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Opportunistic Behavior and Stability of Governances in Automotive Fuel Negotiations in the State of São Paulo (Brazil)

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Abstract: This article evaluates the factors that influence the opportunistic behavior observed in the automotive fuel distribution sector (ethanol and gasoline) and the way this behavior has affected the stability of transactions between distributors and retail gas stations in the State of São Paulo (Brazil). The methodology we adopt in this study is logistic regression. Contracts analysis showed good results in reducing opportunism through fuel adulteration (–68.6 percent), and enforcement by distributors proved effective in curbing opportunism through noncompliance with agreements. We also found that time in the market is a factor conducive to opportunistic behavior, while the application of higher prices is a factor that discourages opportunism.

Keywords: distributors, fuel adulteration, noncompliance, opportunism, retail gas stations

JEL Classification Codes: D23, C25, D86

The fuel distribution sector in Brazil has undergone numerous changes in recent years. One of the most important was the alteration in sectoral legislation that ended the monopoly of supply by five companies and allowed new companies to enter the distribution sector. More than 250 companies soon joined this market segment and about 190 remain today. Concomitantly, the new legislation allowed retail gas stations the choice to remain tied to a distributor or to operate independently. Thus, two main arrangements in this market remain unchanged: (i) hybrid governances for retail gas stations operating under contract and (ii) market governances for gas stations not connected to a distributor.

The main purpose of these alterations was to increase competition in the sector through these two fundamental changes. In fact, a result of the deregulation *was*

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increased competition in the sector, but it was not the only one. Deregulation also facilitated the emergence of the illegal fuel trade and tax evasion practices. Márcia Azanha Ferraz Dias Moraes (2002, 2004) estimate that almost one third of the volume of fuel sold illegally is subject to tax evasion and adulteration. Other authors, such as Mariana Rodrigues Pinto and Emilson Caputo Delfino e Silva (2004), go further stating that the sector facilitated not only fuel adulteration and tax evasion, but also gasoline and ethanol smuggling, as well as noncompliance with the exclusivity provision of fuel supply agreements, where these exist.

Secondary data on inspections produced by sectoral regulators confirm the existence of such opportunistic practices. These practices undoubtedly affect the way in which fuel distribution companies conduct their business. Thus, we focus on the study of opportunistic behavior in the state of São Paulo, which accounts for thirty percent of the gasoline and sixty percent of the ethanol sold in Brazil. In particular, we discuss the factors that may limit or enable opportunistic behavior. Our aim is to gain better understanding of how these elements have contributed to the (in)stability of relationships between distributors and retail gas stations insofar as it pertains to the structures of governance in the coordination of transactions.

The methodology we adopt here is logistic regression because it best fits the purpose of this research. We expect this systematic analysis of opportunistic behavior to contribute to future research in the area, as well as to substantiate agents' decisions concerning the control and monitoring of their commercial partners on a regional scale and beyond. Our hope is that these research findings will project the Brazilian experience into countries where the same dynamic occurs.

We place significance on this type of research because, although it is evident from a theoretical standpoint that opportunistic behavior exists and impacts decision-making agents, it is much more difficult to analyze the factors that actually reduce, coordinate, influence, and favor the agents' practice of opportunistic behavior. It goes without saying that there is significant public interest in the fuel distribution industry when it comes to a country like Brazil which has an enormous and growing number of cars and, an annual turnover of over U$120 million. In addition, the fuel distribution industry has multifaceted effects on the entire economy.

We divide the article into five sections, in addition to this introductory part. The next section presents a brief history of Brazil's automotive fuel production and distribution sector. Section three offers a brief theoretical review about opportunistic behavior, as well as its impact on the continuity of transactions, from the perspective of new institutional economics (NIE). Section four discusses the methodology we use in this research. Section five discusses the main results of our research. The final section presents our conclusions.

A Brief History of the Sector

In the mid-1940s, when Brazil's automotive fuel production and distribution sector began to develop, the production and distribution of petroleum-derived products was subject to strict state control. This condition persisted until the late 1990s, when the

industry was deregulated through liberal reforms and the exit of the state apparatus from Latin America's industrial production base.

Until 1993, only five companies had had permission to operate in the national fuel market (as producers or importers). The activities of these companies were strictly regulated, and retail gas stations were contractually bound to distributors, while the government practiced price-fixing that prevented free competition. Thereafter, the deregulation of the sector began.

Financial and operational requirements for the creation of fuel and lubricant distributors were eliminated by legislation. Thus, new national distributors were created and numerous multinationals entered the Brazilian market. The five groups originally operating since the 1950s underwent mergers and acquisitions, and today comprise the three major economic groups operating in this sector in Brazil. Together with about two hundred smaller companies, they operate in a competitive fringe that comprises about thirty percent of the national gasoline and ethanol market.

Another change was also fundamental to the market. It was the end of exclusive supply to gas stations pursuant to the advent of the white flag gas station (i.e., not contractually bound). As a result, there are gas stations that currently operate with or without exclusive distribution supply contracts. The end of price-fixing in the late 1990s further enabled competition in the sector.

In the midst of this process, there are reports about the emergence of illegal fuel trade and tax evasion practices. Moraes (2002, 2004) indicates that the end of gas station price fixing was followed by the emergence of illegal fuel trade through tax evasion and illegal fuel adulteration, which represented almost one-third of the volume traded. Pinto and Silva (2004, 3) further argue that "the emergence of non-contractually bound dealers and minor distributors in the market facilitated several illegal practices, such as fuel adulteration, gas smuggling, breach of exclusivity contract, and tax evasion."

It is impossible to know whether such practices, especially fuel adulteration, were already rampant prior to deregulation, since control of the sector dates back only to the 2000s. However, an analysis of data from inspection reports reveals patterns of such practices that are much more noticeable among groups just entering the market as compared to distributors who were already in operation.

Brazil's National Petroleum Agency (ANP) performs two main types of monitoring: (i) fuel quality and (ii) retailer compliance with agreements, with or without formal contracts. Inspection reports data from the last eight years show a significant drop in non-compliance rates, as well as an increase in supervisory action. The number of collected fuel samples practically doubled between 2003 and 2010.

The type of adulteration found in gasoline pertains to distillation alteration (i.e., addition of solvents to the fuel), excess amounts of ethanol added to gasoline, changes in octane rating, and other nonconformities involving the appearance and color of the fuel. For ethanol, the highest rate of nonconformity is in the alcohol content, which indicates an addition of water to the fuel. This nonconformity may be due either to the deliberate adulteration of anhydrous ethanol or to its improper handling, which may contaminate water-hydrated ethanol. The purpose of the

fraudulent addition of water to anhydrous ethanol for the production of so-called "wet ethanol" is tax evasion – notably, the ICMS tax – since the sale of anhydrous ethanol is more likely to be inspected than that of hydrous ethanol fuel.

According to the São Paulo State Public Prosecutor's Office, the difference stems from how taxes are collected, which – in the case of hydrous ethanol – are paid by an ethanol plant through levying a tax on invoices. Taxation on anhydrous ethanol, on the other hand, is deferred. That means, it is collected only when the distributor sells the product to the gas stations.

On the issue of brand loyalty, the ANP conducts surveys regarding the source of retailed fuels and publishes its findings. The agency calculates the rate of brand disloyalty based on the percentage of samples that lack invoices confirming the fuel source. In other words, these are fuels sold by a gas station for which it lacks invoices to evidence their origin. These invoices should be available as they are required by the law and must be furnished by agents upon inspection.

Theoretical Review

Institutional economics originated in the works of Thorstein Veblen, John Commons, and Wesley Mitchell. This comprised the "old institutionalism" that had long been left in the shadows of economic discussions, perhaps sidelined by other works or even by a lack of understanding of Veblen's seminal ideas. Later, another stream emerged, the "new institutional economics" (NIE), linked, above all, to the works of Ronald Coase, Oliver Williamson, and Douglass North. With NIE, institutional economics gained greater visibility and recognition, as illustrated by the Nobel Prize for economics awarded to Ronald Coase in 1991, to Robert Fogel and Douglass North in 1993, and to Elinor Ostrom and Oliver Williamson in 2009.

In a break from neoclassical economics, the "economic man" of NIE is not the same as that of mainstream economics. *Homo economicus* – the agent in full possession of information and of rationality for maximizing decision-making – has been replaced by the individual of bounded rationality and opportunistic nature in an environment characterized by uncertainty.

The concept of bounded rationality – introduced as an important element of the NIE by Oliver Williamson (1975) and developed by Herbert A. Simon (1957), Rudolf Richter (2001), and Douglass North (1990) – refers to the cognitive limitations of the individual who cannot always be a maximizer, even if he or she wished to be. The mental decision-making shortcuts routinely used by economic agents in the markets do not always lead to profit maximizing.

On the other hand, Williamson's (1985) opportunism – being the main focus of this article – refers to the avid pursuit of self-interest by the individual(s). In practice, opportunism involves a wide range of behaviors. It could include distortion of information, extreme forms of behavior such as lying, cheating, and stealing, as well as some more subtle behavioral transgressions such as distorting or omitting information. Opportunism also means failure to meet explicit or implicit commitments, and sloughing off or refraining from fulfilling promises and obligations

(Jap and Anderson 2003, in Lopes 2009). Thus, opportunism can be understood as a behavioral uncertainty that affects the setup of transactions, originating from the existence of information asymmetry, which gives rise to problems of moral hazard and corrupt selection (Kemp 2006).

The potential emergence of ex ante and ex post opportunism – that is, actions which, through manipulation or concealment of intent or information are aimed at making profits by altering the original configuration of the agreement/contract – can generate conflicts within the ambit of contractual relationships that govern the transactions between economic agents in the markets. When there is evident asymmetry of information – meaning that an agent possesses information not available to other parties participating in the transaction – there is sufficient inducement for the party that possesses the privileged information to behave opportunistically. This absence of motivation for efficient behavior favors opportunism and causes moral hazard.

Moral hazard thus refers to situations in which market participants cannot surveil the actions of another, so that the latter may resort to contractual breaches or omissions (Kotowitz 1987 in Fagundes 2009). In situations subject to moral hazard, therefore, one of the parties to the transaction may assume attitudes that affect the assessment of business value by other stakeholders. The latter are thus unable to monitor the actions of opportunistic agents (Kreps 1990) or to demand the perfect execution of business relations since the existing contracts are incomplete.

"[S]elf-interest seeking with guile" or human behavior as "calculated efforts to mislead, distort, disguise, obfuscate or otherwise confuse" describe opportunism (Williamson 1985, 6) However, to assume that opportunism is the only motivational force that drives decision-makers is an over-simplification, to say the least.

According to Maria Moschandreas (1997), not all individuals behave opportunistically, at least not all the time. Yet, it is a fact that some individuals may behave opportunistically at some times. In the context of this paper, the mere possibility that some individuals may behave dishonestly some of the time is considered sufficiently important for opportunism to strongly influence institutional design. Consequently, the response of Williamson's "new institutional economics" to these behaviors focuses on the model of hierarchical governance, since this structure has internal mechanisms to monitor work behavior and effort, measure performance measure, and control opportunism.

However, to recognize that not all individuals are inclined to act opportunistically all the time implies that other motives may be important as well, at least for some individuals and some of the time. This recognition raises serious doubts about the effectiveness of internal systems built upon the assumption of universal opportunism. We further argue that the consideration of opportunism, as defined by the NIE, contains very little to explain why this behavior emerges. Hence, there are distortions in the understanding of what control mechanisms remain effective in deterring opportunism, as the literature assumes that hierarchy is not always the best response to restrain opportunism.

Since individuals may have different motivations to behave opportunistically, efforts must be made to map the characteristics that potentiate or deter opportunistic behavior of both the agent and the institutional environment. In this regard, the response of an efficient setup of governance structures to minimize opportunistic behavior should be sought. Also, the selection of partners acquires new significance as a control monitoring tool, independent of the use of the governance structure (yet another controversial issue discussed in greater depth by Moschandreas 1997).

Considering that the existence of opportunism is variable in transactions and from individual to individual, the main problem to manage, as pointed by Williamson (1985), is the impact of opportunistic behavior on the transaction. From the standpoint of an opportunistic agent, his or her behavior will depend on endogenous components (those that drive or prevent the agent's opportunism), on the consequences of his or her opportunistic action for the transaction (such as rules, sanctions, and loss of reputation), and on the institutional environment in which the transaction is occurring. For example, the performance of a known illegal activity will depend on the penalties to which one is liable, and ultimately the possibility of impunity generates opportunism. In the Brazilian context, the slow and cumbersome legal apparatus often facilitates impunity (Aquino 2005, 38).

Research Methodology

We analyze opportunistic behavior using the *logit* model, which has been successfully employed in recent NIE studies to evaluate asset specificities and transaction costs (Athias and Soussier 2007; Bigelow and Argyres 2008; Brickley, Misra and van Horn 2006; Nagaoka, Akira and Yoshihisa 2008). Conceptually, the model follows the general specification used by Jonas Chianu and Hiroshi Tsujii (2004) for discrete choice models. Such is the probability of occurrence of event $j=Prob(Y=j)=f(X, \beta)$ (relevant effects or parameters), where Y is a binary variable indicating the success or failure of a qualitative variable, $Y=1$ indicates "yes," and $Y=0$ indicates "no." Taken jointly in a vector X, these factors explain the success of the event, so that:

$$Prob(Y = 1) = f(X, \beta) \ and \ Prob\ (Y = 0) = 1 - f(X, \beta) \qquad (1)$$

The set of β parameters reflects the impact of changes in X on the probability of success. Also, for mathematical convenience, we use the following logistic distribution:

$$\pi i = Prob(Y = 1) = \frac{exp(\beta`X)}{1 + exp(\beta'X)} \qquad (2)$$

Many applications have used this modeling. Binary choice models ("yes" or "no" models) are frequently used to estimate parameters by maximum likelihood methods. The model for binary choice to explain the success, called *logit*, is that of probability:

$$log\left(\frac{\pi i}{1 - \pi i}\right) = \beta^1 X^1 + \beta^2 X^2 + \beta^3 X^3 + \cdots + \beta n Xn \qquad (3)$$

which indicates the likelihood of success of an event, according to the influence of explanatory factors *1, 2, 3 ... n*.

The logistic regression model was most suitable for the purpose of our research and facilitated the interpretation of the findings. We defined the explanatory variables according to database constraints, indications in the literature, and information collected in the field about the sector by Luiz Fernando Dalmonech (2007) and Selene Souza Siqueira Soares (2012). These authors suggested the existence of explanatory variables that may favor opportunistic behavior in the retail fuel market. Thus, we tested five variables that could potentially influence contractual breaches, which are variables that may encourage or discourage opportunistic behavior at retail gas stations.

Supply Contract with the Distributor[1]

Retail gas stations, bound by contract to a distributor, are expected to show less opportunistic behavior, since the existence of a contractual mechanism is supposed to reduce opportunism given its restrictive clauses and safeguards against such behavior. Contracts presuppose the protection of assets specific to the transaction, which increases the risk for the distributor if the retailer engages in opportunistic behavior. However, the investment in specific assets potentiates mechanisms for preventing opportunism that, if successful, curbs behavior that may be detrimental to the transaction.

Distributor Market Share[2]

In this study, we assume that the higher the distributor's market share, the greater his power of enforcement, and the lower the chance for opportunism, given the risk of penalty. In fact, evidence indicates that larger companies have more organized structures, more specialized departments, and are part of organizations that exert pressure on the sector, including unions and associations. Thus, the objective here is to ascertain whether the distributors' higher market power does, in fact, reduce the risk of opportunistic behavior by retailers.

Size of the City[3]

The size of the city where a gas station is located indicates a proxy variable of the speed (turnover) of sales by the gas station. We assume that the larger the city, the

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[1] Binary variable, with 0 for retail gas stations without contracts and 1 for retail gas stations with contracts.

[2] Variable numerical average share of distributor sales of gasoline and ethanol.

[3] Discrete variable, 0 to 5, as the number of inhabitants: 0 for small cities (less than 10,000 inhabitants); 1 for small towns (between 10,000 and 100,000 inhabitants); 2 for medium sized cities (100,000 to 500,000); 3 for large cities (over 500,000 inhabitants); 4 for metropolises (over 1,000,000 inhabitants); and 5 for mega-cities (over 10,000,000 inhabitants).

higher the sales turnover, given that there are fewer gas stations per inhabitant. With higher sales turnover, there is less chance of being found in an irregular situation. Thus, the expectation is that opportunism is greater at retail gas stations in larger cities as compared to smaller ones.

Time in the Market[4]

Time in the market is a variable that presumably indicates the reputation of a gas station among its customers and among the distributors with whom the retailer negotiates. The assumption is that this variable is correlated negatively with opportunism. Retail gas stations that have been in the market longer presumably have had time to develop a good reputation among peers. This should reduce the likelihood of their engaging in opportunistic behavior since opportunism in the case of a reputable gas station could result in the loss of business on the market.

Sales Price[5]

The pertinent literature (SINDICOM 2010) indicates a direct relationship between price and quality, noting that the possibility of irregular fuel supply at retail gas stations with very low prices is greater. This variable will test whether opportunism does, in fact, occur at retail gas stations with lower prices. If the finding is that higher prices do discourage opportunistic behavior, there are two possible explanations for this. First, it may be that higher prices have to do with the transfer of the cost of monitoring and control of the transaction to the fuel price. Such a transfer would indicate that the financial burden of controlling the risk of opportunistic behavior in transactions ultimately falls on the product user's end. Second, the gains obtained through higher prices may be justified by the good reputation developed by a retail service station since maintenaning this reputation discourages opportunistic behavior. Thus, the higher price of the commercial gain will correspond to the good reputation built.

We used two databases to analyze opportunistic behavior: the Fuel Quality Monitoring Program (Programa de Monitoramento da Qualidade dos Combustíveis, or PMQC), and the Fuel Prices and Sales Margins Survey (Levantamento de Preços e and Margens de Comercialização de Combustíveis, or LPMCC). Whereas the former encompasses the universe of retail gas stations in the state of São Paulo (9,070 retail gas stations), the latter belongs to the competitor monitoring program, composed of a sample of 2,363 retail gas stations in the state. These two databases, PMQC and LPMCC, were set up by the National Petroleum Agency (Agência Nacional de Petróleo, Gás and Biocombustíveis, or ANP) in 2011.

Based on available secondary data, two types of opportunistic behavior can be analyzed that apply to both contracted and non-contracted retail gas stations: (1)

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[4] Number of years in the fuel market.

[5] Numeric variable given in monetary units (real R$ per liter).

Opportunism through fuel adulteration, indicated through a notification by the ANP of nonconforming fuel; and (2) opportunism through noncompliance with the agreement, indicated by purchases outside the exclusive business agreement and non-availability of purchase invoice during an inspection, or in noncompliance with the agreement. (The analysis of opportunism for gasoline and ethanol we do separately.)

We created the initial descriptive analysis, residual graphs, and the receiver-operator characteristic (ROC) curve using statistical software R (free software). We obtained estimates of the parameters and odds ratios through the use of statistical analysis system (SAS) software.

Results

Opportunism Through Fuel Adulteration

Using the database of retail gas stations supplied by the PMQC,[6] we found that the logistic regression model of the variable of opportunism by adulteration was significant ($p < 0.0001$), and the residual analysis was satisfactory. The stepwise method selected the model with the variables of contract, city size, and time in the market. We found market share to be statistically insignificant and, therefore, we excluded it from the model.

The likelihood estimators provided parameters for the logistic model estimated by the equation, where πi represents the probability of an entity i (in this case, gas station i) to behave opportunistically by adulterating fuel. The equation is:

$$log\left(\frac{\pi i}{1-\pi i}\right) = -3.85 + 0.06t - 0.57b + 0.75c5 + 0.15c4 + 0.50c3 + 0.21c2 - 0.50c1 \quad (4)$$

where b has a contract with a distributor; c is size of the city, varying from 1 to 5, where the retail gas station is located; and t is the period of time the gas station has been in the market, measured in years.

The estimated ROC curve indicated that the percentage of correct predictions of the model was 70.2 percent. We interpreted the values of these estimates using the odds ratio.[7] The interpretation of the data allowed us to conclude that the chance of a breach of contract through fuel adulteration (i) diminishes by 68.6 percent, on average, at branded retail gas stations and (ii) increases when the size of the city grows. In comparison to towns with a population of less than 10,000, the chance of a breach of contract through fuel adulteration increases: (i) by 656.3 percent in cities with a

[6] This database does not include price data.

[7] Odds ratio equals eb, where b is the *logit* coefficient. The interpretation of the odds ratio indicates the probability of a breach of contract, starting from a unit increase in the explanatory variable. The possibility of a breach increases or decreases by a factor given by the odds ratio or a percentage given by the equation: [(odds ratio−1)*100]. If the *logit* coefficient is negative, the odds ratio will fall within the interval between 0 and 1. Conversely, if the *logit* coefficient is positive, the odds ratio will be greater than 1.

population of over 10,000,000 (the city of São Paulo); (ii) by 359.4 percent in cities with a population of over 1,000,000; (iii) by 512 percent in cities with a population of 500,000 to 1,000,000; (iv) by 384 percent in cities with a population of 100,000 to 500,000; (v) by 186 percent in cities with a population of 10,000 to 100,000; and (vi) by 6.4 percent in each additional year the gas station remains in the market.

In analyzing the sample of retail gas stations given by the LPMCC database, we found that the logistic regression model of the variable of opportunism by adulteration was significant ($p < 0.0001$), and the residual analysis was partially satisfactory. The stepwise method selected the model with the variables of market share, time in the market, and price. The other variables were not significant for the model.

The likelihood estimators of the model provided parameters for the logistic model estimated below, where p_i represents the probability of an entity i (in this case, gas station i) of behaving opportunistically. The equation is:

$$\pi i = \frac{exp(11.37 - 3.47prG + 0.12t - 0.02Ms)}{1 + exp(11.37 - 3.47prG + 0.12t - 0.02Ms)} \quad (5)$$

where b has a contract with a distributor; Ms is market share; prG is price (the sum of ethanol and gasoline); and t is time in the market, in years.

Our interpretation of the data in this model led to the conclusion that the risk of opportunistic behavior involving fuel adulteration: (i) increases by 2.4 percent with each additional market share unit (in percentage points, p.p.); (ii) decreases by 96.9 percent, on average, with each additional price unit (R$100); and (iii) increases by 13.1 percent for each additional year in the market. The estimated ROC curve showed that the percentage of correct predictions of the model was 70.5 percent.

Opportunism Through Noncompliance with the Exclusive Agreement

We used the LPMCC database to assess the opportunistic behavior revealed by purchases outside the exclusive business agreement. We analyzed the data for gasoline and ethanol separately since the amount of retail sales and their production and supply structures differ considerably.

Opportunism Through Noncompliance with the Gasoline Purchase Agreement

We found that the logistic regression model of the variable opportunism by noncompliance in the gasoline market was significant ($p < 0.0001$), and the residual analysis was partially satisfactory. The method of stepwise selection of variables selected the model with the variables of market share and city size. The other variables were not significant in the model. The likelihood estimators of the model provided parameters for the logistic model estimated below, where p_i represents the likelihood of an entity i (in this case, gas station i) to behave opportunistically. The equation is:

$$\pi i = \frac{exp(-0.16 - 0.01c5 - 0.63c4 + 0.01c3 + 0.26c2 - 0.02Ms)}{1 + exp(-0.16 - 0.01c5 - 0.63c4 + 0.01c3 + 0.26c2 - 0.02Ms)} \quad (6)$$

where *c* is size of the city, varying from 1 to 5, where the retail gas stations is located, and *Ms* is the market share of the distributor.

Our interpretation of the data led to the conclusion that the probability of opportunistic behavior through contractual noncompliance in gasoline sales decreases as the city size grows. Moreover, in comparison to cities with a population of less than 100,000, the probability of opportunistic behavior through contractual noncompliance in gasoline sales decreases: (i) by 31.3 percent in cities with a population of over 10,000,000 (the city of São Paulo); (ii) by 63.3 percent in cities with a population of over 1,000,000; (iii) by 30.7 percent in cities with a population of 500,000 to 1,000,000; (iv) by 10.5 percent in cities with a population of 100,000 to 500,000; and (v) by 1.8 percent, on average, for each additional unit of market share (p.p.) The prediction accuracy of the model was 57.2 percent, representing an adjustment that was less satisfactory than the previous one.

Opportunism Through Noncompliance with the Ethanol Purchase Agreement

We found that the logistic regression model of opportunism by noncompliance in the ethanol market was significant ($p < 0.0001$), and the residual analysis was partially satisfactory. The stepwise method selected the model with the variables of market share, size of the city, and price. We excluded the other variables from the model. The equation is:

$$\pi i = \frac{exp(4.13 - 2.23prE + 0.07c5 - 0.66c4 - 0.12c3 + 0.27c2 - 0.01Ms)}{1 + exp(4.13 - 2.23prE + 0.07c5 - 0.66c4 - 0.12c3 + 0.27c2 - 0.01Ms)} \quad (7)$$

where *c* is the size of the city in which a retail gas stations is located, varying from 1 to 5, *Ms* stands for the market share of the distributor, and *prE* indicates the ethanol price.

Our interpretation of the data led to the conclusion that the probability of opportunistic behavior, through contractual noncompliance in ethanol sales, decreases as the city size grows. Also, in comparison to cities with a population of less than 100,000, the probability of opportunistic behavior decreases by 30.4 percent in cities with a population of over 10,000,000 (the city of São Paulo). Furthermore, the probability of opportunistic behavior decreases: (i) by 66.7 percent in cities with a population of over 1,000,000; (ii) by 42.5 percent in cities with a population of 500,000 to 1,000,000; (iii) by 15.1 percent in cities with a population of 100,000 to 500,000; (iv) by 1.2 percent, on average, for each additional unit of market share (p.p.); (v) and by 89.2 percent, on average, for each additional price unit (R$100). The prediction accuracy of the model was 59.8 percent. The adjustment of this model was also not very good.

Discussion of the Findings

Table 1 summarizes the results described in the preceding section. The results for each of the variables we analyzed separately, matching them with the results of the two databases discussed above.

Table 1. Table of Results

Factors	PMQC database	LPMCC database		
	Adulteration	Adulteration	Noncompliance gasoline	Noncompliance ethanol
Have a contract with a distributor	-68.6%	Not selected	Not selected	Not selected
Market share	Not selected	+2.4 for each p.p.	-1.8% for each p.p.	-1.2% for each p.p.
Size of the city	From +186% to +656% the larger the city	Not selected	From -31.3% to -63.3% the larger the city	From -30.4% to -66.7% the larger the city
Time in the market	+6.4 per year	+13.1% per year	Not selected	Not selected
Price	Not included in this database	-96.6% for each additional R$1,00	Not selected	-89.2% for each additional R$1,00
Residual analysis	*Satisfactory*	*Partially satisfactory*	*Partially satisfactory*	*Partially satisfactory*
Prediction accuracy	*70.2%*	*70.5%*	*57.2%*	*59.8%*

The expected result of this research was partially confirmed. The variable contracts was relevant in the first model and proved effective in curbing breaches of contract through nonconformity, according to the analysis performed with the PMQC. In the LPMCC database, contracts did not prove relevant to either of the opportunistic behaviors evaluated. The processed data suggest that the existence of a contract — and hence of specific assets in the transaction — has been relevant in reducing opportunism through fuel adulteration. It is noteworthy that these same factors have not reduced opportunism via purchasing outside the exclusive business agreement.

Market Share of the Distributor

The expected result was partially confirmed. The analysis found contradictory results in this variable's influence on the two types of opportunistic behavior under analysis. The results indicate that the power of the distributor in the market has served to reduce opportunism through noncompliance, thereby reducing purchases outside the exclusive business agreement, and is more efficient as the distributor's market share increases. As for opportunistic behavior through fuel adulteration, market share appears as an inducer, which contradicts the finding that contracts are effective in reducing nonconformity by almost seventy percent. (We deal with these two findings separately.)

We offer the hypothesis that the greater the distributor's market power, the greater his or her enforcement power. The fact that distributors deal with control of

contract breaches more intensely is expected since purchasing outside the exclusive agreement is a more serious commercial problem than adulteration, which can be dealt with by local inspection authorities rather than suppliers.

When a retail gas station maintains its exclusive purchasing channels, with internal quality control of fuel by the distributor, there is no reason to assume that irregular fuel sales may be occurring at retail units. Instead, if there is suspicion of malfeasance, keeping a control sample (a sample of the fuel that was sold to the gas station) would suffice to legally safeguard and vindicate the distributor. Also, there are some intermediate positions of control in place to ensure proper negotiations between distributors and gas stations. Formal contracts alone, for example, have been effective in reducing opportunistic behavior by adulteration, regardless of the distributor's market share. Thus, we could safely assume that contracts are a factor that reduces breaches through adulteration, simply due to the fact that entrepreneurs are attracted to open-contracted (or branded) gas stations. This hypothesis, however, was not tested in the present study.

Size of the City

The expected results were partially confirmed. The results again showed an inversion of the influence of this variable on the opportunistic behavior of retail gas stations. With regard to opportunism through fuel adulteration, our expectation was fully confirmed. In fact, the risk of fuel adulteration by gas stations in larger cities is higher, probably due to the higher sales turnover and the greater improbability of being caught in the act.

By contrast, it was surprising to find that the risk of fuel purchases outside the agreement is higher in larger cities as compared to smaller ones. The explanation for this may be the type of opportunism. The procedures for adulteration are less conspicuous than those involved in contractual noncompliance. Our belief is that in larger cities, the more frequent presence of distributors, given the frequency of deliveries, may inhibit the delivery of fuel from other distributors. This prospect is intensified by the distributor's market power and ability to use existing enforcement mechanisms to ensure that gas stations maintain the exclusive purchasing channel. In other words, a distributor relies on the existing public regulatory authorities to prevent fuel adulteration.

On the other hand, in smaller cities (with populations of up to 100,000), retail gas stations operate with smaller sales volumes, and also tend to be more closely "watched" by their customers. In less populated areas, customers are usually aware of the practices of retail gas station owners since residents normally know each other, often for many years. Likewise, the formal distributors' control over gas stations' purchasing outside of the existing agreement is probably less intense than in large cities since retail gas stations in smaller cities sell less fuel than retail gas stations in larger cities. In other words, there is a greater possibility of such an event occurring (purchasing outside the contract) and being ignored by the distributor in smaller cities as compared to larger cities.

Time in the Market

For this variable, the expected result was not confirmed. In the two databases, the variable was correlated positively only with fuel adulteration, contrary to our initial expectation. This finding suggests that time in the market increases the agent's knowledge about the dynamics of the sector and the possibilities of malfeasance.

On the one hand, it is possible that time in the market is not sufficient to consolidate the reputation of agents. In that case, remaining in the market is a factor that enables opportunistic behavior and increases the probability of its occurrence. Alternatively, time may be, in fact, conducive to building a reputation. Once reputation has been established, however, the agent may feel free to engage in opportunism by adulterating fuel to turn higher profits. Considering the consumer's difficulty in evaluating fuel quality, such transgression would not result in a decline of fuel sales to loyal customers, at least in the short term. These two possibilities contradict our initial assumption that the longer the time in the market, the less likely it is that agents would engage in opportunistic behavior. The variable of contractual noncompliance proved to be statistically unimportant.

Sales Price

The expected result was confirmed. With regard to the sales price, our findings suggest that higher fuel prices present a lower risk of adulteration. As for opportunism through contractual noncompliance, prices only affect ethanol sales and not gasoline. This was expected since non-contractual purchases are easier when it comes to ethanol as compared to gasoline due to the structure of the ethanol supply chain. Hundreds of ethanol plants throughout the state of São Paulo are involved in the distribution of ethanol, whereas gasoline is limited to three oil refineries only. Notably, the possibility of a parallel (gray) market is more common in the ethanol market as compared to that of gasoline.

The two explanatory hypotheses for the phenomenon are not robust when we analyzed the correlations of the price variable with other variables that could support these explanations. First, since higher prices stem from transferring the costs of transaction monitoring and control to the fuel price (which indicates that the burden of opportunism risk is ultimately borne by the consumer), one would expect a high correlation between prices and contracts or between prices and market share, because the cost of monitoring and control essentially involves the transactions between distributors and contracted retailers. However, this does not appear to be the case since the calculated correlations are low, 0.37 in both cases.

Second, we assumed that the gains obtained through higher pricing are justified by the good market reputation of the retail gas station and that preserving this goodwill discourages opportunistic behavior. If this alternative is confirmed, reputation would not relate to the time a gas station has been in the market since the correlation between time and price is statistically insignificant, 0.07.

It is possible that simply maintaining high pricing would suffice to discourage opportunistic behavior, due to the commercial dynamics of maintaining the expected margins and profitability, without the need to involve reputation-keeping. If gas stations behave opportunistically – whether through diluting fuel with cheaper products or by purchasing fuel outside formal agreements to reduce costs – the opportunistic agents are making use of assets specific to the transaction to sell fuel that does not correspond to that transaction. By doing so, these agents defraud the business relationship by publicizing one company's trademark, while selling another's. Considering the high risk of opportunistic behavior in the sector, the next section facilitates the discussion by dividing the analysis according to governance structures, with and without contracts.

Transactions Governed by the Market

Opportunism Revealed Through Fuel Adulteration

When a retail gas station acts opportunistically and adulterates fuel, it will only be penalized if it is caught in the act. The gas station must present the purchase invoice from the distributor with which it negotiated, and the distributor is then served with a lawsuit by the ANP, to which it must respond. It is the distributor's responsibility to keep material evidence that corroborates the quality of the fuel. Otherwise, the distributor will be solely liable for the sale of illegal fuel. If the distributor keeps a control sample (voucher), this suffices to maintain the stability of transactional relationships since opportunistic behavior by the gas station represents a low risk for the distributor. The operating cost of collecting and storing these control samples is very low, too, when compared to the fines and penalties associated with lacking proof of fuel quality. Moreover, episodes of this type may lead the distributor to cut off his or her commercial relations with a disreputable retailer. In these cases, maintaining the transactional stability is relatively easily.

Opportunism Revealed Through Purchases Outside the Agreement

Any fuel distributor can freely negotiate with a non-contracted gas station. Opportunistic behavior through purchases outside exclusive arrangements may appear whenever there is direct purchase of fuel through an earlier link or through links that do not belong legitimately to the supply chain, such as purchases directly from refineries or from agents not authorized to sell fuels. This opportunistic behavior is deleterious to the participants in the fuel distribution chain since it goes against ANP regulations. It also undermines competition between agents that meet their fiscal obligations and opportunistic agents that behave dishonestly. This type of trade implies tax evasion and illegal trade practices, and is ultimately injurious to consumers.

Transactions Governed Through Contract

Opportunism Revealed Through Fuel Adulteration

When a distributor becomes the victim of opportunistic behavior by its contracted retail network, main risk is the devaluation of his or her trademark in the consumer's opinion. When information comes out that a gas station of a given trademark sells adulterated fuel, the trademark inevitably loses its legitimacy in the eyes of customers, so its reference in terms of the trustworthiness of its fuels (which is an integral part of the trademark) will be questioned. This factor encourages distributors to improve their schemes for selecting business partners, their fuel monitoring and quality control policy, as well as their contractual safeguards.

Preventing opportunistic behavior necessitates the use of various strategies to limit fuel adulteration. The expected result is a strengthened trademark and improvement of a distributor's market position, combined with increasing sales. As an additional result, there is an increase in asset specificity in transactions with contracted retail gas stations, resulting mostly from closer relationships and tighter integration of distributors with their partners.

A distributor, victimized by gas stations opportunism, may aim at renewing or expanding her or her franchise network by signing up other agents, with which it may have had prior commercial relations and from which can expect less opportunistic behavior. On the other hand, it can be assumed that some distributors lack the economic/financial structure to expand their selection schemes, and to monitor and control their retail franchises. Hence, they will decide simply to maintain or rescind these transactions in view of the precariousness of their control mechanisms.

One could even assume that some distributors are not interested in solving these issues, provided that retailers' opportunistic behavior did not affect the legitimacy of their trademarks, or did not damage their reputation to any significant extent, or did not represent a significant loss for their commercial standing. In these cases, the distributors' behavior would not interfere in any way with reducing the opportunistic behavior of retailers. Thus, the responsibility of curbing opportunistic behavior would be solely delegated to the public spheres of market control and supervision.

Opportunism Revealed Through Purchases Outside the Agreement

When opportunistic purchases outside of the exclusive business agreement take place, there is a visible devaluation of the exclusive sales channel. From the distributors' standpoint, the devaluation of their exclusive sales channel slows the return on their investments in adapting the opportunistically behaving gas stations to the company's trademarks.

In response to this type of behavior, fuel distribution companies may increase their contractual safeguards and enforcement mechanisms, or may impel public

control and inspection agencies to activate their legal mechanisms of coercion. A third option entails making it public knowledge that certain retail gas stations are engaging in improper behavior, but negative publicity carries the risk of devaluing a distributor's trademark. Therefore, it may be more reasonable for distributors to make use of their internal control mechanisms rather than those of agencies.

Figure 1 (on the next page) summarizes our analysis of opportunistic behavior in the retail fuel market. We should note, however, that fuel adulteration and buying outside exclusive agreements are complex processes that may also be influenced by non-objective variables (not addressed in this study).[8]

Our overall findings when analyzing opportunistic behavior suggest the existence of high moral risks for agents, and confirm the presence of hidden information and behavior. The results show that contracts are only an initial reference of governance, and that additional monitoring mechanisms are needed to manage these agreements.

Final Remarks

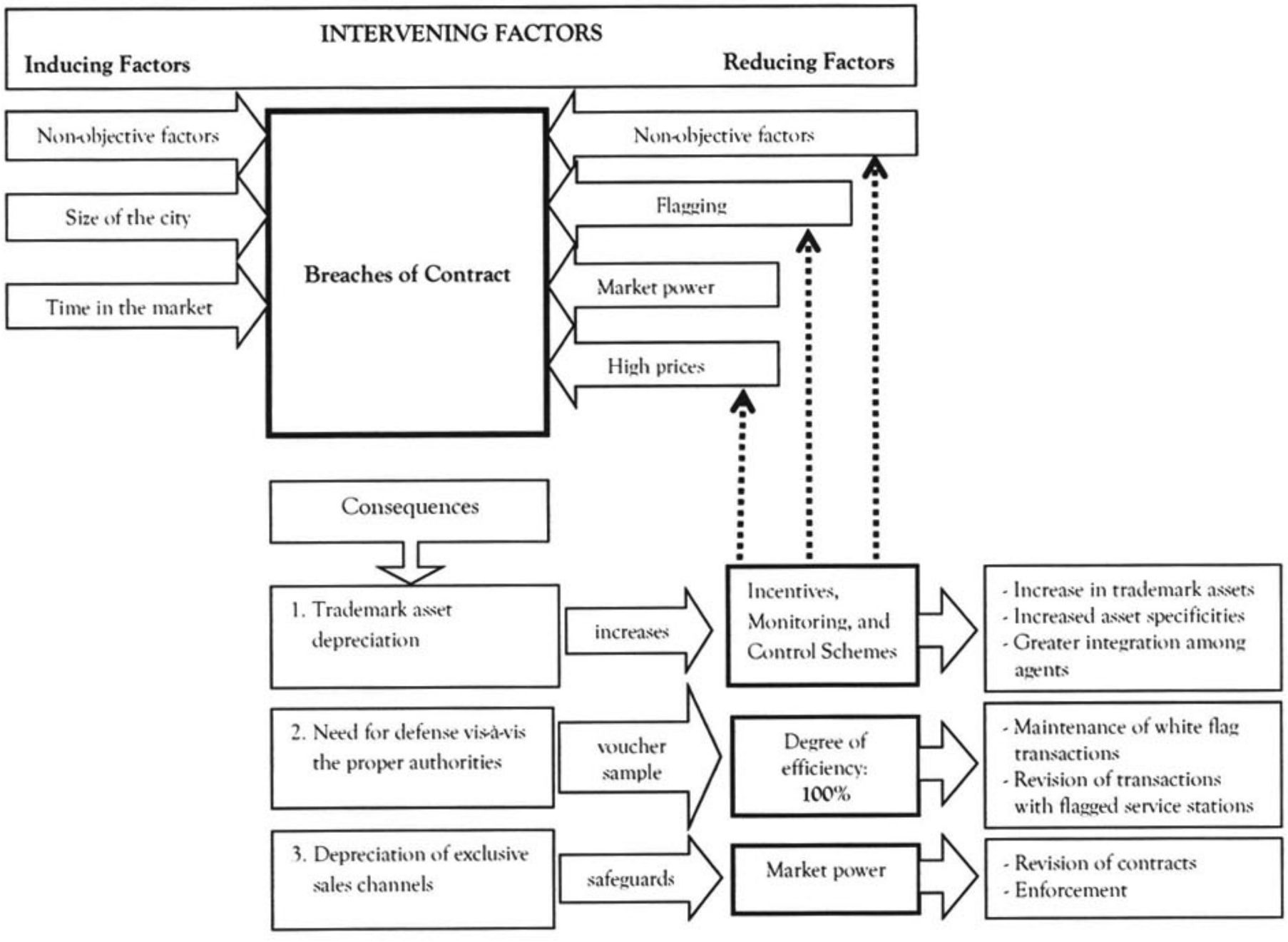
Clearly, dealing with opportunistic behavior in any sector is very difficult. This subject is particularly uncomfortable in this case as it involves behaviors mostly tied to dishonest and illegal practices. However, our review of the literature emphasized repeatedly the importance of opportunistic behavior and its consequences for markets not only in bilateral transactions, but also because of the negative impact these practices have on consumers.

The results suggest that the continuity of transactions depends, as hypothesized, on the impact of opportunistic actions on the agents involved in the transaction. However, our analysis revealed a possible difference between companies that engage in transactions with a few actors and companies that operate in a highly fragmented market, such as the market in the state of São Paulo.

Opportunistic behavior can generate an enormous damage to downstream operations, and not only to the operation being analyzed here (upstream). The transaction costs associated with a chosen governance structure correlates with the impact of opportunistic behavior (retailer-distributor) on the transaction that really matters to an agent (on the retailer-consumer end). That is why, it is important to further examine the evaluation of transaction costs and the forms of governance by means of a supply chain analysis. Assessment of linked transactions will clarify not only the importance of the link and its structure of power, but will also reveal any existing structural weaknesses that give rise to opportunism.

[8] Other issues we did not evaluate here include the personal characteristics of a gas station's owner such as life history and sense of responsibility or willingness to meet established standards.

Figure 1. Structure of Opportunistic Behavior



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