Mergers under Exclusive Dealing:
An Empirical Analysis of the Fuel Industry

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Abstract

An exclusive dealing (ED) contract between two firms stipulates that one cannot deal with the competitors of the other. Since under ED the supplier is not competing to sell to its exclusive retailers, it is not obvious whether a merger of suppliers would have any effect on competition. In this paper, I propose and estimate a structural model featuring individual consumer’s demand, spatial competition among retailers, and vertical negotiations between suppliers and exclusive retailers. The model predicts that, following an upstream merger, the consolidation of exclusive dealing networks creates incentives for the merged supplier to increase wholesale prices. This price increase is proportional to the diversion ratios within the network of exclusivity and affects exclusive dealers asymmetrically. I estimate the model using a novel panel dataset on the Brazilian fuel industry containing detailed information about vertical transactions. The data span a period which includes an important merger, permitting an ex-post evaluation of the simulation. The simulation predicts an average increase of 30% in the wholesale margins of the merged suppliers, while only a small increase in the margins of the non merged. Actual data confirms the predicted increase in the wholesale margins, as well as the difference in the wholesale price increase between the merged and non-merged firms.

Keywords: Upstream mergers, exclusive dealing, externalities, bilateral negotiation.

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1 Introduction

Horizontal mergers (that is, mergers between competitors) frequently take place not only among firms selling products directly to consumers, but also among firms in producer markets. These mergers have the potential to affect competition not only in the upstream (input) market, but in the downstream (retail) market as well. Standard merger analysis focuses on the exploitation of market power in order to raise prices. However, many markets are characterized by a vertical structure where upstream firms act as the only supplier of a particular retailer\(^1\). Under these exclusive dealing (ED) contracts, input suppliers do not compete to sell to their exclusive retailers. In that case, analysis focusing on the input market seems unlikely to predict any effect of horizontal mergers among upstream firms\(^2\).

In this paper I build and estimate a model to study how mergers between suppliers in markets with ED contracts can affect wholesale and retail prices as well as consumer welfare. Upstream mergers\(^3\) in markets with ED have an important difference relative to other types of horizontal mergers: post-merger, not only will the merging firms form a single entity, but the networks of exclusive dealers will also be combined. I show that, with the combined network, the merged supplier is in a better position to negotiate higher wholesale prices with its exclusive retailers, which will ultimately affect the prices paid by consumers. The merged supplier can strike a better deal because, as a result of the consolidation of the networks, it can absorb a larger part of the diverted sales in the case of a hypothetical disagreement with an exclusive dealer. This creates incentives for the merged supplier to increase wholesale prices in its exclusive network. However, the price increase depends on the structure of the downstream competition and need not be uniform.

\(^1\)In the beer industry for instance, some brewers sign ED contracts with distributors, granting the distributor exclusivity within a certain territory. See more about the beer industry in Asker (2004) and Sass (2005). In the fuel industry, stations can either operate independently and be free to purchase fuel from any distributor/refinery or they can sign an ED contract with a given distributor/refinery (e.g. Shell or Texaco), carry the logo of the distributor in the station and commit to purchase only from that supplier. For more on the fuel industry see Hastings (2004), Gilbert and Hastings (2005), Manuszak (2010) and Houde (2012). In the automobile industry, car dealers can either operate as multibrand (independent) stores or under an ED with some specific manufacturer such as Volkswagen or GM for instance. See Nurski and Verboven (2013) for more on ED in the automobile industry. Other examples of industries with ED contracts include smartphones (Sinkinson, 2014) and video games (Lee, 2013). Heide, Dutta and Bergen (1998) consider a sample of 147 manufacturers in industrial machinery, electronic and electric equipment industries and point that over 40 percent of those had ED arrangements with distributors.

\(^2\)To some extent, a similar logic was used by the Senior Vice President and Chief Diversity Officer of Comcast, David L. Cohen, who pointed that the merger with Time Warner Cable “will not lead to any reduction in competition or consumer choice in any market. Our companies serve separate and distinct geographic areas. We don’t compete for customers anywhere.” The main difference between the Comcast-TWC merger and the type of mergers that I study here is that I am interested in mergers between companies that don’t serve directly the final consumer.

\(^3\)In what follows I will use the terms “mergers between suppliers”, “merger in producer markets” and “upstream mergers” interchangeably.
Figure 1: Hypothetical market with 5 retailers, 3 of which have exclusive dealing agreements. Retailers $r_4$ and $r_5$ can either belong to other exclusivity networks or operate as independent retailers, which are free to purchase from any supplier (some of which are not included in this picture). Figure (a) considers the pre-merger case and Figure (b) depicts the post-merger case, where the networks of exclusive retailers of suppliers $U_1$ and $U_2$ are combined.

Figure 1 illustrates how ED between suppliers and retailers can create incentives for price increase after a merger. $U_j$ represents the suppliers (upstream firms) and $r_i$ the retailers (downstream firms). ED contracts are represented by links between upstream and downstream firms. Pre-merger, upstream firm $U_1$ has an ED contract with retailer $r_1$ and $U_2$ has ED contracts with $r_2$ and $r_3$. The new firm resulting from the merger of $U_1$ and $U_2$ will have a network of exclusive dealers consisting of the combination of the two networks. Pre-merger, in case of a hypothetical disagreement between $U_1$ and $r_1$, some of $r_1$’s customers are diverted to $r_1$’s competitors. Therefore, from $U_1$’s perspective all of $r_1$’s potential sales are lost. However, post-merger, in the case of the same hypothetical disagreement, the merged supplier would still be able to capture the share of $r_1$’s sales that are diverted to $r_2$ and $r_3$, which now belong to $U_1$’s consolidated network. When negotiating wholesale prices, the merged upstream firm will take the value of the diverted sales into consideration as an opportunity cost. Hence, the incentive for the merged supplier to raise wholesale prices originates as a response to its ability (post-merger) to absorb a larger part of the diverted sales of any member of the network in case of a disagreement. $^4$

$^4$It is key to take ED into consideration in order to capture the incentives for price increase. Without ED, each retailer is free to purchase from any supplier and wholesale prices are determined in a competitive way. For concreteness, consider the case of fuel. When wholesale prices can be different for the various independent retailers, they can be thought as being determined by a mechanism similar to a price quote or procurement auction. In that case, a merger
My model combines three components to capture the strategic interactions involving suppliers and retailers in a market characterized by ED. The first component describes the vertical negotiations over wholesale prices between suppliers and exclusive dealers. Following Horn and Wolinsky (1988) and the empirical literature on bargaining\(^5\), I assume that wholesale prices are determined as a solution to the Nash bargaining problem conditional on all other prices. The second component models retail price competition accounting for the importance of geographic differentiation. The third component is the individual consumer's demand, which builds on Berry, Levinsohn and Pakes (1995) to estimate price sensitivity and transportation costs for consumers. The demand model is tailored to the application in the Brazilian fuel industry, which requires accounting for the consumption of both gasoline and ethanol due to the popularity of flex fuel vehicles in that country. I assume that consumers are located in the path defined by their commuting behavior as in Houde (2012). Throughout the analysis, I take the network of exclusive dealers as given.

The difficulty in obtaining data on supply arrangements is perhaps the main reason why the literature on ED is still remarkably limited. In this paper I construct a rich panel data on the Brazilian fuel industry combining different sources. The data contains detailed information about vertical transactions including retail and wholesale prices as well as volumes at the station level. Additional information at the station level that I observe includes location, brand affiliation, number of attendants and ancillary services.

In the estimation, I use data only from a period that precedes an actual merger between two large suppliers, which combined had ED agreements with nearly 20% of the retailers in the country. The estimation was conducted in the metropolitan area of Vitoria, which is the capital of the state of Espirito Santo. This state was under suspicion by the antitrust authority for being the one with the largest combined market shares per merger in the country (around 27%).\(^6\) The estimated parameters and model are then used to simulate the effects of the merger. The combination of the networks of exclusive dealers will induce a new set of equations characterizing the equilibrium wholesale prices. These new wholesale prices are then used in the equilibrium condition for the retail pricing to obtain

\(^6\)See page 6 of the Concentration Act for the merger (08012.001656/2010-01) available at www.cade.gov.br.
predicted consumers’ prices for both types of fuel. The simulated wholesale and retail prices are the fixed points of this interaction between the equilibrium conditions from the retail pricing and vertical negotiation. The data span the periods pre and post merger, providing the opportunity to observe the realized prices at the time of the merger and conduct a retrospective analysis.

I find that the bargaining weight of the major distributors varies between 0.52 and 0.60, significantly smaller than unity, which is the “take it or leave it” value. On average, the model predicts a wholesale price increase of 4.8 cents per liter (cpl) for the merged distributors and 1.3 cpl for the non-merged. These changes correspond to an increase of 30% in the margins of the merging distributors compared to the average margin pre merger. At the retail level, the model predicts 4.3 cpl price increase for the exclusive stations of the merged distributors and 2.7 cpl for the remaining exclusive stations. In addition, I find that the average markup of the retailers is approximately 6%.

Since the data span a period which includes the merger studied, I am able to conduct an ex-post evaluation of the model simulation. Actual data confirms the predicted increase in the wholesale margins, as well as the difference in the wholesale price increase between the merged and non merged firms. The observed increase in the wholesale margins was even larger than what was predicted in the simulation: the model predicts nearly 60% of the actual average increase in the wholesale margins.

Strategic complementarity at the downstream level implies that the unbranded retailers will eventually increase their retail prices in response to a price increase of the branded retailers. While the model correctly captures this response for the unbranded stations, it does not predict an increase of wholesale prices for independent retailers. The reason is that independent retailers can purchase from any distributor and in that case wholesale prices are determined in a competitive way, depending on the cost structure of the distributors and not on the price charged by the independent retailer.

In terms of the demand estimates I find that the demand for fuel at any given station is very elastic: average price elasticity of 20%. This value is higher than the one predicted by Houde (2012) for the Canadian market (between 10% and 15%) and similar to what is found in Manuszak (2010) using Hawaiian data. One additional reason why station-level price elasticity in the Brazilian market is expected to be high is the coexistence of two types of fuel that are substitutes for a sizable fraction of the consumers (flex fuel vehicle owners).

Another relevant finding in the demand estimation was that consumers value brands. On average, an unbranded (independent) station has to give a discount of approximately 1.5% in order to make
consumers indifferent relative to purchasing the fuel in a branded station. The money value estimated disutility of driving is twice as big as the average wage in the country, suggesting that consumers tend not to deviate too much from their paths for buying fuel.

The remainder of this paper proceeds as follows. In Section 2 I introduce the data and industry background. Section 3 presents the empirical model. In Section 4 I discuss identification and estimation. Section 5 presents the results and Section 6 the merger analysis. Section 7 concludes.

2 Related Literature and Contributions

This is the first empirical paper to study the effects of upstream mergers in markets with ED. It builds on and contributes to three related literatures. The first is a small but growing empirical literature on markets with ED agreements. The second is the large literature on horizontal mergers. The third is the literature on vertical and bilateral negotiations, more specifically on structural models of bargaining.

The theoretical literature on ED was motivated in large part by the Chicago school argument that in order for an ED agreement to be mutually beneficial it must be associated to efficiency gains. Aghion and Bolton (1987) show that an incumbent supplier and a retailer can exclude an efficient entrant if the contract includes liquidated damages. Chen and Riordan (2007) show how a vertically integrated firm can use exclusive contracts to exclude an equally or more efficient firm that is already in the market. Segal and Whinston (2000) demonstrate that if the manufacturer offering ED contracts cannot discriminate among retailers, both exclusionary and non-exclusionary equilibria exist. All retailers are worse off, so exclusion will only succeed if retailers cannot coordinate their actions to jointly refuse an exclusionary contract. Fumagalli and Motta (2006) show that when ED is between suppliers and retailers instead of suppliers and final consumers, the coordination problem may not occur. In that case, one single deviant retailer may be able to serve the whole market by buying at a lower price from the entrant, enabling the entrant to cover its fixed costs. Johnson (2014) presents a theory in which ED does not serve to exclude or disadvantage rivals. Instead, ED gives each supplier the ability to internalize competition amongst the retailers in the network. Relative to the case without ED, he shows that in equilibrium retail prices increase, benefiting suppliers and

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7See chapters 3 and 4 of Whinston (2006) for an excellent survey of the history and recent advances in the horizontal merger and exclusive dealing literatures.
retailers but harming consumers.

The papers in the theoretical literature that are more closely related to mine are Milliou and Petrakis (2007) and Fumagalli, Motta and Persson (2009). Milliou and Petrakis (2007) study horizontal mergers in the upstream sectors with ED when bargaining is present. Their model assumes Cournot competition at the downstream level and two part tariffs, which leads to wholesale prices lower than marginal costs, and even more so post merger. This generates a reduction on the retail prices following the merger, in the absence of any efficiency gains. There are two important differences between my model and Milliou and Petrakis (2007). First, I consider that the bargaining is only over the wholesale prices. The second difference is that in my model downstream competition is assumed to be Bertrand with differentiated products. Fumagalli, Motta and Persson (2009) consider the case of a merger between an incumbent supplier and a potential entrant in a market with ED. They show that the incumbent can use ED contracts to improve its bargaining position in the merger negotiation with the entrant. Instead, in this paper I am interested in mergers between two incumbent firms. In those cases, I show that the improvement in the bargaining position comes from the merger itself and with respect to the exclusive dealers.

The empirical literature on ED is remarkably limited, in large part due to the difficulty in obtaining adequate data, specially on wholesale prices. Moreover, the existing empirical work on ED has primarily focused on foreclosure. For instance, Asker (2005) tests for foreclosure due to exclusive dealing relationships in beer distribution and finds no significant evidence that exclusive dealing increases market power. Hortacsu and Syverson (2007) find that vertical mergers between cement and concrete producers were, on average, efficiency enhancing, leading to lower intermediate and final good prices and larger quantities. Lee (2013) measures the impact of ED on industry structure and welfare in the video game industry and finds that ED favored the entrant platforms. In contrast, in this paper I focus on how upstream mergers can create incentives for changes on prices under ED and how this affects competitors, competition and consumers.

This paper is also related to a large literature on horizontal mergers, more specifically to recent contributions on the predictions of merger effects, measurement of the effects of actual mergers and mergers in producer markets. In large part, the literature on horizontal mergers has considered

\[^{8}\text{In order to circumvent this data limitation, empirical research modeling vertical negotiations has relied on theoretical assumptions to infer wholesaler behavior (e.g. Villas-Boas (2007), Mortimer (2008), Hellerstein (2008), Manuszak (2010)).}\]
one-tier industries. For instance, Nevo (2000), Pesendorfer (2003) and Houde (2012) consider the case in which merging firms directly set consumer prices\(^9\). To the best of my knowledge, the only empirical papers on mergers in producers’ markets that explicitly consider downstream pricing are Villas-Boas (2007) and Manuszak (2010). There are important differences between this paper and two just mentioned. First, I focus on the case of upstream mergers under ED. Second, none these papers have information about wholesale prices, which imposes some restrictions on the type of behavior that they can allow the upstream firms to have. In practice, both papers assume that the upstream firm charges a single price for all retailers. I observe wholesale prices and can take into consideration the variation in prices and asymmetric incentives to raise prices within the network of exclusive retailers. Finally, I observe prices both before and after the merger which allow me to perform a retrospective analysis of the merger.

The literature on ex-post evaluation of merger simulation is very recent. The motivation for comparing predicted changes from merger simulation with observed prices are to evaluate the accuracy of these forecasts, which can also serve as a test of the assumptions imposed in the underlying model. Peters (2006) uses merger simulation to predict price effects of five airline mergers from the 1980s and compares the predicted prices with observed post-merger prices. Weinberg (2011) studies the effects of mergers on the prices of the merged firms and competitors. Houde (2012) studies spatial competition with an application to a real vertical merger, comparing diff-in-diff and counterfactual simulation methods. Björnerstedt and Verboven (2013) compare the predictions from a merger simulation in the Swedish market for analgesics with the actual merger effects. One important difference of what I do and the cited papers is that I account for the divisions between downstream and upstream firms and the vertical negotiations between them. All the above mentioned papers assume that the merging firms directly set consumers prices. Moreover, none of those papers is related to ED.

The vertical Gross Upward Pricing Pressure (vGUPPI) proposed by Moresi and Salop (2013) explains how a vertical merger can create unilateral incentives to raise prices. They consider the case in which upstream firms are able to charge different prices from the downstream ones. The vGUPPI is very similar to the GUPPI proposed in the Horizontal Merger Guidelines, with the difference that horizontal diversion ratios between two competitors are replaced by the diversion ratio from the upstream merging firm to the downstream merging partner. In my setup, a horizontal merger with

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\(^9\)The last Horizontal Merger Guidelines, issued in 2010, do not address any special aspect related to upstream mergers in markets with ED contracts.
ED has a vertical element because the acquirer is also gaining an ED network from the merger. In this paper I show that the incentives for price increase from mergers under ED also depend on the diversion ratios, but only with respect to the new merged network of exclusive dealers.

Finally, related to the literature on structural bargaining models, this paper closely follows Crawford and Yurukoglu (2012), Crawford, Lee, Whinston and Yurukoglu (2012) and Ho and Lee (2015). The major difference with respect to these papers is that I am interested on the case of a market with ED, which changes the structure of the bargaining. Another closely related paper is Gowrisankaran, Nevo, Town (2014), which studies how hospital mergers can affect vertical negotiations between hospitals and MCOs. The vertical negotiations studied in that paper do not involve exclusivity. Another difference relative to Gowrisankaran, Nevo, Town (2014) is that I account for downstream competition (as in Crawford and Yurukoglu (2012) and Ho and Lee (2015)).

3 Industry Background and Data

Demand for gasoline and other fuels are an important component of households’ budget and changes in their prices can have substantial effects on consumers’ welfare. In the U.S. for example, gasoline spending occupies between 4.5% and 12.4% of households’ disposable income (Houde, 2010). Based on data from the Personal Consumption Expenditures by type of product from the Bureau of Economic Analysis, Langer and McRae (2013) note that gasoline is the largest non-durable item for most households. They also point to a Gallup poll on June of 2008, a period of high gasoline prices, where one quarter of the U.S. households reported that these prices were the single most important problem facing the country.

Even though gasoline is a fairly homogeneous product, gasoline at the pump is a differentiated product because of some aspects like location and ancillary services. An additional reason why the fuel industry is not perfectly competitive is due to the dominance of major oil companies, which represents a concern to antitrust authorities.

The fuel industry includes the processes of production, distribution and retailing. Gasoline is produced in the refineries and ethanol is produced in the distilleries. These products\textsuperscript{10} are then sent

\textsuperscript{10}Gasoline can be of types A and C. Gasoline A is pure gasoline, produced in the refineries, petrochemicals or imported. Gasoline C can be standard, with additive or premium. The gasoline C standard is a mixture of gasoline type A and ethanol. This mixture is realized by the distributors. Gasoline C with additive is a mixture of Gasoline C standard and additives. These additives contain detergents that help cleaning the engine.
to the distributors, who are in charge of mixing fuels and additives as well as storing, selling and
transporting these to the jobbers and retailers. The retailer, which is the only party authorized to
sell to individual consumes, can operate under an ED contract with one distributor or independently,
when it is free to purchase fuel from any distributor. Petrobras is the main Brazilian oil refinery,
producing more than 90% of the total volume of gasoline consumed in the country. Moreover, the
refinery price of gasoline is insensitive to supply and demand because it is regulated by a public
sector entity. All other prices are freely determined in the market, including the the producer prices
of ethanol, wholesale price and retail prices.

Figure 2: Structure of the fuel industry.

Virtually every fuel station in Brazil sells both gasoline and ethanol. There are some features that
differentiate gasoline and ethanol and that might affect consumers’ choices. First, the calorific value of
ethanol is equivalent to around 0.7 of that for gasoline, which implies that for a consumer indifferent
between the two types of fuel there is a threshold values of the ratio of prices that would lead to
consume one or another. The second difference is that a car running on ethanol is less hazardous
to the environment. Third, ethanol has a higher octane rating (110 vs 87-93 on gasoline). Finally, gasoline engine demands less fuel, thus requiring less frequent refueling.

Gasoline sold at the station is a mixture of anhydrous ethanol and gasoline in a proportion that is defined by the regulator and varies between 15% and 25%. Both conventional and flex-fuel cars can use this type of fuel, but the latter category, which has become the dominating passenger car type, can use any blend ratio up to 100 percent hydrous ethanol. The fuel taxes applied to gasoline and ethanol, are modified frequently to make the two fuel types competitive.

The length of the contract between distributors and stations varies depending mostly on the size of the financing, if any, that the station used for renovation or to enter the market. The branded stations also get the support from the distributors in many items such as help with the business plan and structure of the gas station, lease of equipment, advertisements, training for the managers and employees, and marketing promotions (e.g. car raffle). At the end of the exclusivity contract, the retailer is free to switch to a different brand or become independent.

The relation between branded stations and distributors is similar to a franchising agreement, which is potentially very different from vertical integration in terms of incentives. An ED contract can, at least in theory, replicate the effect of vertical integration. In practice, because of limitations arising from transaction costs or legal issues, ED and vertical integration are not equivalent. One example is the possibility of opportunistic behavior that can arise in ED relationships. This is not a problem faced by stations when they are vertically integrated with refineries or distributors.

Houde (2012) notes that between 52% and 72% of branded stations were company-owned in 2001 in the Canadian market. Moreover, in the case of branded stations with ED contracts in that country, wholesale prices are set at the station level in a weekly basis and that “lessee station owners also negotiate a price-support clause that ensures them a minimum profit margin”.

3.1 Data

The data used in this paper comes from several sources. The main piece of information comes from a detailed survey conducted by the National Petroleum Agency (ANP), the Brazilian regulatory agency of oil and natural gas. Every week since July of 2001, ANP collects data on wholesale and retail prices for gasoline, ethanol and diesel at individual fuel stations in over 500 municipalities in Brazil. In general, between 40% and 50% of the fuel stations are surveyed each week. Coverage
reaches 100% in the smaller municipalities. In the larger cities, the survey adopts a rotating sample that eventually covers all stations. The survey provides information about location of stations and distributors as well as brand affiliation and shipping mode (CIF or FOB).

I combine the price data with information about storage capacity of the fuel tanks and number of nozzles for each type of fuel in each station and monthly information about volumes purchased from the distributor for the period between January of 2007 and December of 2011, also provided by ANP. Additionally, I collected data on secondary activities of the station such as existence of car wash, oil change and convenience store from the Department of Federal Revenue of Brazil (Receita Federal). A summary of the main characteristics of the stations is displayed in Table 1. Independent retailers are in general competing more aggressively on prices and not so much in terms of additional services. In particular, the number of attendants and nozzles, used to measure the service speed (time spent in the station), is considerably lower in independent stations. Moreover, stations attached to major distributors on average offer a larger variety of ancillary services than independent retailers, with the sole exception of tire repair.

Table 1: Average characteristics of exclusive and independent retailers (Vitoria metropolitan area)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Major Brands</th>
<th>Unbranded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean std. dev.</td>
<td>mean std. dev.</td>
</tr>
<tr>
<td>Number of attendants</td>
<td>9.49 5.34</td>
<td>6.13 6.02</td>
</tr>
<tr>
<td>Number of nozzles (gasoline)</td>
<td>5.22 1.69</td>
<td>3.47 2.04</td>
</tr>
<tr>
<td>Convenience store</td>
<td>0.26 0.41</td>
<td>0.14 0.39</td>
</tr>
<tr>
<td>Oil change</td>
<td>0.26 0.35</td>
<td>0.09 0.28</td>
</tr>
<tr>
<td>Car wash</td>
<td>0.28 0.38</td>
<td>0.15 0.22</td>
</tr>
<tr>
<td>Highway located</td>
<td>0.31 0.41</td>
<td>0.27 0.32</td>
</tr>
<tr>
<td>Tire repair</td>
<td>0.08 0.28</td>
<td>0.15 0.36</td>
</tr>
</tbody>
</table>

Major brands include include BR, Ipiranga, Shell and Esso.

Data on prices of ethanol at the producer (distillery) level were obtained from ESALQ. These indices are reported weekly, consisting of information of average prices of hydrous and anhydrous ethanol. Information on taxes on both types of fuel was obtained from ANP and SINDICOM.

Figure 3 illustrates the monthly variation on the wholesale prices (FOB shipping\textsuperscript{11}) in the Vitoria Metropolitan Area in 2007. The original price data is at the weekly frequency. For the purpose of

\textsuperscript{11}CIF and FOB are types of shipping agreements and differ in who assumes the expenses and responsibility for the
estimation, I average both retail and wholesale prices at the monthly level in order to have the same frequency as the volume data. Wholesale prices can vary substantially within the same distributor for different exclusive retailers. This variation in prices within the network is not a feature exclusively of the Brazilian market. In the U.S., the refiner/distributor can also set different prices for stations within its own network. The Brazilian market also allows price discrimination with respect to the unbranded stations. However, when selling to unbranded stations, the U.S. refiners/distributors must post a rack price that is the same for all purchasers at that rack\textsuperscript{12}. In the Appendix A.1. I provide the portion of an ED contract of a major distributor where it is specified that the wholesale prices are “freely agreed between the parties”.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{mean_wholesale_gasoline_price_fob}
\caption{Variation of wholesale prices for exclusive retailers of some large distributors and for unbranded retailers}
\end{figure}

Another source of information that I use is the \textit{Relação Anual de Informações Sociais} (RAIS), a matched employer-employee dataset assembled by the Brazilian Ministry of Labor. The data includes information on the occupation of the worker and I use it to obtain the number of attendants in the goods during transit. In the case of CIF (Cost, Insurance and Freight) - Insurance and transportation are paid by the seller until the goods are received by the buyer. When shipping if FOB (Free on board), the retailer is responsible for the transportation and all costs once the fuel is picked up at the distributor.

\textsuperscript{12}See Hastings (2010) for more details on the U.S. market.
stations. The data also includes start and end date on the job, which gives precise information about employment at any point in time.

Figure 4: Municipalities used in the estimation. The divisions within each municipality are the weighting areas, the smallest level of aggregation available for household location in the Census microdata.

The estimation in this paper is based on data from four municipalities in the state of Espirito Santo: Vitoria (capital), Vila Velha, Cariacica and Serra (See Figure 4). These municipalities are part of the Vitoria Metropolitan Area (VMA) and account for 46.2% of the population in the state of Espirito Santo. The VMA has other three municipalities that were not included in the estimation: Fundao, Viana and Guarapari. The first two because they are not part of the weekly price survey conducted by ANP. The last one because it is substantially different from the other municipalities in terms of consumption of fuel, since this is mostly a vacation destination and fuel consumption is highly seasonal.
I use Census microdata\textsuperscript{13} on consumers’ home and work locations, as well as commuting time to construct flows within a metropolitan area. To characterize consumer locations, I use the smallest level of aggregation available for household location, the Census weighting area. Each weighting area requires a minimum number of households, contiguity and homogeneity with respect to a certain set of population characteristics and infrastructure. The Census microdata provides information about home location at the level of weighting area. Work location is known only at the level of municipality. In order to construct commuting flows, I combine the information on home and work locations with the commuting time (also included in the Census). The distances between population weighted centroids of weighting areas and retailers were computed in terms of estimated driving time and driving distance using Google maps.

The demand estimation requires a definition of the relevant geographic market for the computation of market shares. This is a complicated task because isolated geographic markets are rare. In order to capture the possible inter relations among the four municipalities, I computed the commuting flows of workers among the four municipalities, displayed in Table 2.

Table 2: Commuting flows of workers for the four municipalities considered in the estimation

<table>
<thead>
<tr>
<th>Origin \ Destin.</th>
<th>A (Vitoria)</th>
<th>B (Vila Velha)</th>
<th>C (Cariacica)</th>
<th>D (Serra)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Vitoria)</td>
<td>78.98%</td>
<td>4.42%</td>
<td>3.45%</td>
<td>13.16%</td>
<td>100%</td>
</tr>
<tr>
<td>B (Vila Velha)</td>
<td>34.22%</td>
<td>52.71%</td>
<td>6.13%</td>
<td>6.95%</td>
<td>100%</td>
</tr>
<tr>
<td>C (Cariacica)</td>
<td>26.95%</td>
<td>11.86%</td>
<td>50.67%</td>
<td>10.51%</td>
<td>100%</td>
</tr>
<tr>
<td>D (Serra)</td>
<td>29.34%</td>
<td>2.32%</td>
<td>1.74%</td>
<td>66.60%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Census microdata, 2010.

The diagonal of Table 2 contains information about internal flows, i.e. people that live and work in the same municipality. The off diagonal elements show a substantial flow of workers commuting to a different municipality, remarkably to the capital (Vitoria). For instance, more than 1/3 of the workers living in Vila Velha commute to Vitoria on a daily basis. This is suggestive that stations in Vila Velha are competing with stations in Vitoria, at least for those commuting consumers. Because of the intense flow among the four municipalities, I define the relevant market to be the four municipalities in the Vitoria metropolitan area.

\textsuperscript{13}I am thankful to Data Zoom, developed by the Department of Economics at PUC-Rio, for providing codes for accessing IBGE microdata.
Data on the monthly fleet of vehicles per municipality was obtained from Anfavea. This data was combined with information on the registration of new vehicles by fuel type in order to estimate the fraction of flex vehicles in each municipality. Flex fuel vehicles became commercially available in Brazil in March of 2003, reaching more than 80% of the registration of new vehicles after only three years and near 95% in 2013.

4 Empirical Model

Under ED, market power of the upstream firm depends on how it manages competition among the retailers within its network as well as against other retailers. In order to quantify the effects of a merger it is then important to understand how retailers determine price, how consumers choose among the variety of options available and characterize the substitution patterns among stations. The framework described in this Section accounts for these two aspects by formally modeling the individual consumer’s demand and retail pricing. These are the building blocks of the model for vertical negotiations between distributors and exclusive retailers.

In an environment without contractual price commitment, I use a bargaining model to characterize how short run wholesale prices are formed in ED relationships. One concern in business-to-business negotiations under ED is the fear of opportunistic behavior (holdup problem), since the supplier can appropriate a large share of the retailer’s profits after the exclusivity contract is signed (Williamson, 1985). Since this potential holdup problem can discourage important ex-ante investments from taking place, the supplier might want to commit to a lower bargaining power in the ex-post negotiation over wholesale prices (Grout, 1984). Hence, it becomes important to quantify the bargaining power of each party in those relationships to understand eventual incentives for price increase following a merger.\(^\text{14}\)

The timing of the model is as follows: in the first stage, exclusive retailers and distributors bargain bilaterally to decide wholesale prices, and retailers simultaneously set retail prices for each type of fuel; in the second stage individual consumers choose which retailer to purchase from and the type of fuel if the consumer has flex fuel vehicle.\(^\text{15}\) In the following I provide a detailed description of each component of the model.

---

\(^{14}\)See Appendix A.1 for a copy of a contract from a major distributor where it is mentioned that “wholesale prices are freely determined at the time of the purchase through a consensual agreement between the parties”.

\(^{15}\)Any other transfer is considered to be determined by contract and is decided before the bargaining takes place. In this paper I take the networks of exclusive dealers as given.
4.1 Demand

Demand for gasoline \((g)\) and ethanol \((e)\) comes from a population of consumers characterized by a mixture of two groups: group 1 is composed by flex car owners and group 2 by gasoline car owners. The fraction of consumers in group 1 in market \(m\) is \(\gamma_m\). Each consumer \(i\) in group 1 can purchase either type of fuel from any of the \(r = 1, ..., J\) stations or not at all. A market is considered to be a Census Metropolitan Area in a given month. The size of market \(m\) is denoted by \(M_m\) and the total number of retailers in market \(m\) is denoted by \(J_m\).

Location plays an important role in terms of product differentiation in the retail fuel market. The term \(d(l_i, L_r)\) corresponds to the driving time from consumer \(i\) to retailer \(r\). Following Houde (2012), the relevant distance considers the mobility of consumers in the product space and defines the location of consumer \(i\) as the commuting route between the home and work locations\(^{16}\). Given a pair of home and work locations, each consumer is assumed to take the optimal route in terms of travel time. The relevant distance from consumer \(i\) to retailer \(r\) is defined as the extra time that she takes to go to retailer \(r\) on their commuting path:

\[
d(l_i, L_r) = t(\text{home}_i, L_r) + t(L_r, \text{work}_i) - t(\text{work}_i, \text{home}_i),
\]

where \(t(a, b)\) represents the optimal driving time from \(a\) to \(b\).

The individual deviation from the mean utility is modeled as a function of distances and id-

\[^{16}\text{Another possibility is what is known as single-address approach, adopted by several papers in the literature on retail competition (e.g. Davis (2006), Manuszak (2010), and Thomadsen (2005)). It considers the following distance metric:}

\[
d(l_i, L_r) = t(\text{home}_i, L_r) + t(L_r, \text{home}_i).
\]
iosyncratic taste for each type of fuel, $\lambda d(l_i, L_r) + \tau_{if}$ plus an individual specific unobserved utility $\varepsilon_{irf}$.

Taste parameter $\tau_{if}$ represents consumer $i$’s valuation of fuel type $f$. Since there is no natural ordering between the two types of fuel, I set $\tau_{ie} = 0$ and assume $\tau_{ig} \sim N(\mu_\tau, \sigma_\tau^2)$, with $(\mu_\tau, \sigma_\tau^2)$ to be estimated. This structure is consistent with horizontal differentiation between ethanol and gasoline.

The individual specific unobserved utility for each product $(\varepsilon_{irf})$ is assumed to follow a Type 1 Extreme distribution. This assumption implies that the conditional probability that consumer $i$ will buy from station $r$ is

$$P_{r|if} = \frac{\exp(\delta_{rf} + \lambda d(l_i, L_r) + \tau_{if})}{1 + \sum_k \exp(\delta_{kf} + \lambda d(l_i, L_k) + \tau_{if})}.$$ 

The expected value of choosing fuel type $f$ for consumer $i$ in group 1 is

$$I_{if} = ln \left( 1 + \sum_k \exp(\delta_{kf} + \lambda d(l_i, L_k) + \tau_{if}) \right).$$
The probability that consumer $i$ from group 1 will choose ethanol is

$$P_{ie} = Pr (\tau_{ig} + I_{ig} \leq I_{ie}) = \Phi \left( \frac{I_{ie} - I_{ig} - \mu_{\tau}}{\sigma_{\tau}} \right)$$

and the probability that consumer $i$ from group 1 will choose gasoline is $P_{ig} = 1 - P_{ie}.$

Retailer $r$’s predicted market share of fuel $f \in \{e, g\}$ considering only consumers belonging to group 1 is:

$$s_{rf}^1 = \frac{1}{\text{size}_{gr1}} \sum_{i \in \text{Group}_1} P_{r|if} P_{if}.$$  

Consumers belonging to group 2 are gasoline car owners. In that case $s_{re}^2 = 0$ and

$$s_{rg}^2 = \frac{1}{\text{size}_{gr2}} \sum_{i \in \text{Group}_2} P_{r|ig}.$$  

Omitting the subscripts for market, retailer $r$’s total market share of gasoline is the average of the market shares in both groups, weighted by the fraction of consumers in each group:

$$s_{rg} = \gamma s_{rg}^1 + (1 - \gamma) s_{rg}^2.$$  

Since only consumers from group 1 can purchase ethanol, retailer $r$’s market share of ethanol is

$$s_{re} = \gamma s_{re}^1.$$  

### 4.2 Retail competition

I assume that each of the $J$ multiproduct retailers operates as a single firm$^{17}$. Given brand affiliation and the network of stations in the market, retailers simultaneously choose retail prices for gasoline and ethanol given wholesale prices and other costs. Omitting the market subscript, the problem of retailer $r$ can be written as:

$$\max_{p_{reg},p_{re}} \sum_{f \in \{e, g\}} \left[ (p_{r}^f - w_{r}^f - c_{f}^r) M s_{r}^f (p) - \varphi^r (p_{r}^f - w_{r}^f) M s_{r}^f (p) \right],$$

$^{17}$A coordinated behavior of the retailers can be easily accommodated in this model by assuming that each retailer’s objective function is a weighted average of its own profit and the profit of its competitors.
where \( \varphi^r \) represents the fraction of the gross margin that the retailer pays to the distributor in the form of royalties (or franchise fee) when it has an ED agreement. The parameter \( \varphi^r \) is set to zero if retailer \( r \) is independent. Assuming that a pure strategy Bertrand-Nash equilibrium exists, the necessary first order condition can be rearranged to write equilibrium pricing as a function of wholesale prices, retailer’s costs and mark-up:

\[
p^r = w^r + \frac{1}{(1 - \varphi^r)} c^r - \Delta^{-1}_r s_r(p). \tag{1}
\]

where \( p^r \) and \( w^r \) are the vectors of retail and wholesale prices associated to retailer \( r \), \( c^r \) represents the cost of retailer \( r \) in addition to \( w^r \), \( s_r(p) \) is the vector of market shares of retailer \( r \) and

\[
\Delta_r = \begin{pmatrix}
\frac{\partial s_r^g(p)}{\partial p^g} & \frac{\partial s_r^e(p)}{\partial p^g} \\
\frac{\partial s_r^g(p)}{\partial p^e} & \frac{\partial s_r^e(p)}{\partial p^e}
\end{pmatrix}.
\]

The FOC is used to simulate the new price equilibrium post merger. The approach consists in finding a fixed point of (1). The other purpose of the FOC is to uncover \( c^r \), expressing it as a function of observables and terms estimated in the demand model:

\[
c^r = p^r - w^r + \Delta^{-1}_r s_r(p).
\]

### 4.3 Vertical negotiations between distributors and exclusive retailers

The network of exclusive retailers of distributor \( D \) is denoted by \( N^D \). Wholesale price paid by exclusive retailer \( r \in N^D \) to distributor \( D \) is determined by bilateral bargaining. In reality, these negotiations can be interdependent in the sense that in case of a disagreement between \( D \) and \( r \), all wholesale and retail prices could potentially change. As in all papers in the literature on structural bargaining\(^{18}\), I follow Horn and Wolinsky (1988) and condition the solution of the bargaining problem on all other prices. Hence, in the hypothetical case of a disagreement between retailer \( r \) and distributor \( D \), all other retail and wholesale prices will remain the same. This assumption is made for tractability only and in equilibrium retail and wholesale prices will be optimal with respect to each other. Collard-

Wexler et al (2015) show that, under some conditions, this solution is the unique PBE with passive beliefs of a specific simultaneous alternating offers game with multiple parties on both sides.

For all \( r \in \mathcal{N}^D \), wholesale prices \( w^r_f \in \mathbf{w} \) are negotiated simultaneously, with \( w^r_f \) being determined as the maximizer of the Generalized Nash Product (GNP):

\[
w^r_f = \arg\max_{w^r_f} \left( \Pi^D - d^D_{r,f} \right)^{b_D} \left( \Pi^r - d^r_f \right)^{1-b_D} \quad \forall r \in \mathcal{N}^D \text{ and } f \in \{e, g\} \tag{2}
\]

where \( \Pi^D \) and \( \Pi^r \) represent the profits of the distributor and retailer, respectively. The terms \( d^D_{r,f} \) and \( d^r_f \) represent distributor \( D \) and retailer \( r \) disagreement payoffs when negotiating over the wholesale price of fuel \( f \in \{e, g\} \). Parameter \( b_D \in [0, 1] \) is the bargaining weight associated to distributor \( D \).

Under this structure, each wholesale price \( w^r_f \) maximizes the product of distributor \( D \) and retailer \( r \) surplus from the negotiation taking as given all other prices.

The profit of distributor \( D \) with network \( \mathcal{N}^D \) is

\[
\Pi^D = \sum_{f \in \{e,g\}, k \in \mathcal{N}^D \setminus \{r\}} \left( w^k_f - p^{prod}_f - c^D_f \right) M s^k_f(p).
\]

When retailer \( r \in \mathcal{N}^D \) and distributor \( D \) disagree on the wholesale price of fuel \( f \), \( w^r_f \), distributor \( D \) gets profit

\[
d^D_{r,f} = \left[ \sum_{\tilde{f} \in \{e,g\}, k \in \mathcal{N}^D \setminus \{r\}} \left( w^k_f - p^{prod}_{\tilde{f}} - c^D_{\tilde{f}} \right) M s^r_{k,\tilde{f}}(p) \right] + \left( w^r_{f^c} - p^{prod}_{f^c} - c^D_{f^c} \right) M s^r_{r,f^c}(p),
\]

where \( s^r_{k,\tilde{f}}(p) \) denotes the predicted market share of fuel \( \tilde{f} \) in retailer \( k \) if retailer \( r \) is not carrying fuel \( f \) in that period. Each type of fuel is assumed to be negotiated separately, which means that if \( D \) and \( r \) disagree on \( w^r_f \), nothing will change in terms of the price purchased by retailer \( r \) of the other fuel, denoted by \( f^c \).

From the downstream model we have that the profit of retailer \( r \) is

\[
\Pi^r = \sum_{f \in \{e,g\}} \left[ \left( p^r_f - w^r_f - c^r_f \right) M s_{r,f}(p) - \varphi^r \left( p^r_f - w^r_f \right) M s_{r,f}(p) \right].
\]

\footnote{For the sake of tractability, I assume that the franchise fees don’t enter the profit of the distributor. This can be the case for example when these revenues are completely utilized for the purpose of advertisement or other efforts to promote the distributor’s brand.}
In the occurrence of disagreement on $w_f^r$, the retailer will not sell that type of fuel but will still be able to sell the other fuel, which implies on the following disagreement payoff:

$$d_f^r = (p_{fc}^r - w_{fc}^r - c_{fc}^r) M\bar{s}_{r,f}^r (p) - \varphi^r (p_{fc}^r - w_{fc}^r) M\bar{s}_{r,f}^r (p).$$

The FOC of the maximization problem (2) in matrix form, stacking the two types of fuel negotiated with retailer $r$ can be written as

$$w^r = \left( \frac{1}{1 - b_D \varphi^r} \right) \begin{pmatrix} (1 - b_D) (p^{prod}_f + c^D + \Omega^{-1} sD) + b_D (p^r (1 - \varphi^r) - c^r) \end{pmatrix}$$

where $S$ is a diagonal matrix with shares of each type of fuel sold by retailer $r$,

$$D^r = \begin{pmatrix} \sum_{f \in \{e,g\}, k \in \mathcal{N}^D_r} \left( w_{fk}^r - p_{fk}^{prod} - c_{fk}^r \right) \frac{\Delta s_{r,f}^e}{s_{r,e}} \\ \sum_{f \in \{e,g\}, k \in \mathcal{N}^D_r} \left( w_{fk}^r - p_{fk}^{prod} - c_{fk}^r \right) \frac{\Delta s_{r,k}^g}{s_{r,g}} \end{pmatrix}$$

and

$$\Omega^r = \begin{pmatrix} s_{r,e} & -\Delta s_{r,e}^g \\ -\Delta s_{r,e}^{eg} & s_{r,g} \end{pmatrix}.$$

**Price effects of an upstream merger** The decomposition of $w^r$ tells that the equilibrium wholesale price is a linear combination of the distributor’s costs and the value added by the retailer. The vector $D^r$ contains the value of the diverted sales to retailers belonging to network $\mathcal{N}^D$ in case of a disagreement with retailer $r$ and enters as an opportunity cost for the distributor. This is the channel inducing a wholesale price increase following an upstream merger: the combined network $\tilde{\mathcal{N}}^D$ implies that the new vector $\tilde{D}^r$ will be larger than $D^r$, with the difference proportional to the diversion values to the new retailers in the network, $k \in \tilde{\mathcal{N}}^D \setminus \mathcal{N}^D$. In equilibrium, retail prices of the stations in the network will increase in response to the increase in wholesale prices. Strategic complementarity at the downstream level implies that retail prices of the competing stations should also increase. From equation (3) again, this leads to an increase in the wholesale price of the other distributors since the value added by their retailers will now be larger. The equilibrium following a merger will be a fixed point of these interactions between retail and wholesale price determination.
5 Identification and Estimation

5.1 Demand

The demand model is estimated using the nonlinear GMM method proposed by Berry, Levinsohn and Pakes (1995). The set of demand parameters is given by \( \theta = \{ \theta_1, \theta_2 \} \), where \( \theta_1 = \{ \beta, \alpha \} \) and \( \theta_2 = \{ \mu_r, \sigma_r, \lambda \} \) are the vectors of linear and nonlinear parameters, respectively. Linear parameters (\( \beta \)) associated to the mean utility are identified under the assumption that the common characteristics are independent of \( \xi_{rf} \). Identification of \( \alpha \) is more complicated because of the correlation between retail prices and \( \xi_{rf} \). The reason for this correlation is that consumers observe the quality index \( \xi_{rf} \) when choosing where to purchase fuel, which implies that prices can adjust to variations in this term, which is unobserved by the econometrician.

The unobserved product characteristics can be written as

\[
\xi_{rf} = \delta_{rf} (s, x, p, \theta_2) - x_{rf} \beta - \alpha p_{rf},
\]

where \( s \) is the vector of predicted market shares described in Section 4.1. The estimation approach described by BLP is to first obtain \( \delta \) as a solution to a fixed point problem and then construct the vector \( \xi \) to be used in the GMM estimation\(^{20}\).

Since the structural error \( \xi_{rf} \) is correlated with retail prices, we need valid instrumental variables. An instrumental variable should be (i) correlated with retail price and (ii) uncorrelated with the unobserved attributes of the station, \( \xi_{rf} \). Retail price can be written as the sum of costs and markup, suggesting that a valid instrument must be some exogenous variable that impacts cost (i.e., a supply side instrument) or something exogenous that impacts mark up (i.e., a demand side instrument).

\(^{20}\)The vector \( \delta \) is obtained by finding the fixed point of the contraction problem

\[
\delta^{(t+1)} = \delta^{(t)} + \log (s^{obs}) - \log \left( \hat{s} \left( \delta^{(t)} | \theta \right) \right).
\]

The advantages of the contraction mapping are the guarantee of a unique fixed point and that this fixed point will be reached for any initial value of \( \delta \). The main disadvantage is the slow convergence. The root finding equivalent to the BLP contraction is

\[
f (\delta) \equiv \log \left( \hat{s} \left( \delta^{(t)} | \theta \right) \right) - \log (s^{obs}) = 0
\]

and is solved using Newton’s method. The potential problem with Newton’s method is that it is not guaranteed to converge for any initial value. In order to provide “good” starting values, I run a few interactions of the contraction mapping from BLP and then switch to the root finding problem. The fast convergence of Newton’s method relies on user providing an analytical expression for the Jacobian. If finite differences approximation to the Jacobian is used, Newton’s method is very slow to converge.
A natural candidate for instrument is the wholesale price paid by the retailer, which is correlated with the endogenous retail price. However, this variable can be problematic as an IV in the current setup. The reason is that distributors might take into consideration the specific demand drivers in the vertical negotiation, which implies that wholesale price is not a valid instrument.

Instead, I use two cost shifting instruments. The first is the wholesale price of the closest unbranded station\(^{21}\). While this variable must be be correlated with the cost of the exclusive retailers, the assumption that wholesale prices for independent stations are determined in a competitive way implies that it should not be correlated with the unobserved attributes of the stations. The second cost based IV is the interaction of producer price (refinery and distillery) with distance between the retailer and distributor. Both terms (producer’s price and distance) must be correlated with retail prices through costs. Moreover, the interaction is important to create enough variation at the cross section level.

In addition to the cost based instruments mentioned above, I also used demand based IVs. The list of demand side instruments includes the exogenous own characteristics as well as average characteristics of the competitors within different distance radius. These instruments are correlated with prices since proximity in characteristic space will impact the stations’ markup. Finally, I also added the number of competitors within different distance radius as additional demand based IVs.

For a given set of instruments \(Z\), the vector of estimated demand parameters, \(\hat{\theta}\) is characterized by:

\[
\hat{\theta} = \arg \min_\theta \xi(\theta)' Z \Phi^{-1} Z' \xi(\theta),
\]

where \(\Phi\) is a consistent estimate of \(\mathbb{E} [Z' \xi(\theta_0) \xi(\theta_0)' Z]\).

Taste parameters \(\mu_\tau\) and \(\sigma_\tau\) are associated to consumers’ valuation of each type of fuel and ensure that the model is consistent with the horizontal differentiation between the two types of fuel. Identification of these parameters comes mostly from the evolution on the number of flex vehicles, which allows a larger fraction of consumers to decide between the two over time. Identification of \(\lambda\) relies on the panel data dimension of the dataset as discussed in Houde (2012). The argument is that \(\lambda\) can be identified if entry and location choices are correlated with distribution of consumers and independent of \(\xi_{rf}\).

\(^{21}\)When the retailer is unbranded, this IV is the wholesale price paid by the station.
5.2 Supply

The FOC for the retail pricing problem can be written as

\[ c^r = p^r - w^r + \Delta^{-1}_r s_r (p), \]

where \( p^r \) and \( w^r \) are observed in the data and the remaining term comes from the demand estimation. Since all terms in the right hand side are either observed or estimated, we can recover the marginal costs of the retailers using this equilibrium condition. I relate the uncovered marginal costs to some regressors as follows:

\[ c^r = W_r \gamma + \kappa_{b_r} + \gamma_t + \eta_r. \] (4)

The vector \( W_r \) includes characteristics of retailer \( r \) such as number of attendants, number of pumps and ancillary services. The term \( \kappa_{b_r} \) captures brand specific intercept and \( \gamma_t \) is the time fixed effect. Equation (4) is estimated by OLS and the parameter representing the fraction of the gross margins that are used to pay the franchise fee is calibrated to \( \varphi^r = 0.1 \) when the station has an ED contract with a major distributor and 0 otherwise. This value is consistent with information obtained from industry sources.

I am not imposing the retail pricing equilibrium condition in the demand estimation. The advantage of this approach is that the demand will be consistently estimated in the case of misspecification in the supply side. The disadvantage is the lower precision of the estimates when the assumption on retail competition is valid.

The FOC (3) is written stacking the two types of fuel negotiated with retailer \( r \). Since matrix \( D^r \) is a function of unobserved \( c^D \), we need to rewrite that expression for the purpose of estimation. The equilibrium wholesale price can be written as the cost plus a margin that is proportional to the distributor’s bargaining weight \( b_D \):
\[ w^D = \mathbf{p}^{\text{prod}} + \mathbf{c}^D + \frac{b_D}{1 - b_D} \mathbf{S}^D \mathbf{\Omega}^{-1} \mathbf{B(p)}, \]  

(5)

where \( w^D \) is the vector of wholesale prices to all retailers in the network of distributor \( D \). Matrix \( \Omega \) is block diagonal with blocks

\[
\Omega_r = \begin{bmatrix}
    s_{r,e} & -\Delta s_{r,e}^{-r,e} \\
    -\Delta s_{r,e}^{-r,g} & s_{r,g}
\end{bmatrix}
\]

on the main diagonal and \( \mathbf{S}^D \) has market shares on the main diagonal and negative variation in the market shares \( (-\Delta s_{r,f}^{-r,f}) \) in the off diagonal. Given the above expression for the wholesale prices, I assume that the distributor’s marginal cost is a linear function of explanatory variables \( \mathbf{h}, \mathbf{c}^D = \mathbf{h}\Gamma + \eta \) and estimate the following regression:

\[
\mathbf{w}^D = \mathbf{p}^{\text{prod}} + \mathbf{h}\Gamma + \frac{b_D}{1 - b_D} \mathbf{B(p)} + \eta.
\]

The main difference between the equation (3) and (5) is that (5) includes all stations pertaining to network \( \mathcal{N}^D \), while (3) is a matrix representation of the conditions involving each individual station in the network. Endogeneity in this case comes from the fact that \( \mathbf{B(p)} \) is a function of equilibrium wholesale prices. The cost and bargaining parameters are estimated by GMM under the assumption that \( \mathbb{E}[\eta|\mathbf{Z}] = 0 \), where \( \mathbf{Z} \) is the vector of instruments described in the demand estimation.

Identification of the bargaining weights and cost parameters \( \Gamma \) relies on two sources of variations in negotiated wholesale prices between distributors and exclusive retailers: the within network variation and the variation across distributors. The derivation of the bargaining regression uses \( \mathbf{p}^r - \mathbf{w}^r = \frac{1}{(1 - \varphi^r)} \mathbf{c}^r = -\Delta r^{-1} \mathbf{s}_r (\mathbf{p}) \) from the equilibrium condition in the retail pricing. Hence, \( \mathbf{B(p)} \) is determined from the substitution patterns obtained in the demand model and the assumption on retail pricing. This implies that identification of the bargaining weights relies on information from marginal costs.
of the exclusive retailers and hence is conditional on the assumption about retail price competition and consistency of the demand estimation.

The franchise fee does not create a problem for the identification of the bargaining weights because, given $\varphi^r$ and the retail pricing model, the value of the franchise fee is determined solely by wholesale prices. This is important because the bargaining weights cannot be identified if the bargaining impacts fixed transfers. I assume that all fixed transfers are negotiated at the time when the exclusivity contract is signed, which happens before the bargaining on wholesale price takes place.

As pointed in Gowrisankaran, Nevo and Town (2015), it is empirically difficult to identify bargaining weights and cost shifters at the same level. For this reason, I also do not include the distributors’ fixed effects when estimating the bargaining weights for the different distributors.

6 Results

6.1 Demand

Table 3 presents the parameter estimates of the demand model. The model is estimated using monthly data over the period from January of 2007 to April of 2011, which is the month preceding the merger studied in the next Section.

The price coefficient is precisely estimated and indicates that consumers are highly price sensitive. To have an idea of the magnitude of this estimate, it implies an average price elasticity at the station level of -20.4. This estimate is of the same order of magnitude of studies in other markets such as Houde (2012), which considers the Canadian market and finds price elasticity of demand as high as -15 and Manuszak (2010), which finds for the Hawaiian market elasticities as high as -25.7. Price elasticity in the Brazilian market tends to be higher due to the possibility of freely substituting between ethanol and gasoline for the consumers who own flex vehicles.

The coefficient of the dummy variable for unbranded stations is also precisely estimated. The negative sign implies that consumers are willing to pay extra when purchasing from branded stations. The estimated value implies that, on average, an unbranded station has to give a discount of around 1.5% in order to make consumers indifferent relative to purchasing from a branded station, controlling for all other characteristics. Consumer surveys indicate that consumers normally associate branded stations to higher credibility or higher quality, which is not necessarily true since any brand of fuel of
a given octane rating will run an automobile in the same way. Hosken, McMillan and Taylor (2008) find that the only station characteristic that is a good predictor of the retail price heterogeneity is the station’s brand affiliation.

Table 3: Demand Estimates

<table>
<thead>
<tr>
<th>Linear parameters</th>
<th>Estimates</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.325***</td>
<td>0.019</td>
</tr>
<tr>
<td>Unbranded</td>
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</tr>
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<td>Attendants</td>
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<td>0.001</td>
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<td>Nozzles</td>
<td>0.026***</td>
<td>0.005</td>
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<td>Convenience store</td>
<td>0.099***</td>
<td>0.005</td>
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<td>Car wash</td>
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<td>0.006</td>
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<tr>
<td>Oil change</td>
<td>0.103***</td>
<td>0.010</td>
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<tr>
<td>Highway</td>
<td>-0.327***</td>
<td>0.018</td>
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<td>Tire repair</td>
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<td>0.007</td>
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<td>Highway x tire repair</td>
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<td>0.054</td>
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<table>
<thead>
<tr>
<th>Nonlinear parameters</th>
<th>Estimates</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
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<td>( \mu_T ) (avg. taste for gasoline)</td>
<td>0.92***</td>
<td>0.31</td>
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<tr>
<td>( \sigma_T ) (variation in taste)</td>
<td>8.82***</td>
<td>3.41</td>
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<td>( \lambda ) (distance coefficient)</td>
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<td>Time FE</td>
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<td>Observations</td>
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<td>First stage F-statistic</td>
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</tr>
<tr>
<td>Average own-price elasticity</td>
<td>-20.38</td>
<td></td>
</tr>
</tbody>
</table>

*** denotes significance at 1% level, ** at 5% level and * at 10% level.

The estimates of the linear parameters also indicate that consumers value having more attendants and many fueling positions (more nozzles) in the station, both of which are associated to less time spent to refuel. Moreover, convenience store, car wash and oil change significantly increase demand. The negative estimate for availability of tire repair is perhaps capturing the fact that some stations that offer this service are older and not well maintained. The negative coefficient on highway dummy variable suggests that the average consumer dislikes stopping at a highway station, which implies

22Relatedly, Bronnenberg, Dube, Gentzkow and Shapiro (2015) discuss the brand premium for health products and suggest that a sizable share of it can be explained by misinformation and consumer mistakes.
that those stations need to offer a lower price relative to the stations located in the city in order to 
attract the average consumer. The interaction of highway location and tire repair produces a positive 
coefficient with a magnitude higher than the sum of both coefficients on each variable separately, 
indicating that tire repair service significantly increases demand in stations located in highways.

Turning to the nonlinear parameters, the distance coefficient is sizable and precisely estimated. 
Considering a purchase of 25 liters, the estimated cost of driving an hour is R$17.58 ($= \frac{\hat{\lambda}}{\alpha}$). This 
value is twice as big as the average industry wage in the country, which in 2010 was estimated\(^{23}\) to 
be R$ 9,48. This result suggests that consumers tend not to deviate too much from their paths for 
purchasing fuel.

The remaining two nonlinear parameters characterize the individuals’ tastes for each fuel. Both 
coefficients are significant at the 1% level, but not as precisely estimated as the distance coefficient. 
The positive sign of estimated $\mu_r$ implies that the average consumer has a preference for gasoline 
compared to ethanol. To get a sense of how large the preference for gasoline is, when prices are equal 
to the ratio of calorific power\(^{24}\), 0.7, the consumption of gasoline by the owners of flex fuel vehicles is 
estimated to be nearly 10% bigger than that of ethanol. The estimates indicate substantial variation 
in taste, captured by the high value of $\sigma_r$. This result is in line with the findings from Salvo and 
Huse (2011) and Anderson (2010), who document preference heterogeneity for each type of fuel, with 
a significant share of flex drivers choosing the most expensive fuel even when ethanol and gasoline 
energy equivalent prices differ by 20%.

### 6.2 Retail Pricing

Table 4 displays the estimates of the retailers’ marginal costs from the retail pricing model. The 
coefficients are estimated by OLS with time and municipality fixed effects. The high price elasticity 
of the demand discussed in the last section implies that the market power of retailers is limited. The 
average gross margin ($\frac{p_r - w_r}{w_r}$) of the retailers is 12.4% and the estimated average markup ($\frac{p_r - c_r - w_r}{w_r}$) 
is 5.9%.

The number of attendants in the station is a measure of quality since it can proxy for the time 
spent in the station. The estimated coefficient on the number of attendants implies that the cost per

---

\(^{23}\)From www.bls.gov/data. 
\(^{24}\)One liter of ethanol corresponds to approximately 0.7 liters of gasoline in terms of calorific power.
liter of an attendant is 1.2 cents. Considering a station that sells 150k liters per month, this estimate implies a monthly cost of $1,800, a value compatible with the costs of an attendant during the period studied, including taxes and salary paid by the station.

Table 4: Estimates of the marginal costs of retailers

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent retailer</td>
<td>2.779***</td>
<td>0.180</td>
</tr>
<tr>
<td>Number of attendants</td>
<td>1.236***</td>
<td>0.144</td>
</tr>
<tr>
<td>Storage capacity</td>
<td>-1.024*</td>
<td>0.603</td>
</tr>
<tr>
<td>Number of nozzles</td>
<td>0.857**</td>
<td>0.398</td>
</tr>
<tr>
<td>Convenience store</td>
<td>1.110***</td>
<td>0.155</td>
</tr>
<tr>
<td>Oil change</td>
<td>1.047***</td>
<td>0.166</td>
</tr>
<tr>
<td>Car wash</td>
<td>-0.531***</td>
<td>0.152</td>
</tr>
<tr>
<td>Highway location</td>
<td>-0.366**</td>
<td>0.159</td>
</tr>
<tr>
<td>Time FE</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Municipality FE</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>R-square</td>
<td>0.615</td>
<td></td>
</tr>
<tr>
<td>Average gross margin</td>
<td>12.4%</td>
<td></td>
</tr>
<tr>
<td>Average markup</td>
<td>5.9%</td>
<td></td>
</tr>
</tbody>
</table>

*** denotes significance at 1% level, ** at 5% level and * at 10% level. The average gross margin is defined by \( \frac{p - w}{w} \) and the estimated average markup by \( \frac{p - c - w}{w} \).

Estimated marginal costs of independent retailers are on average larger than those of exclusive retailers. This can be related to the fact that exclusive retailers receive support from their distributors on things such as business plan and structure of the station as well as training for the managers and employees. Most of the remaining station characteristics are estimated to affect the marginal cost function of stations as expected. Larger stations (proxied by storage capacity) have on average lower marginal costs, but the estimated coefficient is significant only at the level of 10%. Stations located on a highway also have significantly lower marginal cost\(^{25}\). One interpretation for the negative

\(^{25}\)There is a possible interference on the estimates of the coefficients of highway located and size because highway stations tend to be larger. The signs are preserved when I estimate the model with only highway dummy or storage capacity.
coefficient of car wash is that this service is complementary to fuel sales, then reducing the effective cost of serving an additional consumer\textsuperscript{26}.

6.3 Bargaining

The estimates of the bargaining model using pre-merger data are presented in Table 5. Gowrisankaran, Nevo and Town (2015) argue that it is empirically difficult to identify bargaining weights and cost shifters at the same level. For this reason I follow their approach and estimate two specifications. The specification in column (a) allows the bargaining parameters to vary across distributors. In that case, I do not include the distributors’ fixed effects. The specification in column (b) assumes equal bargaining weights for distributors and retailers, i.e., $b_D = 0.5$ for every $D$.

<table>
<thead>
<tr>
<th>Table 5: Estimates of the bargaining model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bargaining weight estimates</strong></td>
</tr>
<tr>
<td>Estimates &amp; Std. Err.</td>
</tr>
<tr>
<td>(a)</td>
</tr>
<tr>
<td>$b_{BR}$</td>
</tr>
<tr>
<td>0.52*** 0.09</td>
</tr>
<tr>
<td>$b_{Esso,Shell}$</td>
</tr>
<tr>
<td>0.59*** 0.11</td>
</tr>
<tr>
<td>$b_{Ipiranga}$</td>
</tr>
<tr>
<td>0.60*** 0.11</td>
</tr>
</tbody>
</table>

| (b)                                        |
| Estimates & Std. Err.                     |
| 0.5 -                                     |

<table>
<thead>
<tr>
<th>Marginal cost estimates (cents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimates &amp; Std. Err.</td>
</tr>
<tr>
<td>(a)</td>
</tr>
<tr>
<td>Distance (km)</td>
</tr>
<tr>
<td>0.023* 0.012</td>
</tr>
<tr>
<td>Lag producer’s price</td>
</tr>
<tr>
<td>0.027*** 0.01</td>
</tr>
<tr>
<td>BR</td>
</tr>
<tr>
<td>- -</td>
</tr>
<tr>
<td>Esso/Shell</td>
</tr>
<tr>
<td>- -</td>
</tr>
<tr>
<td>Ipiranga</td>
</tr>
<tr>
<td>- -</td>
</tr>
</tbody>
</table>

| (b)                                        |
| Estimates & Std. Err.                     |
| 0.025* 0.0136                             |
| 0.019** 0.009                             |
| -0.025*** 0.001                          |
| 0.018*** 0.001                           |
| 0.007** 0.003                            |

| Time FE                                   |
| Yes                                      |
| Municipality FE                          |
| Yes                                      |

<table>
<thead>
<tr>
<th>number of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>8766</td>
</tr>
</tbody>
</table>

*** denotes significance at 1% level, ** at 5% level and * at 10% level. In specification (a) I estimate the bargaining weights but do not include the distributors’ fixed effects. In (b) I set the bargaining weights at 0.5 and include the distributors’ fixed effects in the specification of marginal costs.

\textsuperscript{26}This interpretation is analogous to the one provided by Houde (2012), who finds a similar result for car wash and convenience store and suggests that gasoline is a loss-leader product.
I find that the bargaining weights of the major distributors varies between 0.52 and 0.60, significantly smaller than unity, which is the “take it or leave it” value. The bargaining weights (specification (a)) and distributors’ fixed effects (specification (b)) of the merging firms (Esso and Shell) are estimated together.\footnote{I also estimated the model allowing for different values of the bargaining weight for Esso and Shell, but they were not statistically different from each other. Making them distinct would create a problem for the merger simulation in terms of which value to use.} Bargaining weight varies across distributors, but not in a significant way. Moreover, none of the estimated bargaining weights is statistically different from 0.5. In the merger simulation I use the specification (b), which includes the distributors fixed effects in the equation for the marginal cost and assumes that bargaining weights of distributors and stations are the same.

The distance term in the marginal cost specification is included to capture both the transportation costs as well as any other managerial costs that vary with distance (e.g. monitoring the quality of the fuel and service provided by the station). According to industry sources, the shipping costs are flat up to a distance of around 250 km. Since the maximum distance to a distributor from stations within the Vitoria metropolitan area is approximately 145 km, the shipping costs are basically captured by the constant term. The lag of producer’s price captures the cost of carrying stocks into the next period. It is precisely estimated and the magnitude of the estimated coefficient means that the cost of carrying stock to the next period is around 1.9% of the producers’ price.

The distributors’ fixed effects capture the average cost deviation with respect to the base group, which is the collection of all distributors other than Petrobras, Ipiranga, Esso and Shell and that have exclusive retailers. Among the major distributors, only Petrobras has estimated marginal cost lower than those in the base group.

7 Analysis of an Upstream Merger: Shell and Esso/Cosan

In this Section, I present the results of the merger simulation and ex-post evaluation of the model predictions. I start with a short description of the merger studied. Next, I provide the details of the simulation methodology employed in the analysis, followed by the results, where I confront the predictions with the observed prices and shares following the merger.
7.1 Brief History of the Merger

Although there are around 200 fuel distributors in the country, the Brazilian distribution sector is very concentrated. As of 2010, the four largest distributors had a joint share of 67.2% in the gasoline market (BR (29.7%), Ipiranga (19.6%), Shell (11.2%) and Esso/Cosan (6.7%))\(^{28}\). The proposed merger between Shell and Esso/Cosan raised a concern in the antitrust authority because of the high participation of the merging firms in some regions. The state of Espirito Santo was the one where Shell and Esso had higher participation, with 27% market share and around 25% of the stations being exclusive of either one of these distributors. After the merger, the exclusive retailers of the merged firm carrying the Esso brand were given the limit of three years to change to the Shell logo.

The exact date at which the two distributors started to operate jointly is not publicly known. The new company (named Raizen) announced that the joint operation should start by the end of the first semester of 2011. Based on ANP data on brand affiliation, the changes to Raizen were observed in the second half of May of 2011 (more precisely, on May/18). I assume that May/2011 was the month when the merged distributors started the joint operation. The vertical line in Figure 6 indicates the merger period. In that month, there was a jump in the average margins of the distributors, both the merging and non merging ones.

![Figure 6: This figure illustrates the behavior of the average wholesale margins \(\frac{w-p_{prod}}{p_{prod}}\) for the merged firms (orange squares) and non merged firms (blue circles). The vertical line indicates the period of the merger. Data from Vitoria Metropolitan Area (VMA).](image)

\(^{28}\)Source: Anuario Estatistico ANP, 2011.
7.2 Merger Simulation Analysis

To simulate the post merger equilibrium, I combine the networks of exclusive retailers of the merging distributors. The predicted wholesale prices are obtained by

\[
    w_{\text{post},r} = \left( \frac{1}{1 - b_D \varphi^r} \right) \left[ (1 - b_D) \left( p_{\text{prod}} + h\hat{\Gamma} + \Omega_{r}^{-1} s\tilde{D}^r \right) + b_D \left( p_{\text{post},r} \left( 1 - \varphi^r \right) - \left( W_r \gamma^r + \hat{\kappa}_{br} + \gamma_t \right) \right) \right],
\]

where \( h\hat{\Gamma} \) and \( W_r \gamma^r + \hat{\kappa}_{br} + \gamma_t \) represent the estimated costs of the distributor and retailer, respectively. Vector \( \tilde{D}^r \) contains the diversion values considering the combined network.

The predicted post-merger retail price \( (p_{\text{post},r}) \) is obtained as the solution to the fixed point problem below:

\[
    p_{\text{post},r} = w_{\text{post},r} + W_r \gamma^r + \hat{\kappa}_{br} + \gamma_t + \Delta_{r}^{-1} \left( p_{\text{post}} \right) s_{r} \left( p_{\text{post}} \right),
\]

which depends on the demand model through \( \Delta_{r}^{-1} \left( p_{\text{post}} \right) \) and \( s_{r} \left( p_{\text{post}} \right) \).

Each component of the model has a clear role in the simulation of the wholesale and retail prices following a merger: (i) the demand is used to predict shares and price sensitivity; (ii) retail pricing is used to predict retailers’ costs; and (iii) bargaining model is used to predict distributors’ costs. To get \( w_{\text{post}} \) and \( p_{\text{post}} \) we iterate the bargaining, retail pricing and demand until convergence.

In the analysis that follows I am considering that the bargaining weights of the distributors and retailers are the same (i.e., \( b_D = 0.5 \)). If the bargaining weights of the distributor increase as a result of the merger, it will get a larger share of the total profits, which will likely induce investments in cost savings.

In order to predict the effects of the merger we need to characterize the prices associated to independent retailers, which in the Vitoria Metropolitan Area corresponds to nearly 15% of the stations at the time of the merger. Independent retailer \( j \) is assumed to procure upstream from a set of \( N_j \) distributors, which compete in a reverse auction with no reserve price to serve retailer \( j \). Each local distributor privately observes its own costs and all distributors are assumed to be risk neutral and behave non cooperatively. The cost considered in the bidding function does not include producer’s price and is assumed to be independent across distributors. There are many variations of possible representations of this procurement auction. In the merger simulation I make the simplifying assumption that the wholesale price that each independent retailer is paying varies only to the extent
of the variation in the producer’s prices. This is equivalent to saying that the realizations of the private costs in the period of the merger are identical to those pre merger.

### 7.3 Results

Table 6 reports the simulated post-merger equilibrium gasoline prices for the Vitoria Metropolitan Area. The results assume zero efficiency gains from the merger.

**Table 6: Merger simulation and observed data**

<table>
<thead>
<tr>
<th></th>
<th>1: No merger (simulation)</th>
<th>2: Merger (simulation)</th>
<th>3: Observed data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Esso/Shell</td>
<td>other</td>
<td>Esso/Shell</td>
</tr>
<tr>
<td>Average wholesale price</td>
<td>2.591</td>
<td>2.587</td>
<td>2.639</td>
</tr>
<tr>
<td>Average wholesale gross margin</td>
<td>9.80%</td>
<td>9.63%</td>
<td>11.84%</td>
</tr>
<tr>
<td>Average retail price</td>
<td>2.926</td>
<td>2.919</td>
<td>2.969</td>
</tr>
<tr>
<td>∆ wholesale prices (relative to the no merger simulation)</td>
<td>4.8 cpl (1.8%)</td>
<td>1.3 cpl (0.6%)</td>
<td>4.3 cpl (1.5%)</td>
</tr>
<tr>
<td>∆ retail prices (relative to the no merger simulation)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Variation in retail and wholesale gasoline prices are measured in cents per liter (cpl). Average wholesale gross margin is computed as \( \frac{w - p^{prod}}{p^{prod}} \).

On average, the model predicts a wholesale price increase of 4.8 cents per liter (cpl) for the merged distributors and 1.3 cpl for the non-merged. These changes correspond to an increase of 30% in the margins of the merging distributors compared to the average margin pre merger. At the retail level, the model predicts 4.3 cpl price increase for the exclusive stations of the merged distributors and 2.7 cpl for the remaining exclusive stations. This implies that exclusive retailers of the merging distributors are only partially passing-through the increase in the wholesale prices to retail prices.
The average increase in the retail prices of the stations in the competing networks is higher than the increase in their wholesale prices. One possible explanation for this is that part of the price increase comes from the higher wholesale price, but another part comes from the strategic complementarity at the retail level, which incentivizes stations to increase retail prices after a price increase of the competitors.

Since the data span the post merger period, I am able to conduct an ex-post evaluation of the model simulation. The analysis presented here is focusing on the short run effects on prices. Figure 7 displays the simulated wholesale margins in the counterfactual case of no merger. The red diamond represents the distributors associated to the proposed merger and the blue diamond represents the remaining distributors. The simulated margins in the absence of merger do not exhibit any significant difference among the distributors.

![Figure 7: Observed and simulated wholesale prices post merger. Data from Vitoria Metropolitan Area (VMA).](image)

The consolidation of exclusive dealing networks following the merger creates incentives for the merged supplier to increase wholesale prices, as we can observe in Figure 8. Importantly, the observed data confirms the model prediction that the increase in the margin of the merging distributors is larger than that of the other distributors. The observed wholesale price increase is of a similar order of magnitude, but larger than what is predicted by the model. The model can capture around 60% of the increase in the wholesale margins of the merging distributors, suggesting that other forces might
have played an important role at the time of the merger.\textsuperscript{29}

![Average Wholesale Margin (merger - gasoline)](image)

Figure 8: Observed and simulated wholesale prices post merger. Data from Vitoria Metropolitan Area (VMA).

Strategic complementarity at the downstream level implies that the unbranded retailers will eventually increase their retail prices in response to a price increase of the branded retailers. While the model correctly captures this response from the unbranded stations, it does not predict an increase of wholesale prices for independent retailers. The reason is that independent retailers can purchase from any distributor and in that case wholesale prices are assumed to be determined in a competitive way, depending on the cost structure of the distributors and not on the price charged by the independent retailer.

8 Conclusion

This paper studies upstream mergers in markets with ED contracts, where by ED I mean a contract between two firms in which one is prohibited from dealing with the competitors of the other. Under this type of arrangement, since the supplier is a monopolist with respect to the exclusive retailer, a

\textsuperscript{29}The model also predicts that the price increase will not be uniform. However, the observed variation in the wholesale price for the region studied at the time of the merger was substantially lower than what was observed pre-merger and than what was predicted by the model. I am currently estimating the model and merger simulation for another region that did not exhibit the same pattern in terms of reduction in the wholesale price variability.
merger between suppliers focusing on the input market has no clear effect on prices. The main result of the paper is to show that mergers under ED can produce sizable incentives for price increase. The network structure of exclusive retailers affects the bargaining position of distributors, creating a channel for wholesale price increase after a merger, with magnitude proportional to the diversion ratios within the network.

The assumption of simultaneous determination of wholesale and retail prices is used in this paper and in the literature on structural models of bargaining for tractability. I am currently working on relaxing this assumption, by allowing wholesale and retail prices to be determined sequentially. In order to do that, we need to understand how changes in the wholesale prices affect retail prices, which involves the computation of passthrough.

Although this paper provides an important step in understanding the vertical relations between suppliers and exclusive dealers, one limitation of the approach is that networks of exclusive retailers are taken as given. This assumption can be important when wholesale pricing influences the decision of retailers to become exclusive or to renew an existing exclusivity contract. In a related paper, I am extending the model to endogenize the network of exclusivity which will allow to access the incentives of retailers and distributors after a merger. This is important because antitrust authorities might want to consider the long run effects of a merger, including the incentives to become exclusive as well as which other mergers would be induced by the proposed merger.

The fuel industry is perhaps an extreme case because of product homogeneity. However, the key feature discussed in this paper is how the combination of the networks of exclusive dealers post merger can affect the incentives of the upstream firm to raise prices. Hence, the mechanism discussed here does not rely on the homogeneity of the goods sold. To a large extent, mergers in other industries where ED is common such as soft beverages, beer and automobiles would have similar incentives for price increase in the short run. In some cases, a long period is needed to realize the efficiencies from the merger as pointed in Focarelli and Panetta (2003). Moreover, in the long run, since products in these industries can be highly differentiated, other aspects must be taken into consideration because of the possibility of changing product variety following a merger. Further study is needed to quantify the effects of upstream mergers in such contexts.
References


Appendix

A.1. Contract terms

The next figure brings a portion of the exclusivity contract of a major distributor mentioning how wholesale prices are determined. I translate the text below (my italics):

(b) Prices - the [wholesale] price of products and lubricants will be the one listed in the invoice, *freely agreed between the parties*, except for the products which prices still are or come to be regulated by the public authority, and in force at the delivery date. The [wholesale] prices will include taxes applicable according to the current legislation, including those related to tax substitution, whenever that is the case.

Figure 9: Portion of the contract of a major distributor mentioning how wholesale prices are determined.