Time consistency in Competition Policy: Lessons from the Ethanol Industry

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Abstract: The goal of our report is to identify the possible effects that technological changes might have on Competition Policy analysis. Based on the current status of the Ethanol Industry in the US and Brazil, we suggest a way to define the Relevant Market in a hypothetical merger case. We conclude that the pace of penetration of flex-fuel automobiles is an important structural change and should be taken into account in order to preserve time consistency in decisions. Doing so, we expect to contribute to future cases that may arise in this and other sectors.
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Introduction

Nowadays, the relevance of Competition Policy analysis has substantially increased. The dynamics of the world demand policy makers to evaluate conduct in a broad variety of fields, each of those having its specific features and trends of development. Ethanol-producing industry has become one of the “hot topics” and has gained popularity in economic debate. Despite not becoming concentrated after a period of fast expansion, consolidation seems to be the logical next step of the sector development. Lately, several mergers have been observed in the press both in the U.S.A. and Brazil\(^1\) and very soon Competition Authorities might face cases in the sector or in one with similar characteristics.

The report intends to employ the theory from the Horizontal Merger Guidelines and apply it to the ethanol-producing industry reality. We try to evaluate how the relevant market definition should be addressed, following an industry structural change, i.e. the introduction of new technology- flex-fuel cars. The kind of change affects the consumer perception of the level of substitutability between two different fuels. We believe the topic of our project will become particularly important, given recent merger trends that might suggest the start of an oligopolization process and induce similar technological changes in other sectors.

The report is divided in two parts; the first part describes the characteristics of the industry- the draw of the chain, the flex-fuel technology and regulatory framework. The second part brings about the main theoretical context for assessment of the Relevant Market definition and applies it to the Brazilian and US industries.

1. The Ethanol Industry

In order to understand the impacts that the introduction of a new technology might have on a Relevant Market definition, and consequently Competition Policy, we are going to make a brief description of the characteristics of the industry and cite the main facts that marked the evolution of the sector in the last decade. Following, we present the new technology and its impact on the sector and finish by discussing the main issues of *ex-ante* regulation present in this industry.

1.1 Characteristics

Our report refers to Ethanol Industry as the sector of the energy chain engaged in production of alcohol to be used as liquid fuel, mainly in light automobiles. Ethanol is normally obtained through the fermentation of sugar cane, corn or soil and used by the final consumer pure (hydrous ethanol) or blended with gasoline (anhydrous ethanol). An important characteristic of these goods is that, as they might be perceived to be a secondary market of the automobile industry, their usage depends on the technology of the automobile used. The perception projects in a peculiar substitutability relation between the ethanol and gasoline, depending on the type of engine used.

The graph observed below presents a brief description of the main participants in the industry. It has, basically, four levels. *Upstream* we have the primary sector producers, and firms owned by individual producers (of different sizes) or vertically-integrated ethanol producers. A level below we observe the ethanol producers, the part of the chain we are going to base our Relevant Market definition analysis on. Normally, these plants are designed to produce both types of ethanol (hydrous and anhydrous) and in the some instances, i.e. Brazil- sugar and electricity. Further *downstream*, there are two levels of retailers, the primer and the final retailers (gas stations), usually or these are vertically-integrated or managed under franchising contracts.
As already mentioned, the usage of ethanol depends on the technology of the engine of the automobile. There are cars able to be powered with just small blended fuels (up to 25% of ethanol), others just with pure ethanol and a class of cars (flex-fuel) able to run with any mix of these fuels. Due to this fact, any analysis of the fuel industry should take into account the characteristics of the portfolio of cars of a certain country or geographical market. In order to deal correctly with technical issues and network externalities, it’s important as well to align the public policies in both sectors and not treat them in a separate way.

An interesting characteristic of ethanol industry is that ethanol, when blended in small percentages with gasoline, has a complementary relation with the fossil fuel. On the other hand, when sold pure, becomes a substitute. Overall, the complementarity, despite being imposed by government mandates, has a technical dimension. The ethanol improves the quality of the combustion of the gasoline in the engine (octane booster). The same result may be obtained by blending other additives obtained in the oil chain. The environmental concerns lead some governments to choose ethanol. These blending demands and the dehydration of the ethanol to less than 1% of water in its composition are important because the mixture with gasoline would not be otherwise stable. On the other hand, when purely sold, ethanol does not require the chemical

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3 Ibid
processing, distinguishing both products cost of production. In the next section we present a brief timeline of the industry's history.

1.2 The industry in the XXI’s century

Despite being implemented since the first automobile-creation attempts\(^4\) and being blended with gasoline since the oil shocks of the seventies\(^5\), the ethanol industry was rediscovered in the last decade of the twentieth and beginning of XXI century. Nowadays, more than 85% of the world’s production is concentrated in two countries, Brazil and the U.S.A., and several others already implementing their own policy or studying the fuel to be an alternative renewable source of energy.\(^6\)

In US, the Clean Air Act of 1990 imposed a series of environmental restrictions on octane boosters used by gasoline retailers, mainly on the MTBE (Methyl Tertiary Butyl Ether), which used to be the main usage rival of ethanol. The Act had a crucial impact on the industry’s development, but it had been the Energy Policy Act (EPA) of 2005 to mark the change in the dynamics of the industry. The EPA not only established the environmental restraints on gasoline additives, but also imposed a series of mandates on renewable fuel consumption and several direct and indirect subsidies to ethanol production. In the US the Act encouraged a large expansion and U.S.A. became the biggest producer and consumer center of the world, starting from a production of 7.5 billion liters of ethanol in 2002 to more than 50 billion liters in 2010.\(^7\) Almost 100% of the production is based on anhydrous ethanol blended with gasoline, E10, but recently there have been some experiences with flex fuel engines able to be powered with an 85% ethanol blended fuel, E85.\(^8\)

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\(^6\)Renewable Fuel Association, (2011)
\(^7\)Ibid
\(^8\)Cornforth, G. et al (2009)
The history of the sector in Brazil is different but, similar to US; the twenty first century marked a complete change in the dynamics of the industry. The first big ethanol-production program in the world began in Brazil in 1975, with the so-called Pró-Álcool, coming as a response to the oil price shock of 1974. The program established a blending mandate of 20% of anhydrous ethanol in the gasoline and fixed the price of the hydrous ethanol based on the already regulated gasoline price. The plan also created a series of incentives to car manufactures to produce ethanol-powered engine cars and guaranteed tax incentives to hydrous ethanol producers. The program worked well during the first years but the low oil prices in the eighties, together with the high sugar prices, made the producers switch the production from ethanol to the second, leaving thousands of consumers without ethanol in the gas stations, fact that created a huge reliability problem in the demand of the sector.9

Following the industry complications, the industry remained stagnated for several years. During the ninetieth, with the liberalization of prices in Brazil and the inflexion in oil price trend started changing the scenario. The blending mandate was reestablished and the market for anhydrous ethanol recovered fast, however, the sales of ethanol-powered cars never came back the level of the plateau achieved in the end of the past decade and the demand for hydrous ethanol continued to be stagnated. In the next section we will make a brief description of the technology and try to assess how it changed the Brazilian ethanol industry and conclude if the introduction of flex cars in 2003 became a factor to determine the trend inflexion in the sector.

1.3 Flex-Fuel

As previously mentioned, the introduction of the flex-fuel technology in Brazil characterized a reform in the Ethanol Industry. The flexibility provided by an engine that can be powered with both types of fuels at any mix level overcame important obstacles in the development of the sector, the problems of reliability

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9 Freitas, L. C. And Kaneko, S. (2011)
of the supply chain, seasonality of prices and lower performance on low temperatures could, now, be avoided by consumers using gasoline as perfect substitute.10

It is of substantial importance to mention that, despite the improvement in flexibility, flex cars have some weak technical performance features when compared to fuel specific engines. However, these affect the customer decision-making process when choosing the car to be bought and, once the choice is already done, he just minimizes the costs, given the possibilities he has. The graph below presents the evolution of the automobile sales on the Brazilian market since the introduction in 2003. It is clear that the flexibility represents an important issue on consumer’s decisions. In US the penetration of flex technology is still incipient. There is a big debate on whether it should be large scale implemented or not.

Graph 1 – Light vehicles sales in Brazil (1979-2010)

source: Anuário da Indústria Automobilística Brasileira 2010 - ANFAVEA

In the next section we are going to present an economic analysis of the main regulatory tools used in the development of the industry.

1.4 Market Regulation

There is common practice in renewable-energy sectors, including the Ethanol Industry, to be highly regulated from the very first steps. The most widely implemented tool governments employ is to create incentives in the sector; the blending mandate- the regulator establishes mandatory percentages of anhydrous ethanol to be mixed with gasoline (i.e., E10 in US and Gasolina C in Brazil). Tax incentives are also presented to suppliers in US and Brazil, and lastly, there is the US Import Tax to “protect” the market from imports.

The blending mandate is adopted in almost all ethanol markets. Governments impose a mandatory fraction of ethanol to be mixed with gasoline. The main purpose is to use a “clean” octane additive to gasoline, diversify the energy mix with a renewable source and reduce the dependence of imported energy sources. Despite not generating inefficiency losses, the mandates distorts the pricing method in the markets, gasoline and ethanol, and as result, higher prices might be faced by consumers. 11

An alternative way governments have adopted to manage the impacts mandates have on prices is to subsidize the sector through distortionary taxation. In U.S.A., the VEETC (Volumetric Ethanol Excise Tax Credit) is applied in the sector since 2004 and guarantees, nowadays, an incentive of $.12 for each liter of ethanol sold. Brazil has stopped subsidizing the sector at national level, but there are several states exempt from the normal regional taxation on liquid fuels, having in practice the same outcome. 12

Finally, the US adoption of a double Import Tax on ethanol has been intensively debated in the economic literature. Gorter and Just (2008) make a

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12 Gorter and Just (2009)
profound description on the economic impact of such taxation and whether it should be addressed as a subsidy to American producers. Goldemberg (2007) emphasizes the importance of international trade on the development of new markets, mainly with the emergence of new suppliers. In the next section, we are going to present the theoretical framework of Relevant Market definition and suggest how should it be applied to the Ethanol Industry.

2. The Relevant Market definition

To identify a potentially competitive concern raised from a merger, a clear market definition has to be specified. Moreover, the “delineation” of the market facilitates the identification of the relevant market participants and provides ability to measure “clear-cut” market shares and market concentration. According to Motta (2004) “…the relevant market should not be a set of products, which ’resemble’ each other on the basis of some characteristics, but rather the set of products that exercise some competitive constraint on each other”. He suggests the definition employs the direct effect of the ability and willingness of customers to substitute a product for another, given a price increase, erosion of quality or service on market dimensions. Another point of importance to competitive analysis would be the ability of suppliers to affect the definition of market.

Overall, Agencies tend to rely on a degree of flexibility in implementing the principles of market definition. These principles will be discussed in the following sections based on the new guideline for horizontal mergers of FTC13.

2.1 Product market definition

The product market consists of the relevant product, the product produced by a merging entity, and the substitutable products it competes with. To assess the relevant markets, Agencies employ technics as the Hypothetical Monopolist

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Test (HMT). The test helps identify the variety of products, realistically interchangeable with the relevant product. The test is performed as follows: a hypothetical profit-maximizing firm, not subject to any price regulation, and the only present and future seller of the products in the relevant market, would likely impose at least a Small but Significant and Non-transitionary Increase in Price (SSNIP)\(^\text{14}\) on a single or a multiple of relevant products, including at least a single product sold by one of the merging firms. The test adopts constancy of all other products not included in the candidate market. It applies to prices of products that would have been prevalent in the market absent the merger.

Overall, the test assesses the incentive to raise prices, depending on ability and willingness of customers to substitute away from products in the candidate market, a natural outcome of an increase in prices, and on the profit margins earned on those products. Reliable market evidence may give Agencies the ability to perform a “critical loss analysis”, and conclude whether at least a SSNIP on a single or multiple products in the candidate relevant market would raise or lower the profits of the hypothetical monopolist.

In the case of ethanol, the existence of two different products sold by firms should be considered. These are the anhydrous ethanol, normally used when blended in small percentages with gasoline and the hydrous ethanol, used in ethanol proportions exceeding 85% of the final fuel. At first, these may seem substitutable, but the degree of substitution depends on the characteristics of the automobile fleet of the country. In the US the penetration of flex cars is ongoing, and accordingly almost all production is directed towards anhydrous ethanol. In Brazil, however, since 2003 the great majority of new automobiles sold have been flex cars, resulting in a constantly increasing market share of hydrous ethanol compared to Gasolina C. These facts suggest a different price relationship between these fuels.

\(^{14}\) Ibid
To assess whether a hypothetical monopolist could exert market power in one of those two separate markets, the HMT should be performed. An alternative way to understand the relationship between these two types of fuel is to rely on the recent economic literature addressing the field. Monks and Luchansky (2008) estimate the supply and demand elasticity of the US ethanol market, taking into account the possible effect prices of gasoline may have on cross-price elasticity. They found that in the US market these goods are complementary and an increase in gasoline prices would decrease the quantity of ethanol sold in the market, complying with the expectation in the absence of flex-fuel technology.

In the Brazilian market, Freitas and Kaneko (2011) and Ferreira et al. (2009) estimate the same indicators with different methodologies. These studies try to analyze the impact of the penetration of flex-fuel cars on the relationship between the fuels. Both studies identify level of substitutability between goods, but indicate that the degree is still not substantial enough to make the prices converge to the technical ratio between both fuels. Another important finding is that the correlation between both fuels tends to increase with the penetration of flex-fuel vehicles, important empirical evidence that should be taken into account.

2.2 Geographic market definition

The field of competition to be affected by the merger may have a geographical dimension if geography limits some customers’ willingness and ability to substitute to some products, or some suppliers’ willingness or ability to serve some customers. Agencies assess the geographical dimension of the market taking into consideration data about cost of transportation. Furthermore, cross-border or long-distance trade may be affected by various other factors, including regulation, tariff and non-tariff trade barriers, language, custom and familiarity, reputation, and availability of service. International transactions are often conditional on fluctuations in exchange rates.

15 Ibid
There are instances when geographic markets may be based on suppliers’ location. The market includes the region from which sales are made. The geographic dimension of the HMT would require the firm, the only present or future producer of the relevant products and located in a specific region to impose a SSNIP from at least a single location, including at least one location of a merging party. The terms of trade for all products produced at a different location are held constant. The exercise does not take into account the location of the customer making the purchase. Agencies would rely on evidence from past shifts in purchasing patterns and derive conclusions about the appropriateness of the geographic definition.

Furthermore, geographic markets may be based on customer location. Competition arises between firms selling to customers in the delineated region. Again, there is no need for the supplier to be located in the geographic market. The HMT assumes a firm, the only present or future seller of relevant products to customers in the region, to impose a SSNIP on some customers in the specified region. The region would form a relevant geographic market if the price increase would not cause customers to switch away from the product or arbitrage. The exercise assumes all other terms of trade to be held constant.

The theoretical background allows us to move to the next part of our project and assess the relevant geographic ethanol production market. The assessment should include an evaluation of the possibility to import ethanol fuel from abroad. The countries of interest to us in the present report are the U.S.A. and Brazil. We are aware of the fact that both counties are able and do produce ethanol fuel at present. The relative ease of entry in the market, referred to in the 2010 Report on Ethanol Market Concentration of the Federal Trade Commission of the U.S.A. makes us believe these markets represent a relevant country geographical market. The conclusion may be further supported by the relevant regulatory framework observed in the countries of interest. The ex-ante regulation discussed earlier in the paper presents particular barriers to trade,
and accordingly does not allow for a broader definition of the geographical market, but a national one.

In the Brazilian case, given the fact that the country is a net exporter, it may not be the case of the market to be necessary broadly defined, but if it should be defined narrowly. Freitas and Kaneko (2011b) divide the Brazilian market in two regions with different socio-economic characteristics and analyze the pattern of the elasticity and cross-elasticity of ethanol under different flex-fuel penetration. The study concludes the differences in the car portfolio lead to different elasticity, suggesting a need for a more precise study to be made in order to define the accurate Geographical market.

2.3 Time consistency, how to assess the penetration of flex-fuel cars?

Freitas and Kaneko (2011) showed the importance the penetration of flex-fuel cars on a country’s portfolio has on the interaction between the prices of ethanol and gasoline. The more significant the level of penetration is, the more substitutable are the goods and, consequently, the more significant competitive constraint goods exert on one another. Without the penetration, if there is one car designed for each kind of fuel, the competitiveness between them is made ex-ante when choosing the car, and agents minimize expected costs.16 When introduced, the customer is free to choose between both fuels, taking into consideration the differences in the price per kilometer of each fuel, and so competition is much more dynamic and depends on the price per unit of energy relation.

In US, despite being available, the penetration of flex cars is still incipient, due to price difference between the automobiles. In order to assess the Relevant Market there, there should a probability inferred to the large-scale penetration of flex-fuel vehicles and if the probability is considerable, another question should be answered, this applied also to the Brazilian market.

16 Assuming same prices, quality, supply reliability and other determinants of consumer’s decisions.
Once the penetration of flex-fuel automobiles seems plausible, the pace of penetration and the effect on the market’s portfolio may be assessed, granting some intuition to the level of substitutability of these, and the effect on relevant market definition? By answering the question, the Agency would be able to know until when a merging entity would be able to exert market power on the ethanol sector “isolated”. Or in another situation, whether a merger between a gasoline producer and an ethanol producer involves substitutable or complementary goods producers.

2.4 Market participants, market shares, and market concentration

2.4.1 Market Participants

All firms earning revenue from operations in the relevant market should be considered market participants. Additionally, firms not being able to earn revenue at present, but committed to entering the market at a forthcoming moment, are also considered market participants. These may include market participants very likely to provide supply reactions with direct competitive impact as a result of a SSNIP. They are assumed not to incur significant sunk costs. The “rapid entrants” have the ability to supply into the relevant market in the short run.

2.4.2 Market Shares

The market shares are calculated for all firms that produce products in the relevant market. Agencies assess these based on historical data about revenues in the relevant market, the best measure of attractiveness to customers, and also take into account the likely effects of ongoing changes in the market conditions. Agencies specifically assess the competitive significance of substitutable products in cases of significant price dispersions, and ability and incentive for rapid expansion of production. Additionally, they would engage in an
observation of the predominant market conditions—contractual terms and strategic practices (network effects, two-sided market, etc.). The future competitive significance, given present performance of the firms in the relevant market would be the primary goal of the Agencies.

2.4.4 Market Concentration

The market concentration is a valuable indicator of the likely competitive effects of a merger. Agencies assess the pre-merger market concentration and the merger-specific effects on post-merger concentration. The assessment may include consideration of market shares but by all means has to evaluate the competitive effects to arise post-merger. These competitive effects would vary across industries. Agencies would consider the market shares across time and across market participants. By implementing the assessment, there would be a “clear-cut” standpoint developed about the number of significant market competitors. Overall, Agencies calculate the Herfindahl-Hirschman Index (HHI) of market concentration. The HHI represents the sum of squared market shares of individual firms. Agencies compare the pre-merger HHI to the one resulting from the merger. Agencies classify markets into three categories, based on the value of the HHI:\(^{17}\):

- HHI below 1500: Unconcentrated Market
- 2500>HHI>1500: Moderately Concentrated Market
- HHI>2500: Highly Concentrated Market

According with the same guidance, changes in concentration after a potential merger would imply:\(^ {18}\):

Small Change in Concentration: An increase in HHI<100 points is unlikely to have adverse competitive effects and ordinarily ➔ no further analysis.

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\(^{17}\) Horizontal Merger Guidelines: U.S. Department of Justice and FTC (2010)

\(^{18}\) Ibid
Unconcentrated Markets: Mergers in unconcentrated markets are unlikely to have adverse competitive effects and ordinarily ➔ no further analysis.

Moderately Concentrated Markets: Moderately concentrated markets, an increase in $\text{HHI} > 100$ potentially raise significant competitive concerns and often ➔ warrant scrutiny.

Highly Concentrated Markets: Highly concentrated markets, $100 < \text{HHI} < 200$ ➔ potentially raise significant competitive concerns and often ➔ warrant scrutiny. $\text{HHI} > 200$ are presumed ➔ enhance market power; the presumption ➔ rebutted by persuasive evidence showing that the merger is unlikely to enhance market power.

For the purpose of our report, we are not going to provide any detailed information about the market participant and their market shares, but base our conclusions on the assessed market concentration in the U.S.A and Brazil.

We have observed the report of the Federal Trade Commission on the concentration in the ethanol production market using the HHI. The calculation assumes the U.S. fuel ethanol production be a relevant antitrust market.\(^{19}\) The FTC does not take into account any assumption to broader or narrower the relevant geographic market. Furthermore, FTC does not include any other gasoline blending component. The HHI values calculated by the FTC have been based on a series of assumptions, and accordingly vary. For the purpose of our report, we would consider the relevance of these assumptions, and the likely implications on our hypothetical merger assessment.

Assumption: Concentration measured with market shares based on production capacity

The production capacity provides useful information about the producer’s competitive significance. To put it in a different way, how may the available resources of a company affect the competitive processes in the industry in the

\(^{19}\) Report on Ethanol Market Concentration (2010)
short run? The results present a value of 288 for the HHI. These suggest an unconcentrated market, and alleviate any potential merger implication.

If we take a look at the downstream market, the firms marketing the ethanol, and attribute the capacity of the producer to the respective marketing firm, the HHI increases to 606. Again, market is unconcentrated under the Horizontal Merger Guidelines.

Furthermore, given the specifics of the industry, the existence of pooling agreement, another calculation method may be employed. A pooling agreement suggests the marketing firm sells the clients producers’ volumes in common. In general, these marketers make sales to clients by assigning a particular plant or plants to serve the specific needs of the specific client. The HHI calculated on the basis of producer capacity assigned to a specific third party, engaged in a pooling agreement, produces a value of 343.

In summary, concentration with market shares based on production capacity indicates the U.S. fuel ethanol production market is unconcentrated.

Assumption: Concentration measured with market shares based on actual production figures

The data about actual production volumes represents a valuable insight to industry concentration. To certain extend, actual figures provide more precise information. Operation at capacity may be hard to achieve, even though industry observers tend to assign as much as 10 to 15 percent improvement in capacity of generation units, following the learning curve assumptions. The actual production figures miss on certain issues, including entry and exit of firms, construction, but at the same time not put into exploitation of new capacity, and utilization. The HHI resulting from actual production market shares assigned to individual producers is 244. The HHI from actual market shares of marketers is
And the HHI calculated on the basis of actual market shares of pooling agreements is 304.

All the above supports the conclusion the U.S fuel ethanol production market is unconcentrated.

The data for Brazil follows a similar trend. The concentration measured with market shares based actual production figures assigned to retailers suggests the Brazilian ethanol market is unconcentrated. In none of the years from 2000 to 2009 does the HHI exceed 1,500.²⁰

The data on concentration from the U.S.A and Brazil suggests there may hardly be any competition policy concerns, resulting from a hypothetical merger in these industries. There has to be a consideration, however, of the vulnerability of the sector. Industry bankruptcies, alike those in 2008 and 2009, resulted in producers idling the plants, and the prices of ethanol in the U.S.A rising, consequently. Events of the kind may cause an increase in concentration, following acquisitions of idled plants, and possible industry restructuring.

The combination of industry shocks and penetration of flex cars may result in a need for amendment of principles of competition policy in merger assessments. These may include some features of the ex-ante antitrust evaluation, i.e. need to assess the future in order to derive conclusions about the likely impact of a merger between different portfolio fuel producers.

Conclusion

Understanding the impacts technological changes might have on Competition Policy assessment is not an easy task. The Ethanol Industry provides an interesting example, where the introduction of a new line of cars able to be powered by different fuels, changes completely the substitutability

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²⁰ Beiral (2011)
relationship between gasoline and ethanol. In this report we aimed to analyze how should a proper Relevant Market definition be made in a possible merger case in the sector.

As common factor in the energy industry the product market definition should be based on the consumption usage pattern and not on the physical characteristics of the fuel. Also common in the energy sector, transportation costs plays an important whole and should be taken into account in the geographical market definition. Another important feature in this sector is the fact that flex-fuel cars change the perception of substitutability of consumers between gasoline and ethanol, making the analysis of its penetration in the market portfolio a crucial point in the sector analyzes.

To assess it properly three questions must be answered:

- How probable is the flex-fuel cars penetration?
- How fast may the penetration be?
- What level the penetration would be enough to put both fuels in the same Relevant Market?

In conclusion we suggest that in US the relevant market should consider only ethanol producers once the penetration of flex-fuel cars does not seem probable at present. In Brazil we conclude that a proper analysis should be made on the renovation pace of the automobile portfolio and might be the case that both fuels could be put in the same relevant market. Geographically, the American market seem to be considered in national level, whether in Brazil a more precise study should be done in order to identify differences in the penetration pattern of flex-fuel-cars.
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