07
Obs	68058	68058	68058

Dependent variable: Price per liter without federal taxes. Unit: Real AR$ (Oct - 2005)
Sample period Jan - 2010 to March-2013
Note: *p<0.1, **p<0.05, ***p<0.01.

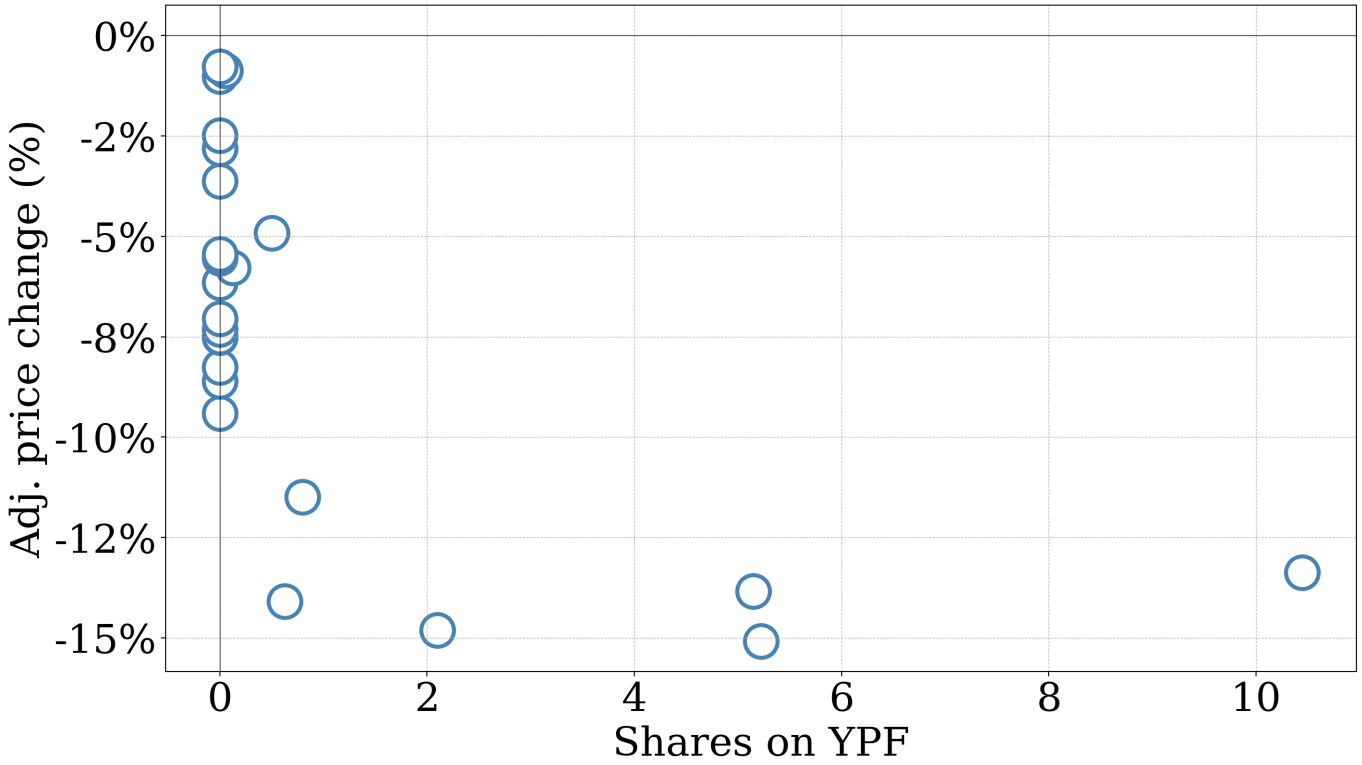
Table 10. Change in YPF relative prices between low ,middle and high income areas after the nationalization

	(1)	(2)	(3)	(4)
Intercept	1.122***	1.132***	1.122***	1.140***
	(0.000)	(0.000)	(0.001)	(0.001)
Post × Premium		-0.105***		-0.105***
		(0.001)		(0.001)
Post × Middle Income	-0.014***			-0.013***
	(0.002)			(0.002)
Post × High Income	-0.021***			-0.019***
	(0.002)			(0.002)
Post × YPF Market Share			-0.021***	-0.031***
			(0.004)	(0.004)
Time FE	Yes	Yes	Yes	Yes
Province FE	No	No	No	Yes
Station-Prod FE	Yes	Yes	Yes	No
R^2	0.79	0.81	0.79	0.81
Obs	68058	68058	68058	68058

Dependent variable: Price per liter without federal taxes. Unit: Real AR$ (Oct - 2005)
Sample period Jan - 2010 to March-2013
Note: *p<0.1, **p<0.05, ***p<0.01.

B.3 Appendix to fact 3

Figure 22. Price changes vs. shares in YPF



This graph illustrates the average change in YPF's prices as a function of province's shares in YPF, comparing the periods before and after nationalization. Prices are adjusted for the evolution of crude oil prices and exclude taxes. The pre-nationalization period spans from Jan-2010 to Mar-2012, while the post-nationalization period covers Apr-2012 to Feb-2013.

Figure 23. Increase in Gasoline Consumption After The Nationalzition by Province Type

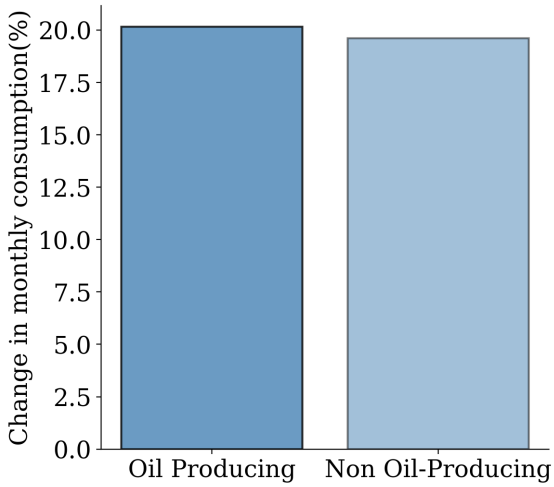
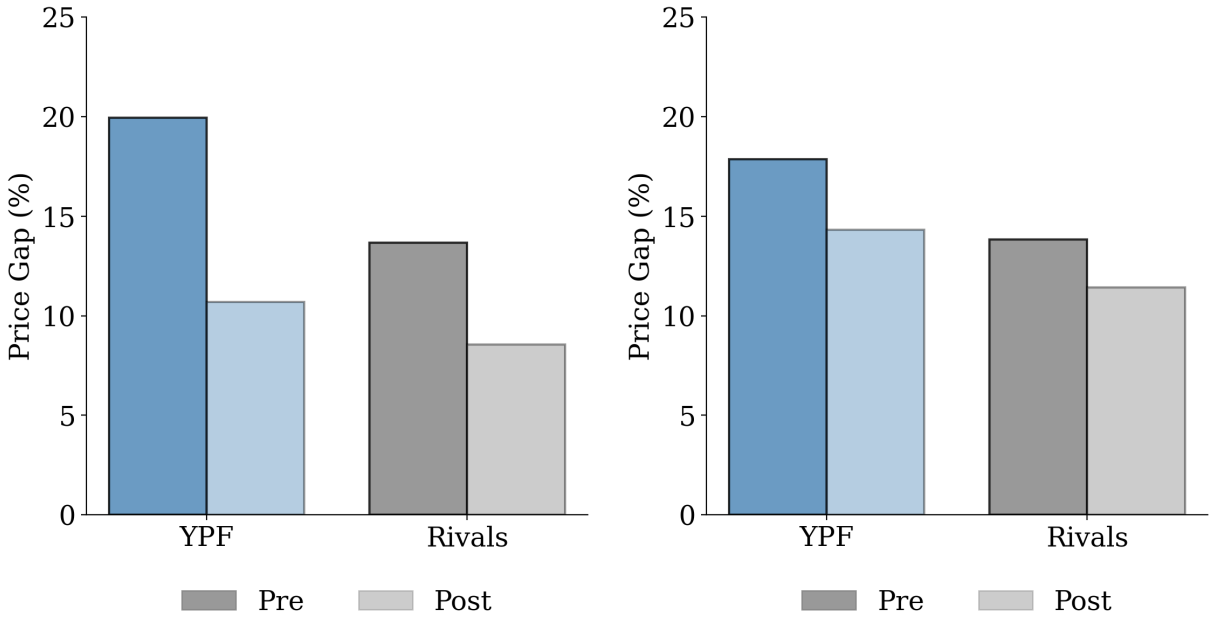


Figure 24. Effects on Regular Gasoline Prices (a) Regular (b) Premium Gasoline



(a) Non-Oil Producing

(b) Oil-Producng

Table 11. Change in YPF relative prices between low ,middle and high income areas after the nationalization

	All		Oil-Producing	
	Reg	Prem	Reg	Prem
Intercept	1.009***	1.206***	1.008***	1.203***
	(0.002)	(0.002)	(0.004)	(0.006)
Middle Income HH	0.021***	0.026***	0.009	0.003
	(0.002)	(0.002)	(0.006)	(0.007)
High Income HH	0.017***	0.018***	0.001	-0.001
	(0.002)	(0.003)	(0.006)	(0.007)
Post × Middle Income	-0.010***	-0.013***	0.014	0.024*
	(0.004)	(0.004)	(0.011)	(0.013)
Post × High Income	-0.018***	-0.017***	0.014	0.034***
	(0.004)	(0.005)	(0.011)	(0.013)
Time FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
R^2	0.17	0.18	0.16	0.28
Obs	35188	32870	5282	4750

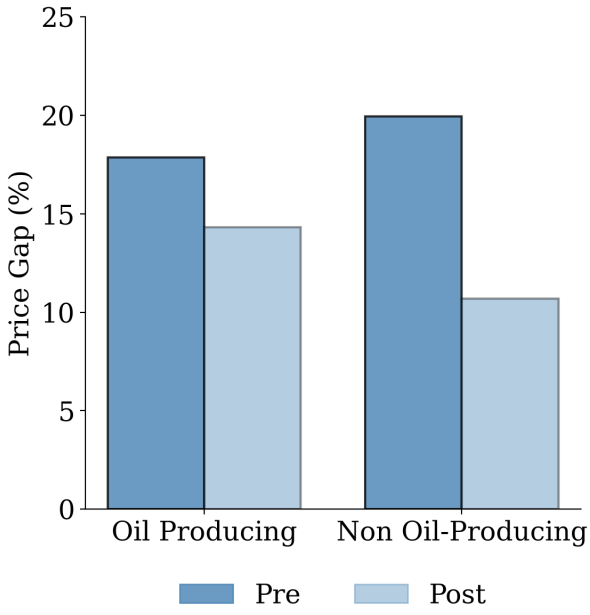
Dependent variable: Price per liter without federal taxes. Unit: Real AR$ (Oct - 2005)
Sample period Jan - 2010 to March-2013
Note: *p<0.1, **p<0.05, ***p<0.01.

Table 12. Change in YPF relative prices between premium and regular gasoline after the nationalization

	(1)	(2)
Intercept	1.022***	1.026***
	(0.001)	(0.001)
Premium Gasoline	0.227***	0.226***
	(0.001)	(0.001)
Post × Premium	-0.105***	-0.108***
	(0.002)	(0.002)
Post × Oil-Producing		-0.082***
		(0.003)
Premium × Oil-Producing		0.004**
		(0.002)
Post × Premium × Oil-Producing		0.020***
		(0.005)
Time FE	Yes	Yes
Station FE	Yes	Yes
R^2	0.45	0.46
Obs	68058	68058

Dependent variable: Price per liter without federal taxes. Unit: Real AR$ (Oct - 2005)
Sample period Jan - 2010 to March-2013
Note: *p<0.1, **p<0.05, ***p<0.01.

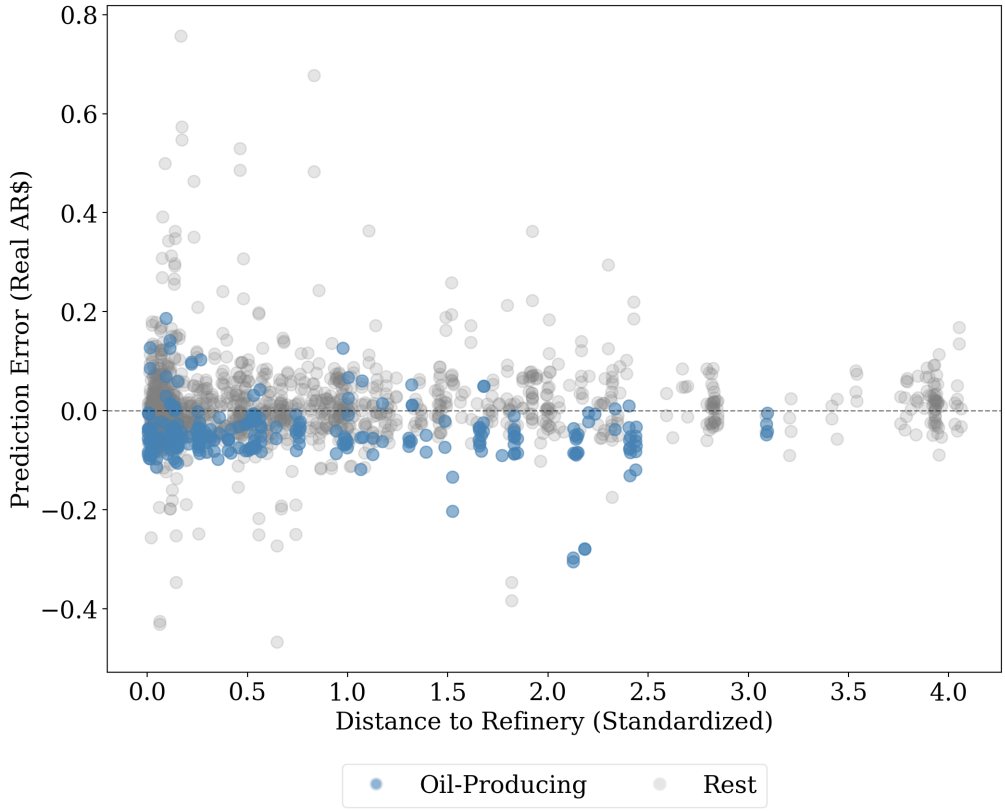
Figure 25. Effects on Regular Gasoline Prices (a) Regular (b) Premium Gasoline



(a) Non-Oil Producing

B.4 Price changes and distance to refineries

Figure 26. Gasoline Prices. YPF Prices in Oil-Producing and Non-Oil-Producing Provinces



This graph shows the relationship between the effects of the nationalization and distance to refineries. We regress prices on time and station-product fixed-effects, plus interactions between the post-nationalization period and gasoline type. We also include interactions between the nationalization period and household income levels (Refer to column 4 on Table 10 for results). We use that specification to compute predicted prices in the post-nationalization period. We compute prediction errors by taking the difference between observed and predicted prices. We plot predictive errors on the distance to the closest YPF refinery. For visualization convenience, we present the results for December 2012.

Table 13. Effect of nationalization. Distance to Refineries

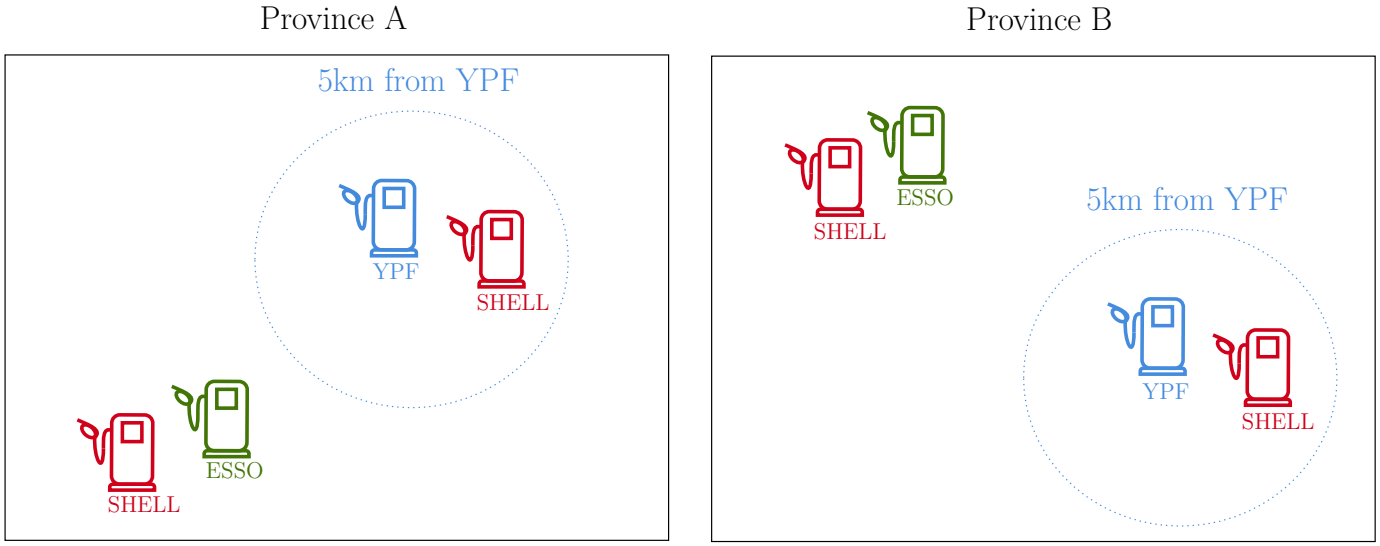
	(1)
Intercept	1.140***
	(0.001)
Post × Middle Income	-0.010***
	(0.002)
Post × High Income	-0.016***
	(0.002)
Post × Distance to Refinery	0.006***
	(0.001)
Post × YPF Market Share	-0.039***
	(0.004)
Time FE	Yes
Station-Product-FE	Yes
Province FE	No
R^2	0.81
Obs	68058

Dependent variable: Price per liter without federal taxes. Unit: Real AR$ (Oct - 2005)
Sample period Jan - 2010 to March-2013
Note: *p<0.1, **p<0.05, ***p<0.01.

B.5 Difference in Differences Design

We examine whether the lower prices of YPF in oil-producing provinces were not a result of a deliberated policy by YPF but a response to a reduction in costs and gasoline demand across all stations in those provinces. The ideal experiment would compare the observed YPF prices after the nationalization with those that a counterfactual *profit-maximizing* YPF would have charged under the same demand and supply conditions. This direct comparison is unfeasible as data on the prices that YPF would have charged after the nationalization does not exist. In order to overcome this challenge, we exploit quasi-experimental variation generated by the fact that before the nationalization, some geographic areas were exposed to YPF competition while others were not. Figure 27 illustrates our empirical strategy

Figure 27. Empirical Strategy



This figures illustrates our empirical strategy

We regress non-YPF prices (e.g., Shell, ESSO) on product-station fixed effects, brand and month fixed effects, month and region fixed effects, interactions between a post-nationalization dummy, and whether the gasoline station was exposed to YPF competition. By including station-product fixed effects, we capture differences in price levels of different stations before the nationalization. By including brands and months fixed effects, we capture brand-specific pricing trends (for instance, as a consequence of changes in production costs or willingness to pay for products of specific brands). Finally, by including region and month fixed effects, we control for demand and cost shocks common to all gasoline stations within a region. So conceptually, this analysis compares the evolution of prices of a rival station close to a YPF with another station of the same brand in the same region but not competing against a YPF. Under the assumptions of parallel trends in the costs of stations of similar brands and the costs of stations in the same province, the coefficient of interest captures the effect of being close to a YPF station on rivals' markups.[25]. Equation 27 presents our main specification

$$price_{i,t} = \alpha_i + \beta_{t,brand(i)} + \gamma_{t,region(i)} + \tau \times \mathbf{1}\{t \geq t_{\text{nationalization}}\} \times \mathbf{1}\{\text{YPF at distance km}\}$$

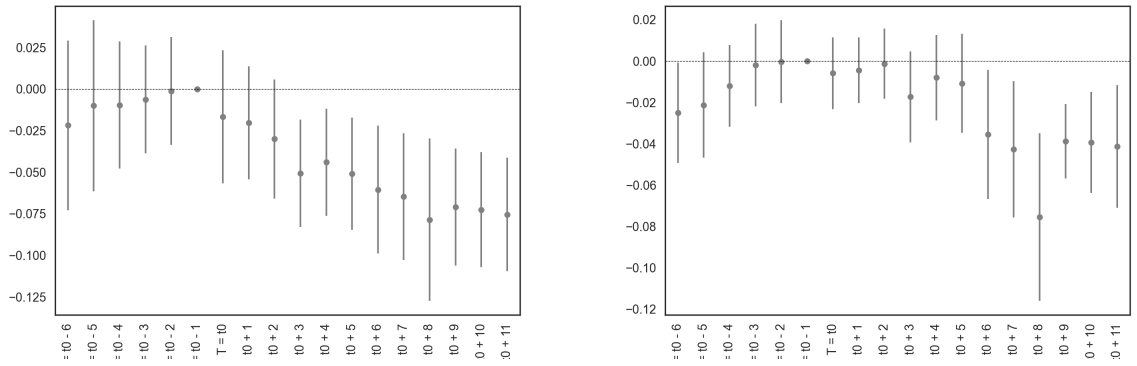
On average, competitors in shareholder provinces exposed to YPF competition set their markups 6% lower post-nationalization compared to similar stations unexposed to YPF competition. Markups of these two groups trended similarly before the nationalization. Effects

[25]Incude derivation

are more prominent for regular than for premium gasoline. Results are robust to alternative definitions of treated and control groups and to estimate the effects of the nationalization using the BJS estimator. Figure 28 presents event-study plots for regular and premium gasoline. Table XX summarizes the results.

This analysis indicates that exposure to YPF competition in shareholder provinces after the nationalization was associated with lower markups. It suggests that what drives lower prices in shareholder provinces is not a demand or cost shock that affects all provinces but exposure to YPF competition.

Figure 28. Effect of YPF proximity on rival's pprices - Oil producing provinces



(a) Regular Gasoline (b) Premium Gasoline

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Sample Description

Table 14. Summary Statistics - Regular Gasoline by Brand

	# Stations		Prices (median)		Volume (median)	
	Control	Treatment	Control	Treatment	Control	Treatment
Shell	46	459	2.01	1.94	55.18	105.46
Esso	31	336	1.97	1.87	51.86	97.85
Petrobras	13	198	2.01	1.88	67.78	103.87
Other Brands	41	272	2.04	1.98	38.27	62.81
Unbranded	74	202	2.10	2.07	15.26	18.00

C Appendix to Section 5

C.1 Demand Results

Table 15. Benchmarking

Own Price Elasticity		**Outside Option Elasticity**	
Median	Houde (2012)	Median	Benchmarks
-3.52	-10	-0.53	-0.37

Table 16. Own Price Elasticities - Description

Constant	-5.871***
	(0.027)
Premium	2.052***
	(0.018)
Unbranded	-0.929***
	(0.038)
Small Brands	-1.219***
	(0.038)
YPF	-0.057**
	(0.029)
Shell	-0.156***
	(0.032)
Petrobras	2.090***
	(0.038)
Market size (Th)	-0.167***
	(0.002)
R-squared Adj.	0.095
Median Elasticity	-3.52
Mkt Size - p10	264
Mkt Size - p50	1,361
Mkt Size - p90	9,049
Note: *p<0.05, **p<0.01, ***p<0.001	

Note: This table shows the results of regressing own-price elasticities on a constant, station's brand dummy variables, whether the product is regular or premium gasoline, and market size. The brand ESSO was left as a control group.

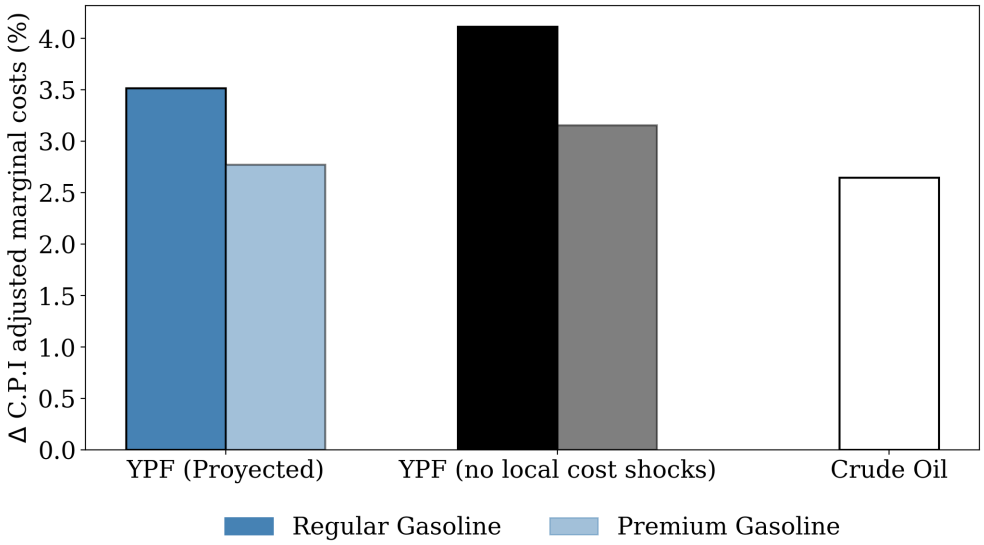
Table 17. Cross Price Elasticities - Description

Constant	0.032***
	(0.003)
Same Quality	0.096***
	(0.004)
Same Brand	0.046***
	(0.004)
Same Station	0.305***
	(0.010)
Closest Rival	0.319***
	(0.007)
Closest Rival #2	0.257***
	(0.007)
Closest Rival #3	0.195***
	(0.008)
Closest Rival #5	0.089***
	(0.009)
Closest Rival #10	0.001
	(0.011)
R-squared Adj.	0.071
Mean Elasticity – Inside Goods	3.47
Median Market Shares (%)	0.89%

Note: *p<0.05, **p<0.01, ***p<0.001
Note 2: Mean Elasticity – Inside Goods
is average sum of cross price elasticities

Marginal Costs Results

Figure 29. Marginal Costs of Gasoline - By Product Type



Notes This figure shows weighted avarage marginal costs for different firms and products. Values are expressed in 2005 Argentine Pesos

Table 18. Regression Results for Marginal Costs of Gasoline

	Marginal Costs
Premium	0.031**
	(0.002)
YPF	-0.249**
	(0.003)
SHELL	-0.016**
	(0.003)
PETROBRAS	0.010*
	(0.004)
UNBRANDED	0.092**
	(0.005)
Distance (100km)	0.004**
	(0.001)
Crude Oil Price (AR$ per liter)	0.106**
	(0.006)
Province FE	Yes
Time FE	No
Obs	70315
Adj. R^2	0.680
F-stat	4974.386

Sample period Jan - 2010 to Sept -2011

Notes: This table shows the results of regressing marginal costs on a constant, station's brand dummy variables, whether the product is regular or premium gasoline, and market size. The brand ESSO was left as a control group.

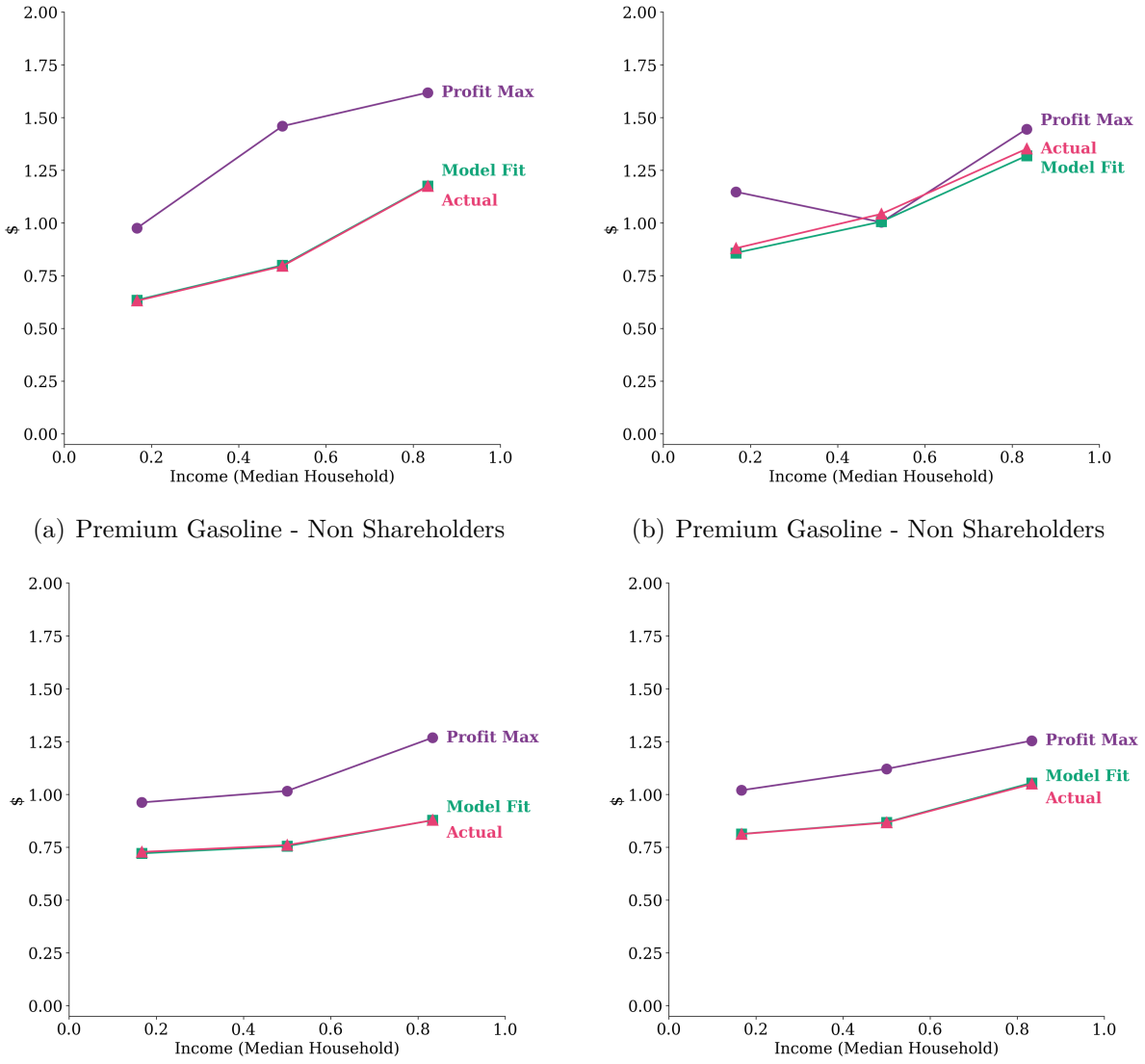
Table 19. Results - Main Specification

Parameter	Point Estimate	Confidence Interval	Description
$\lambda^{\text{non-oil producing, } L}$	-0.25	(-0.56, 0.06)	Low income consumers in non-oil producing provinces
$\lambda^{\text{oil producing, } L}$	0.72	(0.33, 1.10)	Low income consumers in oil producing provinces
$\lambda^{\text{non-oil producing, } M}$	0.27	(0.02, 0.51)	Middle income consumers in non-oil producing provinces
$\lambda^{\text{oil producing, } M}$	0.22	(0.15, 0.30)	Middle income consumers in oil producing provinces
$\lambda^{\text{non-oil producing, } H}$	-0.09	(-0.26, 0.08)	High income consumers in non-oil producing provinces
$\lambda^{\text{oil producing, } H}$	0.03	(-0.01, 0.07)	High income consumers in oil producing provinces
κ	-0.01	(-0.12, 0.11)	Firms

Note: This table present results of conduct parameters in our baseline specification. Confidence intervals are computed using the bootstrap distribution of the estimates, and adjusting critical values using **hallhorowitz1996**

Model Fit - Relevance of Strutural Error in Mark-ups

Figure 30. Correlation between income and mark-ups under diffeernt scenarios



(a) Premium Gasoline - Non Shareholders

(b) Premium Gasoline - Non Shareholders

(c) Regular Gasoline - Shareholders

(d) Premium Gasoline - Shareholders

Note: Subfigures (a) and (b) depict markups for regular and premium gasoline as a function of the median income of households within the census block of the station's location. The purple line illustrates the profit-maximizing case, while the pink line shows the actual markups YPF set, using our cost estimates. The additional case is the prediction of our model without using the estimated unobserved errors. (green line).

D Markup Patterns

In order to rationalize our results, we compare the actual markups that YPF charged (based on our cost estimates) with (1) the expected markups that a profit-maximizing firm would have charged and (2) the markups that firms with different parametrizations would have charged. This exercise illustrates the discussion of subsection 5.3.2.

We did the following steps:

- For each gasoline station and using our cost estimates, we simulate prices under different objective function parameterizations. In particular, a profit-maximizing case, a case in which the government only internalizes the consumer surplus of low-income groups ($\lambda_L = 2$, in), a case in which the government only internalizes consumer surplus of middle-income groups ($\lambda_M = 0.5$), a case in which the government only internalize consumer surplus of high-income groups ($\lambda_H = 0.75$), and a case in which the government does not internalize consumer surplus of any group but puts a negative weight on rivals' profits ($\kappa < -0.4$).

- We match each gasoline station with the income level of the median household located in the very same census block -this allows us to classify stations with high-income or low-income neighborhoods based on observable characteristics-. We compute the average markups, conditioning on the station being located in a low-income, middle-income, or high-income location.

- Additionally, we match YPF's market shares in the market in which that station is located- this allows us to match stations with different levels of rivals' presence-. We compute the average markups, conditioning on the station being located in markets in which YPF has market shares lower than 33%, market shares between 33% and 66%, and market shares above 66%.

- For illustration purposes, we did the same exercise with markups that YPF charged based on our cost estimates.

Figure 31 presents average markups for regular and premium gasoline, conditioning on the income level associated with the station's location, for non-shareholder provinces. First, note that different specifications generate different markups at different locations, being the profit-maximizing case the one in which markups are the highest purple line). In the profit-maximizing case, average markups are higher for both regular and premium gasoline in high-income locations. This pricing is consistent with YPF charging higher prices to

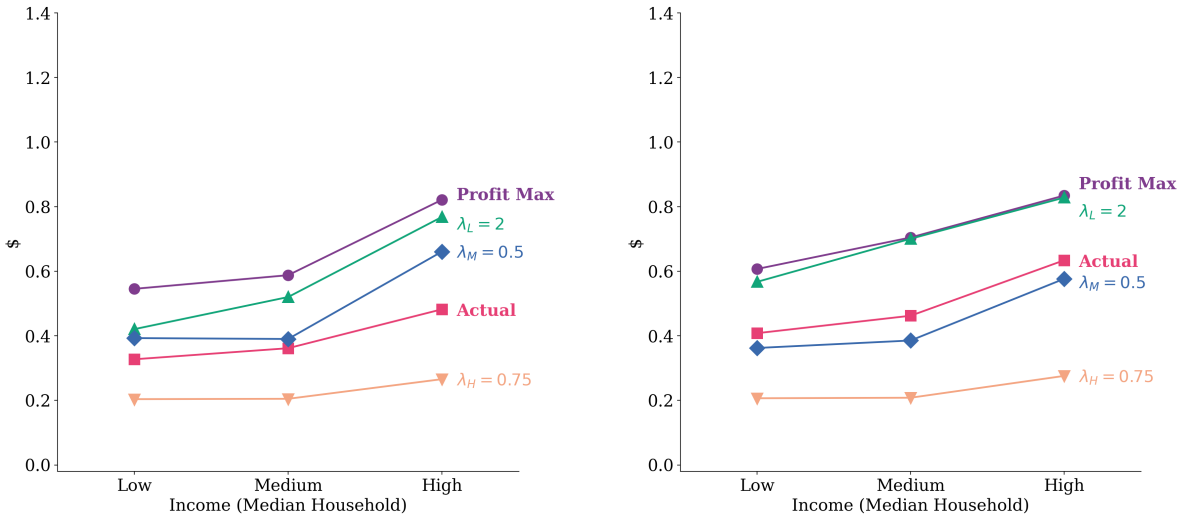
more inelastic consumers. Also, note that in the full consumer surplus internalization case, the firm does marginal cost pricing, so all markups are equal to zero, and there is no price discrimination based on income level.

Four features of the data allow us to discriminate between different objective functions.

Markups of regular vs. premium gasoline at a given province or province type The first type of variation that allows us to disentangle different models is the difference in markups between regular and premium gasoline within a region. Since low-income consumers usually do not consume premium gasoline, a policy that internalizes consumer surplus of low-income consumers (green line) is associated with "subsidies" on regular gasoline and almost no discounts on premium gasoline (we use the term subsidies to refer to any positive difference between profit-maximizing markups and the markups charged by the state-own enterprise). Note that a policy that targets high-income groups (orange line) generates similar subsidies for both premium and regular gasoline. Finally, a policy that targets middle-income groups is somehow in the middle (blue line)

Geografical correlation between markups and consumer's income level The second pattern in the data that aids identification is the geographical correlation between subsidies and consumer's income. A policy that targets low-income individuals (green line) charges relatively lower markups in low-income areas and relatively higher markups in high-income areas. This correlation gets more nuanced as we move from a policy that targets low-income individuals to a policy that targets middle-income individuals (blue line), and almost disappears in the case of a policy that targets high-income individuals (orange line). Since consumers are not perfectly segmented across the space, even a policy targeting low-income individuals will generate some subsidy in high-income areas. The more segmented income groups are across the space, the more informative the correlation between markups and income level will be. If consumers are perfectly overlapping across the space, then this variation will not be able to tell apart different models.

Figure 31. Actual vs. Simulated Markups under Different Parameterizations: All Provinces



(a) Regular Gasoline

(b) Premium Gasoline

Note: Subfigures (a) and (b) depict markups for regular and premium gasoline as a function of the median income of households within the census block of the station's location. The purple line illustrates the profit-maximizing case, while the pink line shows the actual markups YPF set, using our cost estimates. Additional cases presented are when the government internalizes the consumer surplus of only the low-income groups (green line), only the middle-income groups (blue line), or only the high-income groups (orange line).

Markups of gasoline products across provinces Differences patterns between shareholder and non-shareholder provinces in average subsidies to premium and regular gasoline and different patterns in the correlation between markups and consumer's location allow us to identify if the SOEs have different preferences for consumers in shareholder and non-shareholder provinces.

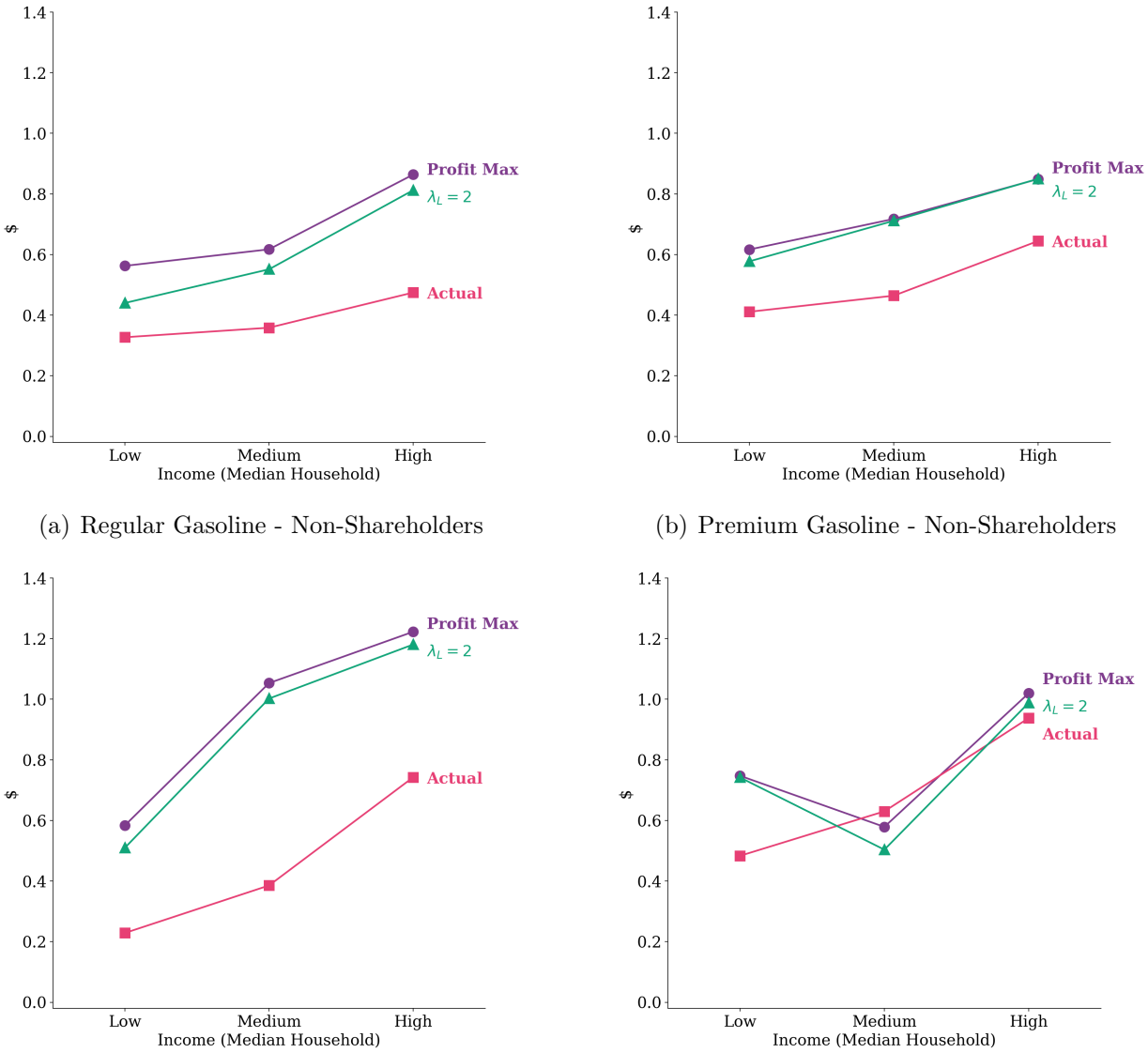
Figure **??** presents average markups for regular and premium gasoline as a function of station's location income level for both non-shareholder provinces (top panel) and non-shareholder provinces (bottom panel). As in the previous graph, the purple line represents the profit-maximizing case. The pink line, represents the actual markups that YPF charged based on our cost estimates. Finally, we keep the line representing the case in which the government only internalizes the consumer surplus of low-income groups (green line).

Markup patterns are considerably different across both space and product when comparing shareholder and non-shareholder provinces. First, the subsidies on regular gasoline are considerably higher in shareholder provinces. In low-income areas, they are around 50% higher. In middle-income areas, the subsidies almost double those in non-shareholder provinces. Second, while in non-shareholder provinces, subsidies for regular gasoline are mod-

erately higher than subsidies for premium gasoline, In shareholder provinces, the discount on premium gasoline is relatively small.

In shareholder provinces, the difference in subsidies between regular and premium gasoline allows us to point down a policy that targets low-income groups. Also, higher subsidies for regular gasoline in middle-income areas inform us about a policy that targets middle-income groups. In non-shareholder provinces, the amount of subsidies in premium gasoline and flatness in the correlation between subsidies and income level is inconsistent with targetting low-income populations. The difference in relative subsidies between regular and premium gasoline and the slope of the purple line (especially in premium gasoline) allows the model to distinguish between targetting middle income vs. targetting the richer groups.

Figure 32. Correlation between income and mark-ups under different scenarios



(a) Regular Gasoline - Non-Shareholders

(b) Premium Gasoline - Non-Shareholders

(c) Regular Gasoline - Shareholders

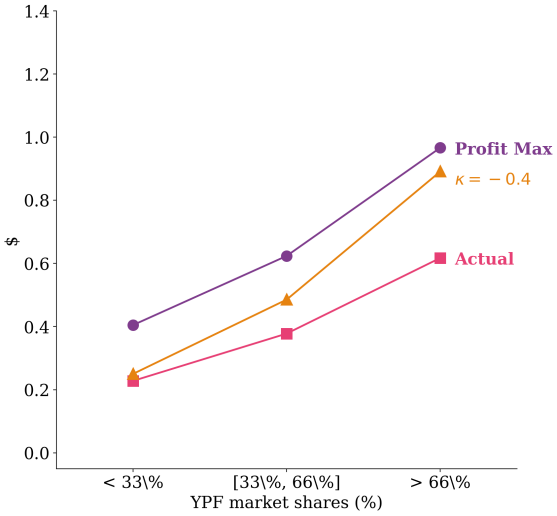
(d) Premium Gasoline - Shareholders

Note: Subfigures (a) and (b) depict markups for regular and premium gasoline as a function of the median income of households within the census block of the station's location. The purple line illustrates the profit-maximizing case, while the pink line shows the actual markups YPF set, using our cost estimates. The additional line represents the case in which the government internalizes the consumer surplus of the low-income groups (green line).

Correlation between markups and rival's relevance The last step in this argument is to distinguish lower markups due to the internalization of consumer surplus from lower markups due to the negative internalization of rival's profits. Figure 33 presents average markups for all gasoline products, conditioning on YPF's market shares in the market in

which the station is located. Note that a profit-maximizing firm would charge higher markups in more concentrated markets. Interestingly, the patterns generated by a firm that put negative weights on rival firms ((orange line) are pretty different from a firm that put positive weight on consumers (blue line). The former charges relatively lower markups the more competition it faces (as if it were trying to kick rivals out of the market) and acts precisely as a profit-maximizing firm in markets where rivals are irrelevant. On the contrary, a firm that puts positive weights on consumers charges lower markups everywhere.

Figure 33. Actual vs. Simulated Markups under Different Parameterizations

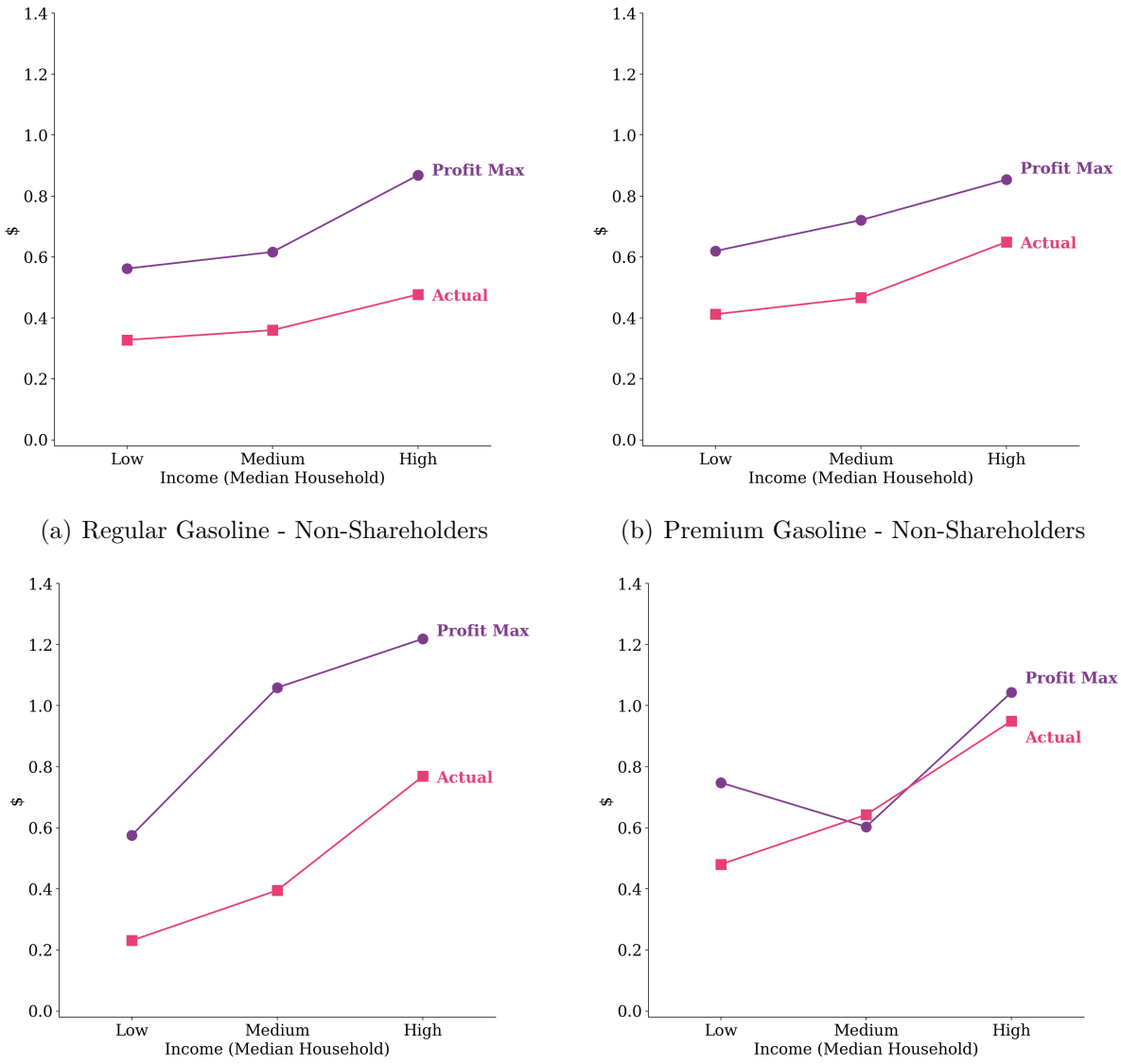


(a) Actual vs Profit Maximizing

Note: This figure depicts markups for all gasoline types as a function of YPF's market share for the station's corresponding market, during the year before nationalization. The purple line represents the profit-maximizing scenario, while the pink line shows YPF's actual markups based on our cost estimates. We also present a scenario where YPF negatively internalizes its rivals' profits (orange line).

E Appendix: Estimation

Figure 34. Correlation between income and mark-ups under diffeernt scenarios



(a) Regular Gasoline - Non-Shareholders

(b) Premium Gasoline - Non-Shareholders

(c) Regular Gasoline - Shareholders

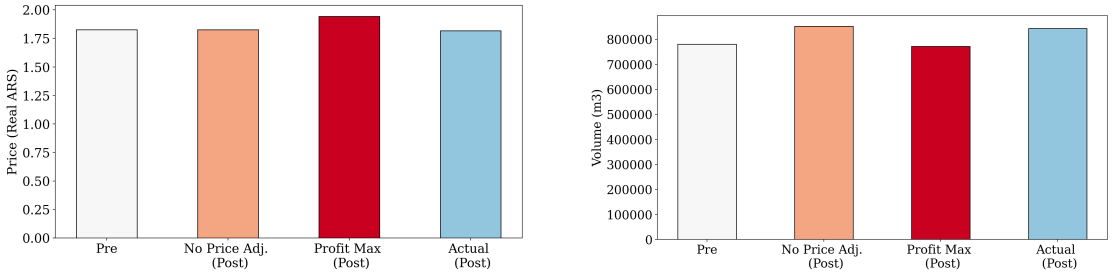
(d) Premium Gasoline - Shareholders

Note: Subfigures (a) and (b) depict markups for regular and premium gasoline as a function of the median income of households within the census block of the station's location. The purple line illustrates the profit-maximizing case, while the pink line shows the actual markups YPF set, using our cost estimates.

F Appendix to section 6

F.1 Effects on Aggregate Prices and Sales

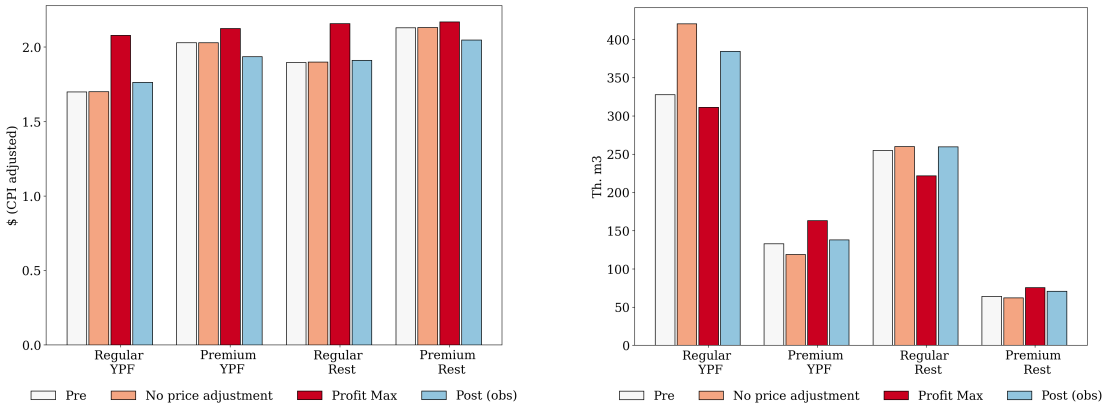
Figure 35. Actual vs Profit Maximizing Prices and Quantities



(a) Prices - All Provinces (b) Quantities - All Provinces

Note: Figures (a) and (b) present prices and under different scenarios.

Figure 36. Actual vs Profit Maximizing Prices and Quantities



(a) Prices - All Provinces (b) Quantities - All provinces

Note: Figures (a) and (b) present prices and under different scenarios.

Table 20. Effects by Demographic Group - All Brands

	Regular Gasoline			Premium Gasoline		
	Profit Max	Actual	*(%)*	Profit Max	Actual	*(%)*
Panel 1: Oil-Producing						
High Income	183	203	*11.0*	54	56	*3.6*
Middle Income	44	58	*30.7*	11	15	*40.4*
Low Income	21	27	*33.8*	4	2	*-56.7*
Panel 2: Other Provinces						
High Income	471	494	*5.0*	189	218	*15.2*
Middle Income	306	363	*18.6*	87	144	*66.8*
Low Income	129	125	*-2.4*	3	18	*532.3*
Panel 3: All Provinces						
High Income	654	697	*6.6*	243	274	*12.6*
Middle Income	350	421	*20.1*	98	160	*63.8*
Low Income	149	153	*2.6*	6	19	*202.9*

Table 21. Effects by Demographic Group - YPF Gasoline

	Regular Gasoline			Premium Gasoline		
	Profit Max	Actual	*(%)*	Profit Max	Actual	*(%)*
Panel 1: Oil-Producing						
High Income	112	129	*14.5*	37	40	*10.3*
Middle Income	25	37	*46.2*	7	11	*69.6*
Low Income	11	22	*103.7*	0	1	*171.8*
Panel 2: Other Provinces						
High Income	260	275	*5.8*	116	142	*22.3*
Middle Income	177	207	*17.2*	49	95	*92.2*
Low Income	84	87	*3.3*	1	13	*981.4*
Panel 3: All Provinces Provinces						
High Income	373	404	*8.4*	153	182	*19.4*
Middle Income	202	244	*20.8*	56	106	*89.5*
Low Income	95	109	*14.8*	2	14	*755.6*

F.2 Effects on consumption by product and consumer type

Table 22. Effects by Demographic Group - All Brands

	Regular Gasoline			Premium Gasoline		
	Profit Max	Actual	*(%)*	Profit Max	Actual	*(%)*
Panel 1: Oil-Producing						
High Income	183	203	*11.0*	54	56	*3.6*
Middle Income	44	58	*30.7*	11	15	*40.4*
Low Income	21	27	*33.8*	4	2	*-56.7*
Panel 2: Other Provinces						
High Income	471	494	*5.0*	189	218	*15.2*
Middle Income	306	363	*18.6*	87	144	*66.8*
Low Income	129	125	*-2.4*	3	18	*532.3*
Panel 3: All Provinces						
High Income	654	697	*6.6*	243	274	*12.6*
Middle Income	350	421	*20.1*	98	160	*63.8*
Low Income	149	153	*2.6*	6	19	*202.9*

Effects on Markups

Figure 37. Distribution of mark-ups by income group - Regular Gasoline

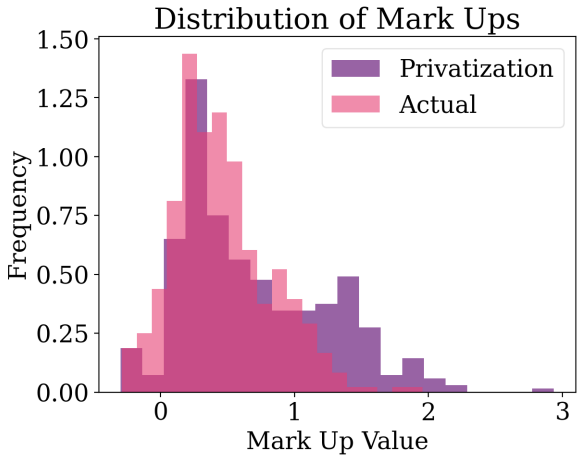
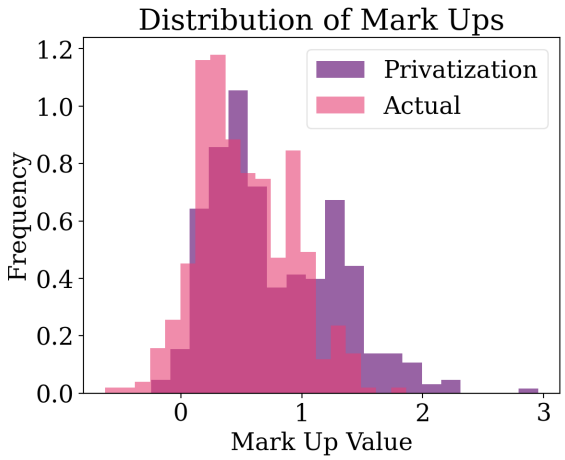


Figure 38. Distribution of mark-ups by income group - Premium Gasoline



F.3 Summary Tables

Table 23. Welfare Effects: Nationalization vs Alternative Scenarios

	Actual	Privatization	Full CS	p = mc
Panel 1: Oil-Producing				
CS	25.1	21.5	40.0	45.3
Profits YPF	10.4	10.6	-0.0	0.0
Profits rest	4.2	4.8	3.0	0.0
Total Surplus	39.6	36.9	43.0	45.3
Panel 2: Other Provinces				
CS	98.8	88.6	138.5	156.9
Profits YPF	27.8	28.5	-0.0	0.0
Profits rest	13.9	15.7	10.3	0.0
Total Surplus	140.4	132.9	148.8	156.9
Panel 3: All Provinces				
CS	123.9	110.1	178.5	202.2
Profits YPF	38.1	39.2	-0.0	0.0
Profits rest	18.0	20.5	13.3	0.0
Total Surplus	180.0	169.8	191.8	202.2

Note: This table shows consumer surplus, profits and total surplus for four different scenarions in a 12-momth period after the nationalziation. Column 1 (nationalization) corresponds to the actual data. Column 2 (profit-maximizing) correspond to a counterfactual scenario in which YPF acts as a profit maximizing firm. Column 3 (*Consumers*) corresponds to a scenario in which YPF fully internalize conusmer surplus, and consumer surplus of all consumers recieved the same weight as YPF's own proifts. Finally, the four column represent a scenaro in which all firms do marginal cost pricing

.

Table 24. Effects on Consumer Surplus by Province and Income Groups

	Actual	Full CS	p = mc
Panel 1: Oil-Producing			
CS	16.8%	85.9%	110.7%
High Income	18.1%	66.1%	87.9%
Middle Income	36.9%	476.1%	580.4%
Low Income	-30.4%	88.1%	90.6%
Panel 2: Other Provinces			
CS	11.5%	56.4%	77.1%
High Income	10.5%	30.6%	43.8%
Middle Income	25.3%	273.4%	369.7%
Low Income	-3.1%	159.0%	169.6%
Panel 3: All Provinces			
CS	12.5%	62.1%	83.7%
High Income	12.0%	37.7%	52.7%
Middle Income	26.6%	295.5%	392.7%
Low Income	-10.8%	139.1%	147.5%

G Appendix to Section 7

Table 25. Effects of Price Rules on Welfare: Comparing Rules to the Actual Case

	Model	Uniform Pricing	Uniform Mark-ups	Full CS
Panel 1: Oil-Producing				
CS	25.1	21.7	25.7	40.0
Profits YPF	10.4	10.0	9.8	-0.0
Profits rest	4.2	4.9	4.4	3.0
Total Surplus	39.6	36.6	39.9	43.0
Panel 2: Other Provinces				
CS	98.8	97.2	94.3	138.5
Profits YPF	27.8	26.7	26.2	-0.0
Profits rest	13.9	14.7	15.8	10.3
Total Surplus	140.4	138.6	136.3	148.8
Panel 3: All Provinces				
CS	123.9	118.9	120.0	178.5
Profits YPF	38.1	36.6	36.0	-0.0
Profits rest	18.0	19.6	20.2	13.3
Total Surplus	180.0	175.1	176.2	191.8

Note: This table displays changes in consumer surplus, profits, and total surplus by comparing three different scenarios against the actual case (nationalization under discretion) during Jun-2012 to Dec-2012. The *Uniform Pricing* column shows the effects of the uniform pricing policy in contrast to the actual scenario (nationalization under discretion); *Uniform Mark-ups* column shows the effects of applying the uniform markups policy; *Full CS* column outlines the effects of a scenario where YPF fully internalizes consumer surplus, treating the consumer surplus of all consumers equivalently to YPF's own profits. Refer to Table 23 for detailed values.

Table 26. Effects of Price Rules on Consumer Surplus: Comparing Rules to the Actual Case

	Model	Uniform Pricing	Uniform Mark-ups	Full CS
Panel 1: Oil-Producing				
CS	25.1	21.7	25.7	40.0
High Income	23.1	19.8	23.7	32.5
Middle Income	1.4	1.0	1.2	5.7
Low Income	0.7	1.0	0.8	1.8
Panel 2: Other Provinces				
CS	98.8	97.2	94.3	138.5
High Income	86.2	84.3	84.0	101.8
Middle Income	10.1	9.8	8.0	30.2
Low Income	2.4	3.1	2.3	6.5
Panel 3: All Provinces				
CS	123.9	118.9	120.0	178.5
High Income	109.3	104.1	107.6	134.3
Middle Income	11.5	10.8	9.2	35.9
Low Income	3.1	4.1	3.2	8.4

Note: This table presents changes in consumer surplus, by income group and province type, when comparing three different scenarios against the actual case (nationalization under discretion) for the period Jun-2012 to Dec-2012. The *Uniform Pricing* represents the effects of applying the uniform pricing policy; *Uniform Mark-ups* represents effects of applying the uniform markups policy; *Full CS* describes a scenario where YPF fully internalizes consumer surplus, equating the consumer surplus of all consumers to YPF's own profits. For detailed values, refer to Table 23.