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Formation of the hydrated ethanol's prices in the combustible Brazilian market

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ABSTRACT

The current study investigated the formation of the hydrated ethanol in the Brazilian fuel market, comprising costs, scale economy and marketing, economical and social factors. The research provides comprehension and reflections about the market, explaining, by means of the multiple linear regression models that the prices paid to the producer, distributor and production costs. There are evidences relative by other variables, with low linear coefficient, that complemented with the quality analysis, guide and give complexity to the price formation. The tool Variable Analysis Statistics (Anova) made possible to identify the advantage of the price of the hydrated ethanol in relation to the gasoline C in the internal market. In this way, an extended reflection of the results permitted to analyze that the advantage of the hydrated ethanol usage in the Center-West region, occurs from variable fleet, distribution basis, tributes, production and number of producer mill. In relation to the prices paid to the producer, distributor and production costs as main explainable variable in the prices formation, there are evidences related by other variables, which for more that have been presented low linear coefficient, there ones have casual relation, if complemented with the qualitative analysis, the ones which, offer, demand, tributes and seasonality are, as examples, factors that guide and give the complexity to the price formation.

Keywords: *Ethanol, price formation, energy, combustible and sugarcane.*

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1. INTRODUCTION

According to the United Nations Conference on Trade and Development (UNCTAD, 2003), the clean/renewable energies can be classified as environmental goods, because they generate final energy starting from renewable sources and/or the clean/renewable energies can be classified as environmental goods, because they generate final energy from renewable sources and/or emit the least amount of substances such as carbon dioxide, carbon monoxide and sulfur dioxide in the atmosphere, among others. These new renewable sources include the modern biomass; small hydro; geothermal energy; wind power; solar energy; Navy and the plants sugar-energy industry responsible for the production of ethanol fuel.

In the studies developed by the Comissão Européia (2004), was recorded that the use of renewable energy, particularly the of origin in biomass, has the following advantages: reduction of greenhouse gas emissions, increase energy supply, sustainable energy generation in the long term, creation of employment opportunities, economic development located and reduction of imports of conventional fuels.

In Brazil, the production of biofuel ethanol arose due to the strategic actions government in the 1970s through the National Alcohol Program (PROÁLCOOL), with two principal segments: the development of sugar cane ethanol as fuel for cars and the development of engines powered 100% by ethanol, and later the flex engines.

One interesting fact is that all the efforts the surroundings of the automotive industry has awakened great discussions in the most different areas of knowledge, proportional to its market size: it is present in almost all continents; employs, in the world, more than 60 million people directly and indirectly; and grew by 30% in the last decade (OICA, 2008). These numbers allow you to confirm its absolute economic and social influence on the planet. The technological planning provided the sector added to commercial interests, productive, environmental, tax and distribution raises the hypothesis that the prices are increased in these situations, it is, in this study, investigate its actual mechanisms of formation and their respective comparative advantages in the internal market. The aim of this study was to analyze the formation of hydrated ethanol fuel prices in the Brazilian market, where the autonomy of decision between having to refuel with gasoline or ethanol is one-sided to the final consumer possessor of a flex vehicle, as a result of technological changes, demonstrating the strong competitive environment sectors of sugar ethanol fuels and vehicles.

To collaborate with this discussion, this work has the theoretical contribution about the formation of prices, costs and markets in the context of the supply and demand for ethanol. With this, has as specific objectives: identify the composition of prices and understand their differential mechanisms, so that the investigation of pricing consolidates in its economic order in the internal market to promote the decision between opt for hydrated ethanol fuel or gasoline C.

It should be noted that the study is limited in its object of examination by the temporal aspect, being that the reporting period reflects the setting of the moment, since it is possible to encounter other situations specific to the market of fuels, if possible on the market technological innovations with hybrid motorization. The statistical model of multiple linear regression used has its limitation, fitting a more qualitative analysis, particularly as regards the fine conditions market imposed on the sector, which are forward-looking and highly dynamic and impact on supply and demand.

2. LITERATURE REVIEW

Among numerous conceptual contributions about price, Ferrel et al (2000) claim to be this one the monetary expression of the value of a product or service, and can be broadly defined as the most flexible of the compound element of marketing. As a complement, Sardinha (1995) discusses that price is the only instrument by which the manager can get

better adjustment between supply that your company does to the market and the existing demand.

According to Dubois et al (2009), expenses relate to the purchase of a good or of a service that will result in a disbursement of the company. Typically, this is represented by the payment and disbursement takes place when the goods become the property of the company.

Therefore, should only be included in the cost of products or services the necessary inputs to the elaboration of these elements. In that it is the investment this represents all expense occurred in the acquisition of goods that will be stocked by the company until the moment of its use, that is, of their consumption. Based on the combined vision of the definitions on costs, one realizes that there is a gap between costs and expenses, despite both being spent.

According to Martins (2001), the hiatus is not characterized to understand that costs are expenses related to the sacrifices occurred in production processes, and expenses are expenses required to obtain recipes. Martins (2000), also brings another concept relevant in respect of costs. These conceptual approaches to motivate the understanding that companies should be aware about the different ways to understand costs. Since costs are likely to track and assess performance, whether in relation to its application or prevent the target cost to be met in a situation where it is estimated that there may be an increase in production.

Coelho (2009) considers that there are errors in pricing based solely on cost. Currently, the competitive environment requires greater dynamism Manager informational and precision decisorial. In this context, clearly understands the importance of price formation as a competitive advantage. To the author, it is necessary to know the difference between the price fixing and strategic pricing. At first, it is estimated only a mathematical value to give numbers to goods and services to be sold, having as parameters the costs. It is an exact calculation, a monetary expression. In the second, the company is able to better administer and coordinate the marketing variables and direct your endeavors to place profitably and permanent in the market.

It is clear that the pricing methodology should be understood as a strategic and competitive tooling, reasoned and consistent, anchored in: costs and accounting, finance and marketing aspects. With this, one realizes that the path to the price formation implies not merely index the cost and the selling price, but reassessing all internal and external factors involved.

2.1. Production Scale Economy

On the theoretical review made in Besanko et al (2000), the approach on economies of scale reveals the moment gets unit/cost savings as it increases the production of given product or service. These are defined in terms of declining average cost functions. Namely, when the company decides to increase production, whereas all inputs are variables, the best way to do it is by changing the scale of the operation, increasing all inputs in the same proportion. Pindyck et al (1994) have another concept called scale elasticity, which refers to the proportion of the variation in the level of the product when all inputs vary in proportion. Keeping everything else constant, the more substantial are the income scale tends to be companies in a particular industry. Typically, the processing companies are more likely to be growing income scale that service firms, because the transformation activity requires substantial investments in capital equipment.

However, regardless of the setting, the ideal is to know that the optimal scale of production occurs when you get constant returns to scale, that is, when the producer is operating with minimal cost (GARCIA, 2004). According to the author, the economies of scale measure the variation in production whereas all inputs used in the production process, i.e. a measure based on the production function, which describes the maximum amount of product that is technically feasible to produce with a given amount of inputs, when the company operates

efficiently, i.e. There is a technical connection. Hogendorn (1975) considers that, in large mass production industries, unit costs are relatively low in a large quantity produced. Thus, companies that achieve an increase in production volume without increasing their fixed costs will have increased economies of scale. The scale gain demonstrates the percentage increase in production when the company increases the volume of production inputs in a given percentage, while receiving a competitive advantage by reducing average costs.

2.2. Political factors in the marketing and price formation

For Bernardi (2010), forming prices becomes a political process because of the involved complexity and responsibility. The number of quality and quantity variables, uncertainties, probabilities and events to be considered and pondered, for its definition, is wide, involving internal and external aspects, interdependencies and systemic interactions.

The complexity is identified to the author on the basis of the prospective analysis of the variables on which the company has little or almost no control, such as: reactions of consumers, competitors, sensitivity to prices, consumption habits, patterns, growing supply and substitute products. The theoretical demarcation which is current, is that there is a policy on pricing, and structuring this pricing policy, today, means a constant challenge to habits, habits and customs, the assumptions and the *status quo.*

Price and demand, in most cases, are negatively correlated, i.e. If the price goes up, demand tends to fall or vice versa. Thus, the external factor based on market demand reflects the intensity with which the buyers want and are willing to pay for a particular item. Despite the demand depend on several factors, especially price (SARTORI, 2004). Additionally, the author also proposes strategies based on market demand, such as: price of exclusivity; establishment of low prices to stimulate growth and increase market share; establishment of price which puts the product in a relative position in relationship to the other, which expresses the relationship between its value and its price; broken prices and round, is the establishment of prices ending in particular digit; and the establishment of price that will create a desirable level of demand. To the author, in addition to external factors in the formation of prices, still the legal restrictions.

Governments can impose restrictions on increases in the prices of some products considered strategic or social. For this purpose, organs can be created with the specific function to analyze the costs and profitability of products and businesses, before authorizing a request for increase in price. Kotler et al (2005), still refer to the fact that the price be flexible because, well, it can be changed quickly, unlike product features contracts with distribution channels and the planned promotions. That is, the price also tells the intended value positioning market by a company for your product or brand. It is understood that the formation of dynamic features and pricing is a strategy of using different prices (suggested or flexible) in search of the best results in the market. Hence the price formation process represents a policy enshrining various methods that include internal and external factors.

2.3. Hydrated ethanol prices dynamic

The dynamics of hydrated ethanol offer contemplates a scenario widely favorable to the industry, and stimulate the increased processing power that helps to reduce further the cost of ethanol production. Its productive peculiarities and the fact of the sector to be deregulated are promoting the complexity, because it fails to align strategic objectives with the expectations of the Government and the population.

Such fact raises the need to develop a solid governance structure and, focused on competitiveness, meets the demands of the products we offer, in a sustainable manner for the business. Otherwise, the volatility will offer short of productive supply needs of the internal market for hydrated ethanol, resulting in recurrent fluctuations in prices, hence the need for gains in production scale.

The dynamism of the offer permeates on the conflicts of interest that are still checked in the productive sector on behalf of issues, due to the lack of organizational maturity, inherited from deregulation, allowing many agents leave to seek a joint planning of supply of raw materials, which may end up reflecting on oversupply of sugar or ethanol and, consequently, in frequent fluctuations in prices. On the other hand, the technological innovations develop alternative uses and ecological, that promise to come to the market and further depressing ethanol offer, since the raw material is the same: sugar cane.

The average production cost parameter to the producer is established by Consecana (2010), and is around 60%, to which parameterizes through a model that dictates the producer's remuneration, calculated monthly on the basis of the Total Recoverable sugar average kilogram (ATR), taking into account also the quality of the production mix of power plants and the prices achieved both on the domestic and foreign sugar and ethanol products.

Still within the dynamism of the sector, there are the considerations presented by Scandiffio (2005) noting that the consumption of ethanol is related to the size of the fleet (in greater intensity) and with the price of fuel (lower intensity). The increased consumption of ethanol depends on both the size of the fleet of flex fuel vehicles and ethanol-only cars, such as the relationship between the two prices: fuel ethanol and gasoline.

The high tax burden also provides the dynamism of prices, flexing a reduction in demand. This is because, currently, the Brazilian States have a different tax burden. With a uniform tax burden, more than 80% of *flex* car owners and exclusively ethanol, would supply their vehicles with hydrated ethanol, according to the estimates of ÚNICA (2010).

There are prospects for growth in domestic demand for ethanol: 55 billion liters until 2020, as MAPA (2010), accompanied by approximately the same amount to be offered. Disregarding the potential foreign market and without even estimating the chance if scenario even worse in terms of scarcity by possibility of ethene and farnesene if devote viable on alternative uses for the manufacture of plastic and diesel respectively, there is still the dynamism in the market for logistic conditions. According to Araújo (2006) the logistics activity in the distribution (and plants) gained importance after the logistics costs are no longer reimbursed by the Government and will be part of the formation of fuel prices; soon, the logistics efficiency has become a difference in competitiveness between the fuel distributors and the plants, implying in the differentiation of prices at resale. Currently, the marketing systems adopted by ethanol plants, after deregulation, have a logistics structure of phase of still existing Pro-alcohol. That is, there is technology in the automotive industry sector, with the flex engine, and energy, with productivity gains, but there was no structural development as for the distribution of fuels within the internal market, and this fact interferes in product pricing.

It is worth mentioning the price dynamics of hydrated ethanol constituted by the location of the producer units, which, in the year 2010, according to data from the Ministry of agriculture, livestock and food supply, producing units, with 437 being ethanol producing 168, and sugar and ethanol 253 (SINDICOM, 2010).

To Lopes (2009), the concentration of distribution companies in the market of fuel, added to the high number of ethanol-producing plants, directly influences the process of distribution of the product, giving greater bargaining power in negotiations with distributors and plants, therefore contributing to the price distortions among the various regions of the country. Thus, the high power that the distributors have makes that they can influence not only the behavior of producers (plants), as well as resellers (posts), minimizing transaction costs and prioritizing potential contractual or relational agreements rather than vertical integration, which can be extremely costly for the company.

Xavier (2008), also found in his studies that the average stock of fuel ethanol in distributors close to producing regions is equivalent to one week's consumption, while most outlying regions, producers centers this stock does not exceed four weeks of consumption, and therefore, in the off-season the impact on price rise is more sensitive. However, Feijó et al

(2008) highlight that consumers are extremely sensitive to the price differential between petrol and ethanol, and migrate from one product to the other quickly, with impacts on domestic ethanol demand. For Goldemberg et al (2008) the main determinant to the final consumer is the level of 70% in the relative price between hydrated ethanol and gasoline C.

3. MATERIALS AND METHODS

This study, as the definition of Moura (1978) is theoretical-empirical, type starting from a theoretical formulation and, later, confronting it with the real facts, through empirical observation. The integration of qualitative research with quantitative, according to Goldenberg (2005), allows the researcher to make a crossing of its findings so as to have greater confidence in their data, which are not products of a specific procedure or of any particular situation.

Richardson (1999) point out that, on quantitative method, the researcher will worry about objective measurement and quantification of results. In parallel, Godoy (1995) points out that the qualitative method provides a wide variety of working methods, analysis and presentation of results and various considerations regarding the subject. However, this traditional approach shows certain limitation when dealing with more complex problems in real-world situations with uncontrolled environments and confused, as is the case of the problem of this research about price formation of hydrated ethanol fuel. Hence the need to observe the quantitative method, and not just the quality, in an attempt to present the formation of hydrated ethanol prices.

The qualitative approach in this research is the premises that open interviews allow observation and holistic analysis of hydrated ethanol market. Because it is an open interview technique has its purpose, such exploratory aiming at detailing of concepts related to the differentiation of the price of ethanol and sugar ethanol sector. According to Lakatos et al (1991), the technique of open exploratory interviews meets the purposes, in which the interviewer introduces the theme, and the respondent has freedom to speak on the topic suggested. Thus, the method chosen for this research is qualitative, with an unstructured, exploratory methodology, which offers reflections and understanding of the context of the problem, being subsequently complemented with the quantitative method.

To carry out this study, primary and secondary data were collected. The first step was to search for secondary data. Cooper et al (2003) argue that the first step in an exploratory study is the pursuit of secondary literature. The methodological procedure in quantitative analysis used a multiple linear regression model in which the dependent variable is the price of ethanol on resale (petrol station), and the independent variables (explanatory variables) were: prices on the Distributor; price paid to the producer; price of gasoline C; number of resellers; ethanol production; freight; taxes on the final price paid at the pump; and hydrated ethanol production costs.

Thus, this research presents two phases supported by qualitative and quantitative methods. The first phase is – primary – is exploratory, supported by secondary data for a better understanding of the subject which is the explanatory variables of price formation; and the second phase – secondary - with quantitative data that contribute to the inductive analysis of the study.

It was done a multiple linear regression model to study the relationship between the dependent variable and independent variable, with the assumption that their waste has normal distribution with mean and variance (NETER et al, 1990: 11). The results were obtained with the aid of SAS® 9.0[6] software, through the *PROC RE.G*[7].

[5] SAS®9.0, represents a software integrated system which makes possible statistics analysis;

[7] PROC RE.G, is used to adjust a linear regression with several diagnostic options and several methods for the models selection.

The following assumptions were made for this research on the Brazilian market, by macroregions of the units (States) of Federation: H_0 (null hypothesis) - there is no significant relationship on the price differences between variables: hydrated ethanol and gasoline C; H_1 (alternative hypothesis 1) - there is a significant relationship on the price differences between variables hydrated ethanol and gasoline C. The H_1 hypothesis has made it possible to assess the magnitude and intensity of fuel prices in Brazilian hydrated ethanol, allowing later macroregions, associate possible variables that govern the formation and the explanation of differences in prices for hydrated ethanol.

4. RESULTS AND DISCUSSION

It is necessary to emphasize that the data presented in Table 1 include the averages obtained in the year 2009. The results of the statistical analysis are here understood as descriptive, by observing how the data set behaved through the tables, and values of p 0.05 > indicate that no differences between the compared objects, p values and statistical differences indicate 0.05 <. All independent variables were analyzed between themselves in order to verify that there is a strong correlation between them, from the respective analyses of behavior. Multiple linear regression analysis allows to say that were found correlations above 0.7 (moderate to strong correlation) between some independent variables. In this way, the regression model may have been hampered by a problem called multicollinearity, which is characterized by an independent variable be also explained by other independent variables.

Was verified, in the linear regression model, through the use of SAS® 9.0/PROC REG, the value of the factors of inflation , action of variance (VIF) which measures the degree to which each independent variable is explained by other independent variables. In this, it is possible to identify the highest values of VIF, and the corresponding variable that showed high correlation with the other independent variables, as intervener, was removed from the template.

Considering the model without the variable removed and checking again the VIF, it was found that the variable “n” was also committing the results of the model, being withdrawn. And so on were removed the variables until the VIF values were below 1.0. According to Hair et al (2005), the analysis of the correlation matrix allows you to identify variables with correlation less than 0,9 considered indicative of substantial limit collinearity. That is, to be the model, from the analysis of multicolinearity, were disregarded the variables that inflated the variance, given its strong correlation with the dependent variable, and the qualitative analysis their understandings and their relationship in the formation of hydrated ethanol prices in the resale, which accentuates, so its complexity.

Therefore, the following multiple linear regression model, the dependent variable (also called the response variable) is price: resale, and the independent variables (also called explanatory variables) are: price: Distributor; Price: Producer; Price: Gasoline C; Number dealer posts; Production: Ethanol; Freight; Taxes on the final price paid at the pump; Hydrated Ethanol Production and costs. The final model, with their estimates, is given by:

Table 1 – Prices model: hidrated ethanol

Price: Reselling R$ (l) = intercept **+** 0,67408 *price paid at the distributor R$ (l) **+** 0,22045 *price paid to the producer R$ (l) **+** 0,13882 *gasoline price C R$ (l) **+** 2,05E-05 *number of reselling posts **-** 4,9E-06 *hydrated ethanol production (10^3 m^3) **+** 1,32764 *freight R$ (l) **+** 0,25953 *FEE on the final price paid in the pump R$ (l) **+** 0,41461*hydrated ethanol producing costs R$ (l).

Notes:
a) Intercept is the price: Resale value when all values of the covariates are equal to 0 (zero)
b) 2, 05E-05 (scientific notation), means 0.0000205. After designed the multiple linear regression model, the following result:
For this model, the coefficient of determination (R2) obtained was 0.9706. This means that 97% of the variability of your data are being explained by the regression model covariates.

Also allows you to observe that all the explanatory variables were significant for the regression model, because they present p-value below 0,05.

Using the multiple linear regression, by quantitative analysis to describe how each independent variable explains the resale price of ethanol (response variable), got the results depicted in the Table 1, in which:
a-) The Price: Distributor, Price: Producer and Costs hydrated Ethanol Production costs are factors that influence the composition of the resale price of ethanol at a significance level of 0.05. The other variables do not have significant contribution, however noted that the variable: Shipping has a very high estimate, but your confidence interval is large and, therefore, has no significance, which may have occurred due to sample size. Freight would be more variable: viable significantly to the model, if the sample number was greater, which would decrease the amplitude of the confidence interval and find significance.
b-) due to the linear relationship between the independent variables with the variable response, it is possible to affirm that, for each unit of increase in independent variable, the ethanol price changes according to the estimates. € each unit increased in the price of a liter by the Distributor, the resale price increases in 0.67408, in the presence of all the factors that make up this regression model, i.e., in the presence of: price: Price: Gasoline Producer, C, no Posts, Resellers: Ethanol Production, freight, taxes on the Final price paid at the pump, Hydrated Ethanol Production costs. Also, the increased price of each real liter by the producer, the resale price increases in 0.22045 in the presence of: price: Price: Gasoline Distributor, C, no posts, resellers: Ethanol Production, freight, taxes on the Final price paid at the pump, Hydrated Ethanol Production costs. And so on for the other variables that have their respective estimates. It is worth mentioning that the value of the variable: Shipping estimate is also significant, contributing, and to the formation of the price; However, your level of significance is high, demonstrating the risk of assuming such a correlation.

5. FINAL CONSIDERATIONS

It was noted that there is a new configuration in the Brazilian market of hydrated ethanol fuel. This research demonstrates the complexity in the formation of hydrated ethanol prices in the internal market. Considering only the quantitative method and isolating the qualitative inferences concluded that part of the explanatory variables demonstrated in multiple linear regression analysis of influenced the composition of the resale price, so significant: the price paid to Distributor, price paid to producers and production costs.

A view from an analysis of multiple linear regression model, in which fifteen variables assigned by the literature review about the ethanol market provided an explanatory analysis for formation of hydrated ethanol prices in the resale, the model also contributed to reinforce that, in addition to 3 significant variables, there are others that also have their deterministic estimation in price formation as: taxes, production of hydrated ethanol, no gasoline price and resellers jobs c. Despite other variables also being aroused to the quantitative study behaved not statistically significant in its linear relationship by multicollinearity.

It was verified that the prices paid the distributors have strong explanatory relation in price formation of hydrated ethanol. These are exclusively responsible for distributing fuels in resale. Explain the formation of hydrated ethanol prices in the Brazilian market is more complex than accounting, as pointed out algebraic or also by literature review. The theoretical assumption proved to be adherent to this study, since market dynamics fuels binds substantially the supply and demand of both raw materials and hydrated ethanol.

The quantitative analysis has identified that, despite the existing complexity be expressive by reasons of supply and demand for hydrated ethanol prices are also formed significantly by the behavior of prices paid to the Distributor and producer, as well as for its cost of production at the plants. These three variables, identified in the study as the main explanatory variables in price formation of hydrated ethanol, meet the core problem proposed in this research, but should not be considered in isolation in understanding of

price oscillations. This is because there are other variables with estimation of linear relationship less significant, and that helps to explain the formation of prices, such as: taxes, production of hydrated ethanol, petrol price C and no jobs resellers. These variables affect the rates and enhance the reasons of different pricing practices in macroregions of the internal market.

The pricing is also constituted by the qualitative aspects of the ethanol market and affecting supply and demand, such as: tax differentiation, fraud, alternative uses of raw sugar cane, regulations, expansion of production, productivity, soil and climate, seasonality and even regional economic interests.

Under the qualitative point of view, it is concluded that the distribution, since the raw materials to the hydrated ethanol, assigns analytical capacity of relevance to supply the market, supply, and marketing mechanisms be clear among the agents. Accordingly, the need for a well-defined mechanism part of the challenge to establish a well coordinated and integrated strategic planning. It became apparent that the practice of differentiated pricing between the fuel stations, in addition to the quantitative findings observed in the market, there are also qualitative considerations, because the business relationship established between the distributors and resellers, resulting in interesting aspects of analysis of variation of prices, since some dealers have exclusive contracts on delivery of hydrated ethanol long-term agreement, whereas for others, there are options more advantageous acquisition between distributors. Both compete in the fuels market. However, the exclusive dealer, due to its high investment in the joint venture to meet certain contractual clauses and also by established business relationship with the Distributor, has its price paid for fuel increased at the time of supply, which is passed on to the final consumer, i.e. how the stock is dam to the Rotary Distributor and then resale, whatever the price taken by this is immediately transferred to resale, with which it has his pre-established business relationship in supply. In spite of mills and distilleries establish significant trade volume with the distributors that employ exclusivity in resale, other distributors take the same price passed the producer (plant or distillery), because this also has its own negotiations with producers on the *spot* market.

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