FUNDAÇÃO GETULIO VARGAS
ESCOLA DE PÓS-GRADUAÇÃO EM ECONOMIA

Felipe Flores Golfín

Exclusivity Contracts And Competition: The Case Of The Brazilian Fuels Market

Rio de Janeiro
April 5, 2016

Felipe Flores Golfín

Exclusivity Contracts And Competition: The Case Of The Brazilian Fuels Market

Dissertação submetida a Escola de Pós-Graduação em Economia como requisito parcial para a obtenção do grau de Mestre em Economia.

Orientador: André Garcia de Oliveira Trindade

Rio de Janeiro
April 5, 2016

Ficha catalográfica elaborada pela Biblioteca Mario Henrique Simonsen/FGV

Golfín, Felipe Flores
Exclusivity contracts and competition: the case of the Brazilian fuels market, 2016 / Felipe Flores Golfín. – 2016.
30 f.

Dissertação (mestrado) - Fundação Getulio Vargas, Escola de Pós-Graduação em Economia.
Orientador: André Garcia de Oliveira Trindade.
Inclui bibliografia.

1. Combustíveis - Brasil. 2. Contratos de exclusividade. 3. Concorrência. I. Trindade, André Garcia de Oliveira. II. Fundação Getulio Vargas. Escola de Pós-Graduação em Economia. III. Título.

CDD – 662.6

SRA FGV

FELIPE FLORES GOLFÍN

EXCLUSIVITY CONTRACTS AND COMPETITION: THE CASE OF THE BRAZILIAN FUELS MARKET

Dissertação apresentada ao Curso de Mestrado em Economia da Escola de Pós-Graduação em Economia para obtenção do grau de Mestre em Economia.

Data da defesa: 23/03/2016.

ASSINATURA DOS MEMBROS DA BANCA EXAMINADORA

André Garcia de Oliveira Trindade
Orientador (a)

Luis Henrique Bertolino Braido

Lavinia Rocha de Hollanda

Abstract

Exclusivity contracts can help stations by providing brand-value that allows them to obtain higher profits, relative to unbranded retailers. However, branded retailers may have a stronger negative effect over its competitors' profits. It is not clear which one of these two effects dominates (brand-value vs competition effect). Therefore, the impact of exclusivity over the number of participants in the downstream market is not determined. In this paper, I empirically study the effects of exclusivity agreements on competition in the Brazilian gasoline sector. In order to do so, I estimate an entry model of endogenous product-type choices using data of retailers' locations and contract choices along with data from the 2010 Brazilian Census. I use my estimates to simulate entry decisions under two counterfactual scenarios: i) mandatory exclusivity and ii) no exclusivity.

KEYWORDS: *vertical relations, exclusive contracting, vertical constraints, gasoline markets*

JEL Codes: L13, L42, L71, L81

Contents

1 Introduction **6**

2 Related Literature **8**

2.1 Theoretical Literature on Exclusivity Agreements 8

2.2 Empirical Literature on Exclusivity Agreements 9

2.3 Empirical Literature on Two-Period Entry Models 9

2.4 Empirical Literature on Gasoline Markets 10

2.5 Relation to this work 11

3 The Brazilian Fuels Market **12**

4 Theoretical Framework **14**

5 Data **16**

5.1 General Description 16

5.2 Reduced Form Evidence 18

6 Estimation Strategy **20**

7 Results **21**

7.1 Probit Analysis 21

7.2 Structural Model 21

8 Counterfactual Exercise **24**

9 Conclusion **26**

List of Figures

1 Gasoline Production and Distribution Chain 12
2 Potential locations - São Jose do Rio Preto, SP 16
3 Dispersion of stations by type 19
4 Population-Probability elasticity 23
5 Income-Probability elasticity 23
6 Counterfactual Results 24

List of Tables

1 Distribution of brands among retailers. 13
2 Demographic Summary Statistics 17
3 Industry Summary Statistics 18
4 Number of Retailers vs Demand Proxies 18
5 Competition effect by type 19
6 Exclusivity decision: Probit Analysis 21
7 Estimation Results 22
8 Markets used in the estimation. 29
9 Continuation: Markets used in the estimation. 30
10 Counterfactual Results 30

1 Introduction

Exclusive dealing (ED) is a practice in which a retailer agrees to sell the products of only one distributor. This type of agreement is prevalent in many sectors, such as insurance, car dealers or gasoline markets. The practice has been labeled as anticompetitive in the past[1], however there is no conclusive opinion over its effects on competition in the downstream market. Exclusive dealing can generate increases in the wholesale prices by limiting competition in the upstream market, it also can mitigate any double marginalization problem or improve the quality of the final product. Neither one of these two alternatives has a clear effect over the number of participants in the downstream market.

I explore the effect of exclusive arrangements on entry in the brazilian gasoline market. In Brazil, companies cannot directly participate in both the distribution and retailing of gasoline. Therefore, a common agreement in this industry is one in which a gasoline station signs an exclusivity contract with its provider.

Gasoline markets is an appropiate scenario to study this topic, not only because of the structure of contracts, but also because it is a relevant market in most countries. In the United States, for example, consumers devote 2.25% of their annual income on gasoline purchases and in Brazil a gallon of fuel represents almost 20% of an average consumer's daily income (Bloomberg (2014)).

To measure the effect of exclusive dealing on competition I construct a static model of firm entry based on (Mazzeo, 2002) and Seim (2006). In the model, each market consists of a set of locations. Potential entrants choose a location and a type (exclusive or independent) to enter the market, and they do so simultaneously. Firms have private information; therefore, they maximize the expected profit across locations in order to make entry decisions. I estimate the model with data from the Brazilian fuels market.

The model is estimated using data from two different sources. From the *ANP - Agencia Nacional de Petroleo*[2] I obtained a database with the addresses of all the retailers that were active in 2010, from the *IBGE - Instituto Brasileiro de Geografia e Estatística*[3] I obtained information on the limits of each census tract, which I used to define the potential locations within each market. In addition, I use data from the 2010 Brazilian Census to calculate some demand proxies (population, mean family income, education, among others) for each census tract.

[1] Two well-known cases in the U.S. are Standard Fashion v. Magrane and Houston Tampa Electric v. Nashville Coal where a court determined that exclusivity contracts attempted against competition.

[2] ANP: Regulatory body of the Brazilian gasoline sector.

[3] IBGE: Brazilian Institute of Geography and Statistics

After estimating the benchmark, I simulate the expected number of participants in the market under two counterfactual scenarios: i) firms can only enter as exclusive retailers and ii) absence of exclusive contracts.

First, I find that demand proxies, such as population and income, positively affect the profits of branded and unbranded retailers. In addition, I conclude that the effect of these variables is stronger for exclusive stations. For example, an increase in the population of a particular location can raise the probability of entry of an exclusive retailer by 17% more than it would that of an independent one.

Second, the model's estimation suggests that the presence of an extra branded retailer in the market has a negative effect over profits. However, the presence of an additional independent retailer only has a negative effect on profits when it is located within a 1km radius of the firm.

The counterfactual results indicate that exclusivity contracts have a negative effect over the expected number of retailers in the markets. The results suggest that a ban on exclusivity agreements could increase the number of stations, on average, by 50%.

The remainder of this paper is structured as follows. Section 2 discusses the related literature. In Section 3 the structural model is introduced. Section 4 describes the data. Section 5 presents the estimation strategy. Section 6 contains the results. Section 7 presents the counterfactual exercise and Section 8 concludes.

2 Related Literature

This paper relates to three different literatures, the one studying the effects of exclusivity contracts on competition and welfare, the literature on endogenous entry and more specifically the literature on gasoline markets. In this section I will discuss the main papers of each one of those literatures and their relation to my work.

2.1 Theoretical Literature on Exclusivity Agreements

The study of exclusive dealing began with a series of theoretical papers analyzing the case of an industry were the seller signs exclusivity agreements with the final consumer. The seminal paper of the area by Rasmusen et al. (1991), argues that exclusive dealing has the potential to be an anticompetitive practice. It presents an environment where firms need to serve a minimum number of consumer to enter the market. In this case, the incumbent may sign exclusive agreements with enough buyers to impede entry of any competitor.

Bernheim and Whinston (1998) and Segal and Whinston (2000) build on this paper and study a similar framework; however, they allow for a richer model and show that exclusivity agreements can generate exclusionary and non-exclusionary equilibria. Fumagalli and Motta (2006) study the case of a vertically integrated industry in which the manufacturers sign exclusivity contracts with the retailers, the authors prove that the possible foreclosing effects of exclusivity clauses depend on the intensity of competition in the downstream market.

Chen and Riordan (2007) show that the interaction between vertical integration and exclusive dealing can generate a foreclosure effect that neither one of the two types of contracts can produce on its own. They present a framework in which a vertically integrated firm forces independent downstream retailers to sign exclusive agreements, this in turn drives upstream competitors out of the market. Other papers have departed from the discussion of the foreclosure effect and focused on different potential consequences of exclusive agreements. de Meza and Selvaggi (2007) presents a model in which ED can help foster relation-specific investments.

One of the most recent contributions to the theoretical literature is the paper by Johnson (2015). The author drops one of the main assumptions of the previous literature and uses a framework in which no supplier has an inherent contracting advantage over another. In his model, partial exclusivity[4] may arise and exclusivity may be beneficial to upstream

[4]Partial exclusivity occurs when not all downstream firms are associated with a supplier and remain independent to buy from any upstream firm.

and downstream firms by raising final prices. This paper is of particular interest to my study because it discusses the effects of the exclusive arrangements on the downstream market, which so far had not been explored in the literature.

2.2 Empirical Literature on Exclusivity Agreements

As seen above the theoretical literature on ED is extensive and shows that exclusivity contracts can have ambiguous effects on competition and welfare. Yet, the empirical research is very scarce and similarly to the theoretical work the results are not conclusive. For example, Asker (2005) finds no evidence for foreclosure effects of exclusivity in the Chicago beer markets. On the other hand, Lee (2013) estimates a structural model of the video game industry and concludes that exclusive dealing leads to more competition, but consumers' welfare would be higher without exclusive relations.

Recently, a few papers have emerged that attempt to close the existing empirical gap. Soares (2015) estimates a structural model of the Brazilian gasoline market and finds that mergers in the upstream market increase prices and that the network of exclusive retailers affects the size of the increase. Sinkinson (2015) studies the smartphones industry in the United States and shows that exclusivity contracts between handset providers and wireless carriers increased prices, but incentivized entry in the market. Nurski and Verboven (2015) asks if exclusive dealing in the European car market creates an entry barrier to downstream firms. The authors use a structural approach to conduct policy counterfactuals and conclude that a ban on exclusive dealing would increase the presence of small dealers.

2.3 Empirical Literature on Two-Period Entry Models

The theoretical model and empirical strategy used in this paper builds on the endogenous entry literature. The seminal papers in this area are Bresnahan and Reiss (1991) and Bresnahan and Reiss (1990), in these papers the authors consider the entry decisions of homogenous firms and build a two-stage entry game, they then estimate their model with data on the number of participants and demand proxies for a sample of markets in the United States.

The first papers focused on studying the entry determinants of homogeneous firms, the next contributions to the literature by Mazzeo (2002) and Seim (2006) introduced frameworks to deal with endogenous product differentiation choices. The former studies motel markets along U.S. interstate highways, the author builds a model in which firms have complete information over the profits of its competitors and use this information to strategically choose whether to enter the market, and if so with which type. He finds that the

competition effect varies by type of firm, however, his model is limited to the extent that the number of types must be small for the model's estimation to be computational feasible.

Seim (2006) proposes a different approach to model endogenous product type choices, she introduces private information in the firms' profits, which allows dealing with the computational burden of estimating a model with several product types. The author studies the video retailing industry and builds a model in which firms choose among a set of locations within the market to differentiate from each other. Her model allows for several different types (in the form of locations) and uses demographic characteristic and competition effects to explain firms' spatial positioning choices.

Orhun (2013) also focuses on an industry with spatial differentiation; the author studies entry choices by supermarkets in the United States. She introduces location specific unobservables into a private information framework similar to the one developed by Seim (2006).

Cilberto and Tamer (2009) provides a different solution to the problem of multiple equilibria present in all of the previous models, instead of imposing assumptions on entry decisions the authors use a partial identification approach.

2.4 Empirical Literature on Gasoline Markets

Finally, this paper relates to the literature on gasoline markets. One the most influential papers in this area is Hastings (2004), in this study the author exploits exogenous variation in the number of integrated retailers in the American fuels market to measure the impact of vertical integration on prices and concludes that a larger presence of vertically integrated stations increases final prices. In a similar paper Hastings and Gilbert (2005) examines empirically the relationship between vertical integration and wholesale gasoline prices. They find evidence that vertical integration can increase wholesale prices.

Houde (2012) builds a more structural model to answer a similar question, his main contribution is to show how to incorporate spatial differentiation in a discrete choice demand model, he then uses data on Quebec's fuels market to estimate the model and concludes that mergers in the upstream market generate a price spike. Sampaio and Sampaio (2013) uses the entry model introduced in Bresnahan and Reiss (1990) to study competition in the Brazilian fuels market. Using this methodology, they do not find evidence for colluding behavior in this market. It is important to note that in their model all firms are homogenous, therefore they cannot conclude anything about the effects of exclusivity.

Several authors have focused on aspects of the fuels industry, other than vertical relations. Houde et al. (2010) presents a comprehensive survey of the main questions that have been studied in this literature.

2.5 Relation to this work

As seen above, the theoretical literature has suggested that exclusivity agreements have the potential to affect competition in the downstream market. This paper relates to this literature in that it quantifies this effect on a particular industry, by exploring the impact of exclusive contracts on the number of downstream market participants.

The methodology used in this paper follows previous approaches of the two period entry models literature. Specifically, it resembles Mazzeo (2002) in that firms endogenously choose their type. In addition, it follows Seim (2006) by assuming that retailers hold private information about their profit and differentiate from competitors by spreading across locations in within the market.

Finally, similar to other papers in the gasoline markets literature this work studies vertical relationships in this industry. However, most of the previous contributions focus on environments in which full vertical integration is the most common type of agreement. In this case, I explore some consequences of exclusivity contracts and focus on the number of market participants, rather than final and wholesale prices. To the best of my knowledge, this is the first empirical paper that studies the consequences of exclusivity contracts on entry behavior in the downstream market.

3 The Brazilian Fuels Market

The current institutional makeup of the Brazilian fuels market was established in the early 2000s by the introduction of the *Lei do Petróleo*. Before the passing of this law the industry was a monopoly in all of its stages (production, refinery and distribution), with the exception of the downstream market. The new law ended the government's control over final prices and allowed private companies to get involved in every comercial activity of the industry.

The distribution chain of fuels starts with the extraction (or importation) of petroleum which is then processed by the country's refineries. This stage is heavily dominated by Petrobras-BR (a Brazilian state-owned oil company), that refines almost all of the oil that is consumed in the country. For example, in the period from 2000 to 2007 Petrobras was responsible for 98.7% of the refineries' production (Ayres and de Freitas (2008)). Among other products, refineries produce Gasoline A that they sell to distributors.

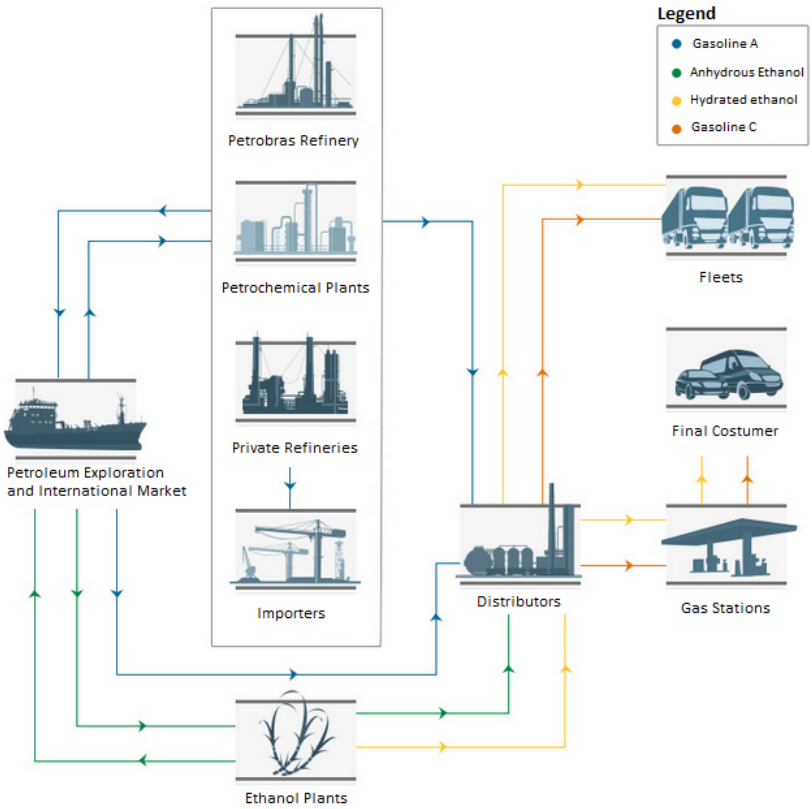

Figure 1: Gasoline Production and Distribution Chain

Source: Petrobras (2015)

As shown in Figure 1, distributors buy Gasoline A from the refineries, and hydrated and anhydrous ethanol from the ethanol plants. Then, they mix anhydrous ethanol with the

Gasoline A in order to produce Gasoline C[5]. Distributors sell Gasoline C and hydrated Ethanol to gas stations[6].

At the final stage of the distribution chain there are the gas stations, which freely set retail prices. By law, distributors cannot operate stations. However, a common practice in Brazil is for a distributor to sign an exclusivity agreement with the gas station that buys its product. This type of contract allows the "branded" station to utilize the name of the distributor to promote its products (usually the distributor covers the advertising costs), and in turn the station agrees to buy a certain amount of fuels from the distributor at a price set by the latter (de Oliveira and Maia (2012)).

Table 1: Distribution of brands among retailers.

Distributor	**2010**	**2011**	**2012**	**2013**	**2014**
Ale	3.08	3.32	3.41	3.36	3.29
BR	20.49	22.31	23.41	23.52	23.64
Ipiranga	9.74	16.4	16.73	16.89	16.94
Raizen	14.2	14.92	15.15	15.18	15.41
Others	16.58	7.3	7.62	7.66	7.63
Unbranded	35.92	35.74	33.68	33.39	33.08

Even though there are several distributors operating in the market, almost 90% of the branded stations have signed exclusive agreements with one of four companies. In table 1 I present the market's brand distribution. As can be seen, Ale, BR, Ipiranga and Raizen dominate the upstream market, approximately 60% of the retailers are associated with one of those four brands. This market composition has remained stable in the past four years, with the exception of Ipiranga's expansion in 2011. This is one of the interesting facts of the industry, unbranded and branded stations coexist, and unbranded stations hold an important share of the downstream market.

[5]The Agency of Petroleum, Gas and Biofuels (ANP) requires that gasoline sold at gas stations must contain 25% of ethanol.

[6]Brazil has an important fleet of ethanol-fueled and flex cars (almost 70% of vehicles in Brazil can run on both gasoline and ethanol), which can run on hydrated ethanol.

4 Theoretical Framework

I follow Seim (2006) and consider a two-period game of entry. In the first stage of the game, a set $\mathcal{F}_m$ of retailers decide, simultaneously, whether to enter the market m. Markets are composed by a fixed set of locations, and firms may operate as exclusive or independent retailers.

Each firm that decides to enter must choose a location and a type (independent or exclusive) to do so. Let c index an specific location and type combination. Then, a retailer r that operates in location-type combination c, receives the following profit in the second period.

$$\pi_{r,c} = D_c^m \beta + \sum_k \gamma_{c,k}^m n_k^m + \xi^m + \epsilon_{r,c}^m. \tag{1}$$

Where, D_c^m is a vector of demand proxies, n_c^m refers to the number of firms operating in location-type combination c, ξ^m is a market level shock and $\epsilon_{r,c}^m$ is a location-type-firm specific shock. β is a vector of parameters for the demand characteristics and $\gamma_{c,k}^m$ reflects the competition effect of retailers of different location-type combinations.

A firm that decides not to participate in the market receives the following profit.

$$\pi_{r,0} = \epsilon_{r,0}^m. \tag{2}$$

I assume that all competitors of a certain type, that are located within a certain distance band of firm r, have the same effect over this firm's profit. Formally, I make the following assumption about the competition effect within the market.

Assumption 1. *Let c, k, k' index location-type combinations. Then, $\gamma_{c,k}^m = \gamma_{c,k'}^m = \gamma_{t,b}$ if k and k' are of type t and $\mathcal{D}_b \leq d_{c,k}, d_{c,k'} \leq \mathcal{D}_{b+1}$, where $\mathcal{D}_b$ defines the cutoff of a particular distance band and $d_{c,k}$ is the distance of location k to c.*

This assumption also implies that the effect of exclusive and independent competitors over profits is the same for independent and exclusive firms. In addition, I assume that retailers only observe their own location-type specific shocks.

Assumption 2. *Retailer's r location-type shocks $\epsilon_{r,1}^m, ..., \epsilon_{r,C}^m$ are private information and are i.i.d. with extreme-value type 1 distribution.*

Firms make entry decisions in order to maximize profit in the second period. However, since entry decisions are made simultaneously by all retailers and the firm only observes its own private shock, the location choices of its competitors are unknown. Therefore, it chooses the location-type combination that maximizes the expected profit in the second

period. That is, it chooses an optimal location-type combination c^* such that

$$\begin{aligned} \mathbb{E}[\pi_{r,c^*}] &\geq \mathbb{E}[\pi_{r,c}], \forall c \neq c^* \\ \mathbb{E}[\overline{\pi}_{r,c^*}] + \epsilon_{r,c^*} &\geq \mathbb{E}[\overline{\pi}_{r,c}] + \epsilon_{r,c}, \forall c \neq c^*. \end{aligned} \tag{3}$$

Then, the probability of retailer r choosing location-type combination c is given by

$$p_{r,c} = \mathrm{P}(\mathbb{E}[\overline{\pi}_{r,c^*}] + \epsilon_{r,c^*} \geq \mathbb{E}[\overline{\pi}_{r,c}] + \epsilon_{r,c}, \forall c' \neq c) \tag{4}$$

$$p_{r,c} = \frac{\exp(D_c\beta + \sum_t \sum_b \gamma_{t,b}\mathbb{E}[N^c_{t,b}])}{\sum_k \exp(D_k\beta + \sum_t \sum_b \gamma_{t,b}\mathbb{E}[N^k_{t,b}])}.$$

Where $\mathbb{E}[N^c_{t,b}]$ is the expected number of competitors of type t within a distance band b of location c. The last equality follows from assumption 2. Given that the entry decision of all firms is symmetric, the probability of entry in a particular location-type combination is the same for all retailers. That is, $p_{r,c} = p^*_c, \forall r$. Then, for location-type combination c, the expected number of competitors of a particular type and distance band is equal to

$$\mathbb{E}[N^c_{t,b}] = (\mathcal{E} - 1) \sum_{c'} \mathbb{I}^{c,c'}_{t,b}\, p^*_{c'} \tag{5}$$

where, $\mathcal{E}$ is the expected number of market participants and $\mathbb{I}^{c,c'}_{t,b}$ is equal to one if location-type combination c' is of type t and within distance band b of c, and zero otherwise. Given this, the vector of probabilities forms the following system of equations

$$p^*_c = \frac{\exp(D_c\beta + (\mathcal{E} - 1) \sum_t \sum_b \gamma_{t,b} \sum_{c'} \mathbb{I}^{c,c'}_{t,b}\, p^*_{c'})}{\sum_k \exp(D_k\beta + (\mathcal{E} - 1) \sum_t \sum_b \gamma_{t,b} \sum_{c'} \mathbb{I}^{k,c'}_{t,b}\, p^*_{c'})}, \forall c. \tag{6}$$

To compute the expected number of firms in the market $\mathcal{E}$, a retailer considers the following probability of entry

$$p_{Entry} = \frac{\exp(\xi)[\sum_k \exp(D_k\beta + (\mathcal{E} - 1) \sum_t \sum_b \gamma_{t,b} \sum_{c'} \mathbb{I}^{k,c'}_{t,b}\, p^*_{c'})]}{1 + \exp(\xi)[\sum_k \exp(D_k\beta + (\mathcal{E} - 1) \sum_t \sum_b \gamma_{t,b} \sum_{c'} \mathbb{I}^{k,c'}_{t,b}\, p^*_{c'})]}. \tag{7}$$

Considering this expression the firm can compute the expected number of market participants.

$$\mathcal{E} = \mathcal{F} * p_{Entry} \tag{8}$$

Where, $\mathcal{F}$ is the potential number of market participants. Equations 6 and 8 will be key in the estimation strategy presented below.

5 Data

5.1 General Description

As seen in the model presented above, firms choose whether to enter, their type (exclusive or independent) and a location within the market. In practice, potential locations are the centers of the census tracts[7] that belong to the market. To illustrate, in figure 2 I present the locations for São Jose do Rio Preto, SP.

The *IBGE* provides public access to data on the geographic coordinates of the census tracts. However, this information is only available for a selected sample of municipalities of each state. Since it is important to have a rich territorial division to allow for the geographical differentiation observed in the fuels retailing industry. The sample was further restricted to include only municipalities with at least six locations (census tracts).

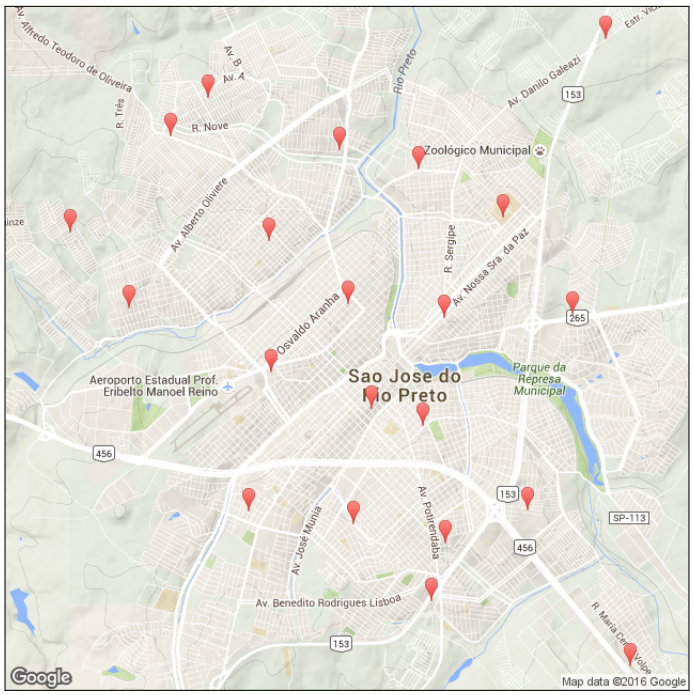

Figure 2: Potential locations - São Jose do Rio Preto, SP

I then used the Brazilian census to obtain demographic and market characteristics of each census tract. Demographic measures are population, mean income, proportion of people with a car or motorcycle and mean years of education, this data is taken from the 2010 census. In addition, I used the ANP weekly sample of retailers in the fuels industry to obtain the list of active stations in 2010. Then, using information on the retailer's address, I was able to link each retailer to its respective census tract. With

[7]The center of each tract is calculated as the mean position of all retailers operating in that area.

this, I calculated the number of independent and exclusive stations per census tract and linked this to the census data.

Since each market is composed of at least one municipality I excluded municipalities with a population of over 1.5 million. This was done to avoid including groups of retailers that do not actually belong to the same market. The final sample consists of 45 markets[8], across 18 states with populations ranging between 150 000 and 1 million people.

Table 2: Demographic Summary Statistics

Variable	**Mean**	**Min.**	**Max.**
Market Level (N=44)			
Number of tracts	18.80	4	46
Total population	380 307	158 381	932 748
Population of biggest tract	50 531	16 915	185 558
Median population across tracts	25 572	13 507	103 857
Tract Level (N=684)			
Years of education	8.10	5.5	10.81
Personal Income	1467.46	194.0	5519.6
Family Income	989.43	117.05	4382.81
Proportion of people with car	0.53	0.01	0.92
Proportion of people with motorcycle	0.24	0.05	0.57

In table 2, I present some summary statistics of the markets' demographic measures. Markets in the sample have, on average, 19 different locations and a population of 380,307 people. The mean proportion of people who own a car across markets is equal to 53% and the tracts median population is close to 25 000 people.

Table 3 provides a summary of the gasoline retailing industry. On average there are 74 retailers per market, however, since the size of the market varies a lot in the sample the number of stations can be as high as 194. Competition is intense among retailers, on average, a station faces five competitors within a 1 km radius and the mean distance to the closest competing location is less than 3 km.

[8]The list of markets used in the estimation is presented in the appendix.

Table 3: Industry Summary Statistics

Variable	Quantity	Proportion	
Overall			
Number of retailers	3274	100%	
Number of branded retailers	2142	65%	
Number of unbranded retailers	1132	35%	
Variable	**Mean**	**Min.**	**Max.**
Market Level (N=44)			
Number of retailers	74.41	27	194
Number of branded retailers	48.68	7	147
Number of independent retailers	25.73	1	63
Tract Level (N=684)			
Total number of retailers	4.81	0	81
Closest location in km	2.66	0.19	73.78
Number of stations < 1km	5.88	0	81
Number of stations < 3km	24.48	0	101
Number of stations < 10km	71.75	0	162

5.2 Reduced Form Evidence

In this subsection I present some reduce form results about the retailers' location and type choices. An important aspect to analyze is how much demographic variables affect the retailers' location choices, to this purpose I present the results of a simple regression of the number of retailers on population (the unit is 10 000 people) and income (in thousands of *reales*), controlling for market fixed effects. The results indicate a positive relation between the demand proxies and the number of retailers, as expected. However, these variables appear to explain very little of the location choices. An extra 10 000 people in the census tract, that is approximately half of the mean median population across tracts, is associated with an increase of just one station.

Table 4: Number of Retailers vs Demand Proxies

	Dependent Variable		
Variable	**Total #**	**# of Unbranded**	**# of Branded**
Population	1.441**	0.624**	0.817**
Income	3.760**	1.097**	2.663**

Significance levels : † : 10% * : 5% ** : 1%

From these regressions, it appears to be a difference in how important demographic measures are to explain the location of branded and unbranded retailers. For example, there exists a statistically significant difference between the income coefficients of these two regressions. This could mean that independent stations avoid stronger competition by spreading through the market, which would diminish the importance of demand proxies to explain location choices.

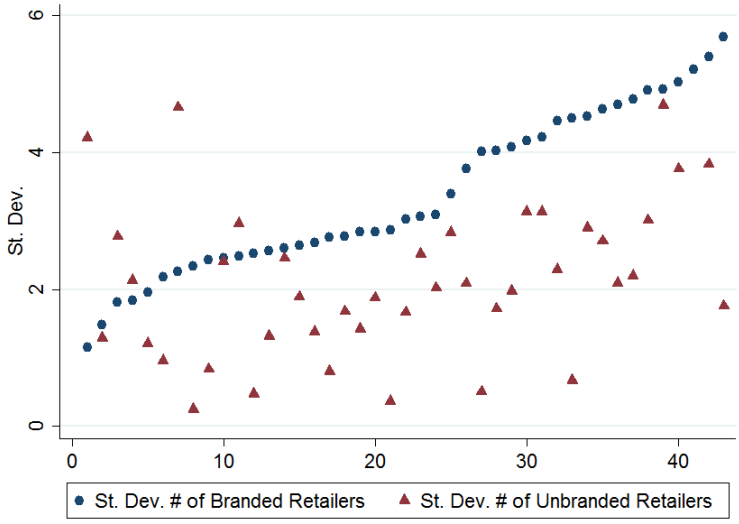

Figure 3: Dispersion of stations by type

To support this claim I plot, for each market, the standard deviation of the number of retailers across locations by type. The circles in figure 3 represent the standard deviation of the number of branded stations across locations for each market in the data. Each triangle that lies directly below (or above) a circle, represents the standard deviation of the number of unbranded retailers for that same market.

This graphic suggests that independent retailers spread more evenly across the market, which is consistent with the hypothesis that independent stations shun competition more than exclusive ones.

Finally, it is interesting to analyze if the presence of unbranded and branded competitors has a differentiated effect over location choices. To see this, in table 5 I present the results of a regression of the number of stations (by type) on the number of exclusive and independent competitors within a 1km radius, controlling for market fixed effects and demographic characteristics of the location and of its neighboring census tracts.

Table 5: Competition effect by type

	Dependent Variable		
Variable	**Total #**	**# of Unbranded**	**# of Branded**
# Branded Competitors < 1km	-0.417**	-0.165**	-0.251**
# Unbranded Competitors < 1km	-0.192	-0.095	-0.097

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

For the three specifications, the effect of competition of exclusive stations was stronger than that of independent ones. For example, for a particular location, four extra ex-

clusive competitors within a 1 km radius are associated with one less branded station. Meanwhile four extra independent competitors have no statistically significant effect over the number of branded retailers. This evidence points to differences in how demographic and competition variables affect the location and type choices of firms.

6 Estimation Strategy

To estimate the model presented in section 4 with the data described above, I first compute the entry probabilities for each location-type combination in the data using equation 6. For each census tract c, I set the center of the tract to be the mean position of all the retailers operating in that location. I then use this center to calculate to which distance band each competing location belongs, that is I compute the dummies $\mathbb{I}_{t,b}^{c,c'}, \forall c'$. Instead of solving the probabilities' system of equations I exploit the fact that the operator defined by equation 6 is a contraction.

To compute the probabilities I need $\mathcal{E}$, however, the expected number of participants is not observed in the data. I follow Seim (2006) and set $\mathcal{E}$ equal to the actual number of firms in the market and to compensate for this I calculate the market level shock ξ that matches the expected number with the observed one. Following equation 8 I can write

$$\xi = \ln(\mathcal{E}) - \ln(\mathcal{E} - \mathcal{F}) - \ln(\sum_k \exp(D_k\beta + (\mathcal{E}-1)\sum_t \sum_b \gamma_{t,b} \sum_{c'} \mathbb{I}_{t,b}^{k,c'} p_{c'}^*)) \tag{9}$$

This step makes use of the number of potential participants $\mathcal{F}$, I exogenously set this number to be a fixed proportion of the observed number of operating retailers, $\mathcal{F} = \alpha * \mathcal{E}, \alpha > 1$. Second, I make the following assumption on the distribution of the market level shock.

Assumption 3. *The market level shock ξ_m is i.i.d. with a normal distribution* $\mathrm{N}(\theta, \mu)$.

Given this assumption, I can use the calculated probabilities for each location-type combination and the probability of the market level shock to compute the likelihood function of the observed spatial distribution of retailers in each market, for each value of the parameters.

$$\mathcal{L} = \Pi_c \, [p_c^*(\beta, \gamma)]^{\#R_c} \, \Pi_m f(\xi_m | \theta, \mu) \tag{10}$$

In this last expression $\#R_c$ refers to the number of retailers in the location-type combination c. Then, I estimate the parameters by maximizing the likelihood function $\mathcal{L}$. Standard errors are calculated using bootstrap.

7 Results

7.1 Probit Analysis

Before presenting the results of the full model I focus on the contract choice at the retailer level. That is, I take as exogenous the retailers' location choices and study the binary type choice. In table 6, I present the results of a probit analysis of retailers' exclusivity status. In this specification, I control for demand proxies and potential competition effects.

As can be seen in the table, the presence of more unbranded stations is associated with a lower probability of entering the market as an exclusive retailer. Conversely, more branded stations in any one of the distance bands are associated with a higher probability of choosing to be exclusive. These results seem to indicate that a simple model is not able to appropriately explain retailers' contract choices and that the strategic behavior of the stations must be accounted for with a more complex and structural approach, as the one presented below.

Table 6: Exclusivity decision: Probit Analysis

Variable	**Coefficient**	**(Std. Err.)**
Population	-0.012	(0.008)
Income	0.123**	(0.030)
# of Unbranded < 1km	-0.055*	(0.028)
# of Unbranded < 5km	-0.025**	(0.003)
# of Unbranded < 10km	-0.010*	(0.004)
# of Branded < 1km	0.017	(0.016)
# of Branded < 5km	0.012**	(0.002)
# of Branded < 10km	0.007**	(0.002)
Intercept	0.243**	(0.077)

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

7.2 Structural Model

In this section, I present the results of the model's estimation. As demand proxies, I use population in two different distance bands, and mean personal income at each location. In addition, I consider competition effects in four distinct radii around each location: 1 km, 3km, 10km and more than 10km.

Table 7 displays the parameters' estimates. Population is measured in units of 10 000 people. The results show that population positively affects profits for both independent and exclusive retailers, and that this effect is 17% stronger for exclusive stations relative

to independent ones. However, a higher population in any one of the two distance bands considered has a negative effect over profit. Even though this is counterintuitive, the effect of population in neighboring locations is small relative to the one of the location's own population and these coefficients are very unprecise and not significantly different from zero.

Table 7: Estimation Results

Variable	**Estimate**	**Std. Error**
Income	673.01	94.77
Income $*$ Exc	267.53	74.76
Pop_{0km}	216.76	49.43
Pop_{0km} $*$ Exc	37.23	17.13
Pop_{1km}	-25.48	23.05
Pop_{1km} $*$ Exc	25.01	22.1
Pop_{3km}	-20.75	22.94
Pop_{3km} $*$ Exc	2.2	2.78
γ_{1km} $*$ Exc	-13.38	11.72
γ_{3km} $*$ Exc	-25.49	26.09
γ_{10km} $*$ Exc	-239.52	129.96
γ_{+km} $*$ Exc	-320.26	173.72
γ_{1km}	-37.48	42.52
γ_{3km}	45.56	38.53
γ_{10km}	108.13	94.31
γ_{+km}	144.94	121.47
μ	-1.4	1.2
σ	0.03	0.03

Income is measured in units of 1000 *reais*, and it positively affects profits. For exclusive retailers the income coefficient is 40% bigger than that of independent stations. The competition effect varies significantly between branded and unbranded stations. The presence of exclusive competitors in any one of the distance bands has a negative impact on profits. However, for independent stations the competition effect is positive outside of the smaller distance band of 1km. This could be due to the fact that the model cannot fully explain the firms location choices. Therefore, the model associates a higher profit with location that have more retailers.

To better illustrate the effect of the demand proxies over entry decisions, I compute the elasticity of the location's probability to changes in population and income. In figure 4, I plot the mean variation in the location's entry probability, in response to increases in population.

As expected, a higher population has a positive effect over the entry probability and this effect is stronger for exclusive locations. For example, a 30% increase in population

implies a 20% higher probability of entry; in contrast this same shock over population only increases the probability of entry in independent locations by 17%.

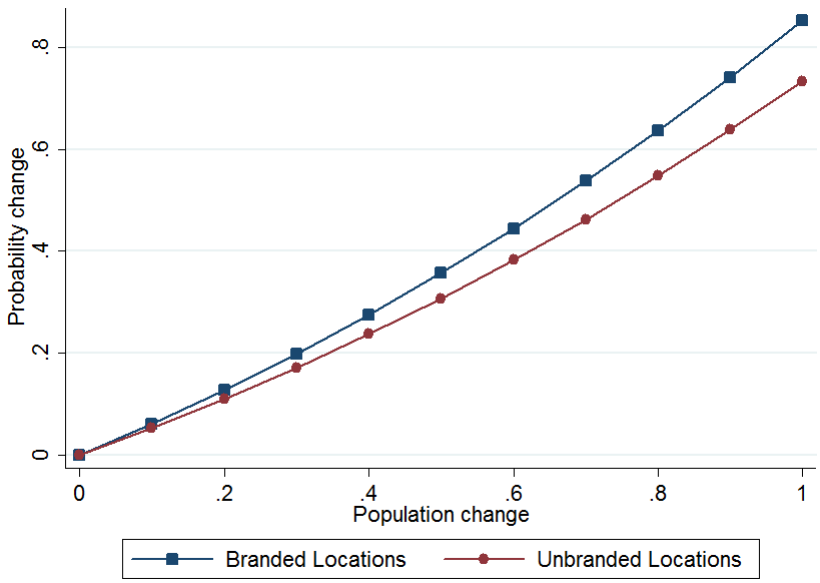

Figure 4: Population-Probability elasticity

Figure 5 presents a similar analysis for income. For exclusive locations, a 70% increase in income translates into a 10% percent increase of the entry probability. An equivalent shock in an independent location increases the entry probability only in 7%. Table 7 also presents the estimated parameters of the market shock distribution. One interesting thing to be noted is that the model predicts a small standard deviation of the market shock.

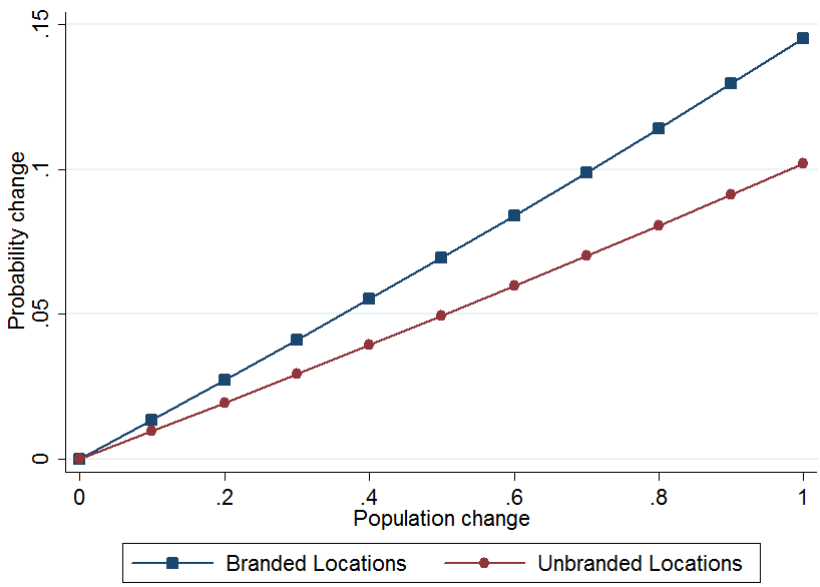

Figure 5: Income-Probability elasticity

8 Counterfactual Exercise

In this section, I present the results of the counterfactual simulations. Using the parameters presented in section 7, I calculated the expected number of market participants under two different scenarios. First, I considered a case in which firms can only enter as exclusive, but they can still choose the location within the market. Second, I considered an alternative scenario where retailers must be independent.

These two cases are relevant because they allow to understand which one of the two contrasting effects of exclusivity dominates (brand-value vs competition effect). To compute the expected number of entrants I used the following equation given by the model

$$\ln(\mathcal{E}) - \ln(\mathcal{E} - \mathcal{F}) - \ln(\sum_k \exp(D_k\beta + (\mathcal{E} - 1)\sum_b \gamma_{t,b} \sum_{c'} \mathbb{I}_{t,b}^{k,c'} p_{c'}^*)) - \xi = 0. \tag{11}$$

Using the data I can recuperate the market's shock that rationalizes the observed number of market participants, as explained in section 6. Given this market shock I am able to compute the left hand side of the previous expression for each $\mathcal{E}$. Then, the expected number of entrants will be the value of $\mathcal{E}$ that solves equation 11.

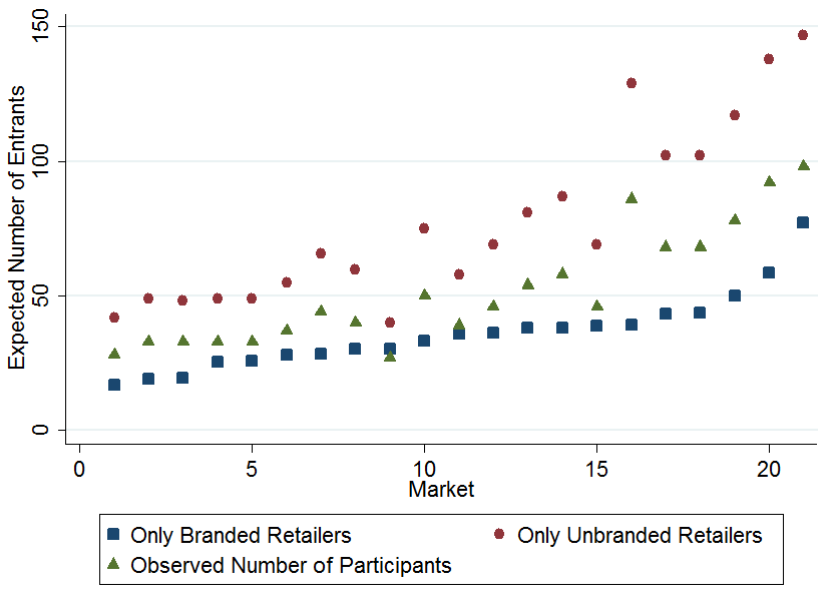

Figure 6: Counterfactual Results

In figure 6, I plot the expected number of participants for each market under the two distinct scenarios, and the observed number of stations[9]. For illustrative purposes, markets are organized from lowest to highest number of stations in the mandatory exclusivity

[9]The complete results of the counterfactual are shown in table 10 of the Appendix

case [10]. Each square represents the expected number of retailers in the case of mandatory exclusivity, and each circle directly above a square represents the expected number of retailers for that same market in the absence of exclusivity agreements. Triangles represent the actual number of retailers in that market.

The model predicts that under mandatory exclusivity a lower number of stations are expected to enter relative to the case where retailers must be independent. In fact, on average, the expected number of retailers in the independent case is more than double the number under full-exclusivity (116% more). In addition, the model predicts that the actual number of entrants would fall between these two extreme cases for almost every market. Meaning that the absence of exclusivity contracts would increase competition.

The parameters estimates presented in section 7 show two competing effects of exclusivity. On one hand, exclusivity allows retailers to extract higher profits from demand proxies. On the other hand, exclusive competitors have a stronger negative effect over profits, relative to independent ones. The counterfactual results suggest that, of the two previous effects, the latter dominates. Intuitively, this is what is driving the higher number of stations in the no-exclusivity case.

[10]For some of the markets I was not able to find the solution to equation 11, therefore the graph includes fewer markets than those included in the initial sample.

9 Conclusion

In this paper I explored the effect of exclusivity contracts over competition. I construct an structural model based on the existing two-period entry models literature and estimate it using data from the Brazilian gasoline industry. The results suggest that a retailer's exclusivity status can have a direct impact over its profits. It is possible that consumers give a positive valuation to the retailer's brand and that this is justifying the positive coefficient attached to the exclusivity-demand proxies interaction.

The parameters estimates also point out to differences in the effect that independent and exclusive competitors have over profits. The model suggests that the presence of more exclusive stations has a stronger negative impact over profits.

Finally, the counterfactual exercises indicate that exclusivity contracts diminish the expected number of market participants. The model predicts that a prohibition on exclusivity contracts would imply an average 50% increase in the number of operating stations.

It is important to note that the two-stage entry models, such as the one developed in this paper, have some limitations. First, the profit functions used in these models do not have a structural interpretation. They lack a pricing and demand function that could explain better what drives the profit of the retailers. Second, these models disregard any dynamic component of the entry decision. In practice, stations can change their type (independent or exclusive) over time and a more complex dynamic model could exploit these decisions to gain information about the retailers' profit.

A potential avenue for future research is to construct and estimate a more complete model of the industry that allows to better understand the effect that exclusivity has over the retailers' profits. That is, a model that takes into account aspects such as the consumers' choice between different stations and the brand choice that stations make. This type of model would help to shed light on the consequences of exclusivity contracts.

At the moment, I am in the process of collecting data on contracts characteristics and quantities sold at the retailer level. I hope that this data permits the estimation of a more complex model of the industry.

References

Asker, J. (2005). Diagnosing foreclosure due to exclusive dealing. Unpublished Manuscript.

Ayres, A. J. S. and T. A. de Freitas (2008). Análise do mercado de combustíveis no brasil e no rio grande do sul. Unpublished Manuscript.

Bernheim, D. and M. D. Whinston (1998). Exclusive dealing. *Journal of Political Economy 106*(1), 64–102.

Bloomberg (2014). Pain at the pump: Gasoline prices by country. Available at http://www.bloomberg.com/visual\discretionary{-}{}{}data/gas-prices.

Bresnahan, T. and P. Reiss (1990). Entry in monopoly markets. *Review of Economic Studies 57*(3), 833–882.

Bresnahan, T. and P. Reiss (1991). Entry and competition in concentrated. *Journal of Political Economy 99*(5), 977–1009.

Chen, Y. and M. H. Riordan (2007). Vertical integration, exclusive dealing, and ex post cartelization. *The RAND Journal of Economics 38*(1), 1–21.

Cilberto, F. and E. Tamer (2009). Market structure and multiple equilibria in airline markets. *Econometrica 77*(6), 1791–1828.

de Meza, D. and M. Selvaggi (2007). Exclusive contracts foster relationship-specific investment. *The RAND Journal of Economics 38*(1), 85–97.

de Oliveira, D. P. and V. F. C. Maia (2012). Free competition and exclusivity clause in fuel distribution contracts. *Revista de Direito Administrativo 259*, 123–147.

Fumagalli, C. and M. Motta (2006). Exclusive dealing and entry, when buyers compete. *The American Economic Review 96*(3), 785–795.

Hastings, J. (2004). Vertical relationships and competition in retail gasoline markets: Empirical evidence from contract changes in southern california. *The American Economic Review 94*(1), 317–328.

Hastings, J. and R. Gilbert (2005). Market power, vertical integration and the wholesale price of gasoline. *The Journal of Industrial Economics 53*(4), 469–492.

Houde, J. (2012). Spatial differentiation and vertical mergers in retail markets for gasoline. *The American Economic Review 102*(5), 2147–2182.

Houde, J.-F. et al. (2010). Gasoline markets. *The New Palgrave Dictionary of Economics. Palgrave Macmillan, Basingstoke*.

Johnson, J. (2015). Anticompetitive exclusive dealing without exclusion. Unpublished Manuscript.

Lee, R. (2013). Vertical integration and exclusivity in platform and two-sided markets. *American Economic Review 103*(7), 2960–3000.

Mazzeo, M. J. (2002). Product choice and oligopoly market structure. *The RAND Journal of Economics 33*(2), 1–22.

Nurski, L. and F. Verboven (2015). Exclusive dealing as a barrier to entry? evidence from automobiles. Unpublished Manuscript.

Orhun, Y. (2013). Spatial differentiation in the supermaket industry: The role of common information. *Quantitative Marketing and Economics 11*(1), 3–37.

Petrobras (2015). Cadeia de comercialização e a composição dos preços. Available at http://www.petrobras.com.br/pt/produtos-e-servicos/composicao-de-precos/gasolina/.

Rasmusen, E. B., J. M. Ramseyer, and J. John S. Wiley (1991). Naked exclusion. *The American Economic Review 81*(5), 1137–1145.

Sampaio, R. and L. Sampaio (2013). Competicao entre postos de gasolina em pequenos municipios brasileiros: Uma analise a partir de um modelo de entrada empirico. *Economia Aplicada 17*(4), 579–598.

Segal, I. R. and M. D. Whinston (2000). Exclusive contracts and protection of investments. *The RAND Journal of Economics 31*(4), 603–633.

Seim, K. (2006). An empirical model of firm entry with endogenous product-type choices. *The RAND Journal of Economics 37*(3), 619–640.

Sinkinson, M. (2015). Pricing and entry incentives with exclusive contracts: Evidence from smartphones. Unpublished Manuscript.

Soares, I. (2015). Mergers under exclusive dealing: An empirical analysis of the fuel industry. Unpublished Manuscript.

Appendix

Table 8 presents the list of municipalities used in the estimation. It is worth noting that not all markets consist of one unique municipality, for example a single market is composed by Florianopolis, Palhoca and Sao Jose, because of their geographic proximity.

Table 8: Markets used in the estimation.

State	Municipality	# of tracts	# of stations
Alagoas	Arapiraca	12	33
Alagoas	Maceio	22	144
Amapa	Macapa	16	50
Bahia	Vitoria Da Conquista	13	37
Bahia	Feira De Santana	14	87
Bahia	Itabuna	14	33
Bahia	Camacari	11	28
Goias	Anapolis	10	58
Minas Gerais	Divinopolis	7	40
Minas Gerais	Governador Valadares	13	44
Minas Gerais	Juiz De Fora	14	68
Minas Gerais	Montes Claros	21	67
Minas Gerais	Sete Lagoas	13	37
Minas Gerais	Uberaba	16	75
Minas Gerais	Uberlandia	17	115
Mato Grosso Do Sul	Campo Grande	8	163
Mato Grosso Do Sul	Dourados	9	39
Mato Grosso	Rondonopolis	11	55
Para	Santarem	10	33
Para	Maraba	4	33
Paraiba	Campina Grande	20	51
Paraiba	Joao Pessoa	10	92
Piaui	Teresina	15	123
Parana	Cascavel	17	71
Parana	Ponta Grossa	15	59
Parana	Maringa	19	79
Rio De Janeiro	Campos Dos Goytacazes	8	83
Rio Grande Do Norte	Mossoro	13	43
Rondonia	Porto Velho	20	78

Table 9: Continuation: Markets used in the estimation.

State	Municipality	# of tracts	# of stations
Rio Grande Do Sul	Caxias Do Sul	26	97
Rio Grande Do Sul	Pelotas	19	68
Rio Grande Do Sul	Santa Maria	16	46
Santa Catarina	Blumenau	19	69
Santa Catarina	Florianopolis	46	102
Santa Catarina	Sao Jose	46	56
Santa Catarina	Palhoca	46	36
Santa Catarina	Joinville	29	105
Sao Paulo	Bauru	17	98
Sao Paulo	Franca	19	86
Sao Paulo	Marilia	10	46
Sao Paulo	Piracicaba	20	77
Sao Paulo	Presidente Prudente	12	65
Sao Paulo	Sao Jose Do Rio Preto	22	107
Sao Paulo	Sorocaba	20	105
Sao Paulo	Votorantim	20	16
Sao Paulo	Ribeirao Preto	19	155
Sao Paulo	Limeira	6	54
Tocantins	Palmas	7	27

Table 10: Counterfactual Results

	Expected Number of Entrants		
Market	**No Exclusivity**	**Mandatory Exclusivity**	**Observed Number**
1	41.745	16.785	28
2	49	18.997	33
3	48.147	19.707	33
4	49	25.539	33
5	49	25.779	33
6	55	27.95	37
7	65.879	28.507	44
8	59.798	30.364	40
9	40	30.506	27
10	74.947	33.337	50
11	58	35.946	39
12	68.912	36.189	46
13	80.802	38.133	54
14	86.961	38.243	58
15	68.951	38.967	46
16	129	39.198	86
17	102	43.439	68
18	102	43.774	68
19	117	50.173	78
20	138	58.733	92
21	147	77.252	98