Chapter 12
Deregulation of the Sugarcane Ethanol Industry in the Late 1990s: The New Role of the Government and More Efficient Ways of Marketing

Through the interviews conducted, we gathered a considerable amount of information regarding the deregulation of the sugarcane ethanol industry in Brazil. We attempted to summarize the main results of our research by theme. Given the central question, which was to what extent could the government disengage itself from intervention in the industry, three major study questions emerged:

- *If the disengagement were only partial, what would be the new role of the government in the sugarcane ethanol industry, determined on the basis of an analysis of the new institutional environment and the existing market failures in the production chain, as well as on the basis of the new public policy objectives?*
- *What are the most efficient forms of transactions for the sale or purchase of materials and products, considering the characteristics of the markets for sugarcane, sugar, and ethanol, as well as the post-deregulation institutional environment?*
- *Which actors and power resources could influence the process of deregulation and the fate of the industry?*

The discussion of each question was made in light of economic theories relevant to the issues. In order to discuss the new role of government and the need for governmental regulation of the production chain, we sought to identify existing market failures by analyzing the characteristics of the markets studied and of the institutional environment on the basis of the industrial organization theory. Likewise, we used the principles of New Institutional Economics to analyze the characteristics of the markets and of the institutional environment in order to identify the most effective ways in which to market the inputs and the outputs of the sugarcane ethanol production chain.

To begin our analysis of the data collected, we identified the characteristics (of the institutional environment and of the markets) that were indicative of market failures, which could obviate the need for state regulation. We then synthesized the views of the interviewees regarding government intervention in each of the markets (for sugarcane, sugar, and ethanol). We also sought to identify the most efficient forms of transactions for the sale purchase of materials and products within those same markets. It is noteworthy that the vast majority of interviewees

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(approximately 89%) believed that it was impossible for the government to disengage itself completely from intervention in the sugarcane ethanol industry.

Diverse arguments for the partial disengagement of government were put forward, varying widely in the degree of interference that each considered ideal. Only three interviewees believed that the state should fully withdraw from the sector. Nevertheless, those same interviewees stated that, before the government disengaged from the industry, allowing market forces to act freely upon it, the fact that market price of fuel ethanol was not competitive with that of gasoline should be addressed through a tax mechanism.

The Characteristics of the Markets for Sugarcane, Sugar, and Ethanol: Market Failures, the Necessary Forms of Government Intervention, and the Most Efficient Governance Structures

The Sugarcane Market

In analyzing the market for sugarcane, using its characteristics to identify not only the most efficient forms of transaction but also the market failures, we noted a consensus among the interviewees (sugarcane suppliers, producers, legislators, and government officials) regarding certain characteristics of sugarcane production that distinguish it from that of other agricultural products:

- an extended, seasonal growth cycle
- perishability
- high transport costs

In terms of the most efficient forms of transaction in the sugarcane industry, we based our analysis on the work of Williamson (1985), seeking to identify the level of specificity of the assets involved (location, physical, human resources, and time), given that higher asset specificity translates to greater dependency among the parties involved. Therefore, the hierarchical relationships must be more efficient in order to regulate the transaction. In addition, we attempted to identify the changes that deregulation brought about in the institutional environment. According to Zylbersztajn (1995), such changes can alter the most efficient governance structures.

As previously mentioned, high transport costs preclude the shipment of sugarcane over long distances, the distance between the plantations and the production facilities having considerable influence on the cost of transportation, which is a significant part of the overall production cost. Therefore, the degree of locational specificity is high, thus imposing geographic restrictions on the market.

The temporal specificity is also important because of the perishability of the sugarcane (the product cannot be stored, has to be harvested at the optimal time, and cannot be transported over long distances), and the problems related to supply peak

at certain times. Without appropriate incentive mechanisms, most of the sugarcane would be delivered during periods when the sucrose content is highest (resulting in surpluses during those periods and shortages during others, thus making it difficult to plan and manage the use of manual labor and machinery in the harvesting and processing of the sugarcane).

The physical specificity can be considered high for sugarcane suppliers and processing facilities alike. For the sugarcane suppliers, although the assets available for production (machinery, land) can be reallocated to other crops, from the time of planting, those assets are "tied" to a sugarcane crop for at least 5 years. Because sugarcane has a long growth cycle, the first cane is not harvested until 12–18 months after planting, with annual harvests thereafter. On average, the significant investments made in planting, cultivation, and processing the sugarcane are not recovered until after the fifth harvest. For the sugarcane processing facilities, the physical specificity is high because the types of equipment required (sugarcane crushers, ethanol storage tanks, etc.), which are designed exclusively to produce sugar or ethanol from sugarcane, cannot typically be converted for use in other activities. The dependence of the processing facility on the sugarcane supplier increases in parallel with increase in the proportional contribution of the suppliers (in relation to the amount of sugarcane needed to reach the facility's total crushing capacity),[1] as well as with increase in the number of other neighboring facilities "competing" for that same raw material. In addition, sugarcane is sold exclusively to sugar mills and ethanol plants (there are no alternative uses for sugarcane). Therefore, prior to planting, sugarcane suppliers need to have a guaranteed market for their product for that 5-year period. Furthermore, sugarcane suppliers are dependent upon the processing facilities in the sense that there are a limited number of facilities within shipping distance (that within which transport of sugarcane is viable), as well as because their contribution to the overall sugarcane processing capacity of the facility can vary depending on how much of its own sugarcane the facility uses. Therefore, given the characteristics of the assets involved in the transactions (for the raw material and for the end products), sugarcane suppliers and processing facilities are mutually dependent. On the basis of the theory of transaction cost economics (Williamson 1985), it is expected that the transactions involved in the marketing of sugarcane and sugarcane-derived products will be made through hierarchical relationships (supply contracts between agents and the leasing of lands by processing facilities, or the cultivation of sugarcane on their own land, resulting in the immobilization of the capital). That is, the use of the market (sugarcane purchases on spot markets) would be the least efficient way of selling this particular raw material.

In recent harvest seasons, it is estimated that approximately 70% of the sugarcane grown in the state of São Paulo was cultivated in a hierarchical manner (on lands leased or owned by processing facilities), while the remaining 30% was obtained from the sugarcane suppliers. It is of note that, despite the high asset specificities found, there were few formal contracts between suppliers and processing facilities prior to the harvest of 1998–1999. That might be explained by the regula-

[1] The production of sugar and ethanol from sugarcane is, to some extent, vertically integrated.

tory institutional environment, in which the relationship between sugarcane suppliers and processing facilities were ruled by the government and bolstered by the legislation then in control, which imposed a commitment between the two parties.

The Sugarcane Cultivation Statute,[2] which governed the relationship between sugarcane suppliers and processing facilities, and established the form and supply levels for sugarcane to be obtained from suppliers by processing facilities, ensured that the latter would take receipt of the sugarcane grown and would have a sufficient supply of sugarcane to crush. In addition, Law no. 4,870, passed in 1965, which had reinforced the provisions of the Statute as well as established the participation of suppliers in the valuation of sugarcane inventories and the system of payment by sucrose content, resulted in the marketing of the product. However, over time, the strict legal provisions of the Sugarcane Cultivation Statute have been losing strength in the face of the new reality in which the volumes of sugarcane produced have grown exponentially since the implementation of the *Programa Nacional do Álcool* (Proálcool, National Ethanol Program). In addition, the Sugar and the Ethanol Institute had not readjusted the official production levels for sugar, ethanol, and, consequently, the sugarcane itself. Similarly, the official monthly marketing levels of sugar ceased to exist, effectively ending the participation of the sugarcane suppliers in the valuation of inventories, which had been linked to those levels. In addition, the remuneration for sugarcane by sucrose content came to be achieved by adding a premium onto the official price, which also ceased to exist (on February 1, 1999).

The change in the institutional environment of the sugarcane ethanol industry, which began when the Federal Constitution of 1988 was adopted, was accentuated by the deregulation of the industry and resulted in profound changes in the relationships among the parties involved, especially considering the fact that the existing legislation was no longer applicable. Deregulation made it necessary to create a new type of relationship that could substitute for government intervention, given the mutually dependent relationship between the parties. As early as the harvest of 1998–1999 (when the expectation was that price controls would be lifted in May 1998, as scheduled), some of the transactions between sugarcane suppliers and producers (of sugar and ethanol) in the state of São Paulo came to be guaranteed by contracts between the suppliers and the processing facilities (despite the new law postponing the lifting of price controls until February 1999). The contracts were based on the new model of remuneration for sugarcane, established by the *Conselho dos Produtores de Cana-de-Açúcar, Açúcar e Álcool do Estado de São Paulo* (CONSECANA-SP, São Paulo State Council of Sugarcane, Sugar, and Ethanol Producers).

[2] Decree-Law no. 3,855 (handed down on November 21, 1941).

The CONSECANA-SP

Regarding the CONSECANA-SP model of remuneration for sugarcane,[3] the opinions of the interviewees differed greatly, not only between sugarcane suppliers and sugar/ethanol producers but also among those within each category.

In some regions, virtually none of the sugarcane processed came from independent suppliers, and there was therefore little discussion on the issues related to the CONSECANA-SP model. This was the case in the regions surrounding the ethanol plants created via Proálcool,[4] where most of the sugarcane processed was cultivated on the land owned or leased by the plants, because the Proálcool financing of their construction had been approved only upon proof of land ownership in order to ensure the availability of sugarcane. A similar situation existed in the state of Paraná, where most of the sugarcane processed was grown on lands owned or leased by agricultural cooperatives, which had constructed the processing facilities (sugar mills and ethanol plants). However, in Paraná, the CONSECANA-SP model was considered important as a reference for the price of the sugarcane cultivated on the leased lands.

Among the sugarcane suppliers interviewed, there were diverging views regarding the CONSECANA-SP model. Some were completely against the implementation of the model, whereas others had a favorable view of the model but believed that it would not work without government regulation. Those in the former group gave two reasons for their opposition to the model: first, they believed that the resulting price for sugarcane, in relation to the prevailing prices of sugar and ethanol, did not sufficiently remunerate the suppliers; and second, they believed that increase in the prices of sugar and ethanol would not result in a corresponding increase in the price paid to the sugarcane suppliers. Therefore, they believed that the model, in addition to requiring changes in its technical parameters in order to facilitate agricultural activities, would only function with government regulation. Opposition leaders even requested that the government pass a provisional measure to formalize the model, setting ground rules for transactions between suppliers and producers. Those who were in favor of implementing the CONSECANA-SP model felt that it was conceptually fair, because the parties shared losses as well as profits, but also believed that it would require government regulation in order to convince all parties to accept the model,[5] as well as to ensure that the contract would be honored. In addition, they feared that the board of arbitration provided for in the model

[3] The CONSECANA-SP model has now been widely adopted in the state of São Paulo.

[4] The Proálcool plants were located in the states of Mato Grosso, Mato Grosso do Sul, and Goiás, as well as in the central-western region of the state of São Paulo.

[5] According to one sugarcane supplier, interviewed in Sertãozinho in September of 1999, only one of the twenty processing facilities in the region formalized the CONSECANA-SP model through contracts. The rest of the processing facilities, although making payments based on the total recoverable sugar, did not enter into contracts in order to do so. The obstacles to formalizing the negotiations between the parties were put up by the sugarcane suppliers as well as by the producers of sugar and ethanol.

would be unable to resolve conflicts and disputes, which would consequently end up in the common-law courts, resulting in significant delays that would be detrimental to the supplier.

The suppliers interviewed identified various problems occurring during the 1998–1999 harvest season,[6] chief among which were failure of the processing facility to provide the sugarcane supplier with a copy of the contract, some suppliers even being obliged to sign blank sheets of paper (otherwise the facility would not take receipt of the sugarcane), and failure to make payment (breach of contract on the part of the processing facility). The interviewees gave the following explanations for that behavior:

- Few of the sugarcane suppliers had the necessary structure for planting, transportation, etc. (in recent years, the processing facilities had taken over various stages of the production process), making it difficult for the suppliers to change crops and weakening their negotiating position with the processing facilities.
- The trade associations were unprepared to deal with the new deregulated environment (given that technical issues had previously been considered more relevant than were economic issues).
- Few of the members of the trade associations participated in the implementation of the CONSECANA-SP model.
- In the previous system of remuneration for sugarcane, the suppliers were far removed from market issues, which made it difficult for them to analyze the problems arising from oversupply, and this lack of understanding further limited the acceptance of the model.
- Small suppliers, who individually did not account for a significant portion of the sugarcane processed at the facilities, had much less bargaining power than did the few large suppliers.
- The balance of power between the suppliers and the producers was unfavorable to the former.
- The fact that there were numerous suppliers (most of which were small) made it difficult for them to form blocks that would have strengthened their negotiating position with the processing facilities.

Among both the interviewees affiliated with the processing facilities and the suppliers, there was no consensus regarding the CONSECANA-SP model. Of the 18 sugar and ethanol producer representatives interviewed, 15 (83 %) gave an opinion about the model, all believing that it should be implemented. Most agreed that it was the correct model but differed on the need for government regulation. Of those 15 interviewees, 11 thought that the model could operate entirely without government regulation through self-management. They argued that once the contracts had been established, the board of arbitration would be able to resolve any conflicts, be-

[6] It is noteworthy that, even in the Sertãozinho region, which is home to the largest association of sugarcane suppliers in the world and where 35–40 % of the approximately 17 million t of sugarcane processed in the 1998–99 harvest season was obtained from independent suppliers, several issues were also raised in the first year during which the CONSECANA-SP model was used.

cause according to the Arbitration Law (Law no. 9,307, passed in September 1996), the board of arbitration would be the ultimate authority. According to Article 31 of that Law, a ruling by the board produces the same effects as a ruling handed down by the organs of the judiciary and, when there is an award or penalty involved, shall be enforceable. In addition, disputes would be resolved in a timelier manner than in the common-law courts, thus avoiding losses for either party. According to Article 23 of that same Law, rulings would be made by the deadline stipulated by the parties. When no deadline was stipulated, rulings would be made within 6 months.

The interviewees affiliated with the processing facilities argued that there had long been an imbalance in the sugarcane ethanol production chain, because the raw material (on average accounting for 60% of the cost) was purchased at prices set by the government whereas the end products were already being sold on a free market (since the early 1990s, in the case of sugar) or were already beginning to be discounted due to the surpluses produced in recent years. Some even said that there had been a significant transfer of income from the industrial sector to the agricultural sector, and that the viability of the production chain as a whole would depend on this new form of remuneration for sugarcane. In this group, there was also a consensus that the model was technically and economically effective, but was implemented at the time of oversupply of the end products in which the flat prices of the products were inevitably passed on to the producers, hindering their acceptance of the model. Furthermore, factors external to the model, such as the multiple postponements of the lifting of price controls, were cited as being detrimental to the acceptance of the model and to the relationships among the parties. Therefore, the producers believed that conflicts of interest between suppliers and producers could be managed within the framework of the CONSECANA-SP model, that the involvement of the government would add no value to the model, and that relevant discussions to overcome the initial difficulties should be regarding the parameters of the model (e.g., industrial efficiency of the processing facility, the "mix" of production, and how to collect prices) rather than regarding whether or not it should be implemented. The producers also stressed the importance of supplier associations to enlighten their members about the need for a contract as a guarantee. They also stated that certain issues, such as issues related to the efficiency of sugarcane plantations, a minimum scale of production, and distance from the processing facility, had become extremely relevant, because many sugar plantations that were viable under a regime of tabulated prices would no longer be so in a free-market environment. Among the producers who voiced an opinion about the CONSECANA-SP model, there were some (34%) who believed that the model would work only with government regulation. First, because they believed the negotiated settlement made between sugarcane producers and mills in the state of São Paulo (without government intervention) would not necessarily be replicated in other producing states. This way, the interviews believed that the government should approve the use of CONSECANA-SP model nationwide (adjusting the technical parameters of the model for different regions), stipulating penalties in the case of contract breaches by either party. They stressed that the difficulties encountered by some in using the CONSECANA-SP model during the harvest of 1998–1999 could have been much greater in

the absence of a formal contract between the parties because the legislation previously utilized became difficult to apply after deregulation. In other words, although conflicts might arise between the parties that were adopting the CONSECANA-SP model, the problem was to execute the instruments provided for in the contracts, which was better than not having contracts at all. The producers felt that, without a minimum level of regulation requiring the parties to honor the contracts, surplus production could result in the processing facilities using only their own sugarcane, thus leaving the sugarcane suppliers without any market for their product. It was also stated that the model had the ability to achieve fair distribution of the income generated by the activity of the parties, protecting the suppliers, which could be crucial to the recovery of the sector, because the processing facilities were undercapitalized and would not, if necessary, be able to take over the agricultural portion of the production process. Therefore, the producers believed that the technical particularities of sugarcane cultivation required trading via contracts, and that it would take at least a minimum of government regulation to ensure that the remuneration for sugarcane by a parametric formula would be used by all producers in all states.

According to Silva,[7] at that time (in 1999) other countries had adopted the system of remuneration of sugarcane according to the price of sugar by parametric formulas, including Colombia, Mexico, Venezuela, Bolivia, Costa Rica, Australia, South Africa, Thailand, and Argentina. However, there was no standard in terms of the level of government involvement in negotiations between suppliers and producers. In Argentina, South Africa, Bolivia, and Colombia, negotiations were bipartite, whereas in Mexico and Australia, there was no government involvement at all. The interviewees who represented the Brazilian government recognized the existence of problems in this link of the supply chain (the supply of sugarcane to the processing facilities). However, given the numerous claims made by the parties involved, there was still no consensus about whether or not to create a regulatory mechanism or how best to do it. Due to the surplus production during the harvest seasons of 1998–1999 and 1999–2000, together with the fact that the processing facilities were no longer required to purchase a defined quantity of sugarcane from the suppliers, difficulties were emerging and there were many requests for the government to regulate the relationship between sugarcane suppliers and processing facilities. The position of the government was that a balanced market model[8] would work well without government interference. Nevertheless, given the regional differences and the crisis caused by the surplus existing at the time the CONSECANA-SP model was implemented, the need for a regulatory mechanism was being reviewed.

From the information gathered in the interviews, we concluded that, although there was a new generation of suppliers and producers with modern management techniques, and concerned with issues of efficiency and partnership, the relationship between the two parties has historically been contentious, and that most were

[7] SILVA, G.M.A. Advisor to the CIMA Technical Subcommittee.Personal Communication, 1999.

[8] If the supply is to be consistent with the demand, sugarcane from independent suppliers is needed in order to achieve the required levels of production, and a partnership emerges between the parties so that an adequate supply can be ensured.

at that time interested in immediate results, and opportunistic behaviors tended to complicate the free market. Therefore, the particularities of sugarcane cultivation, as well as those of the sugar and ethanol production processes, created mutual dependence between the parties. That, together with the lack of credible commitments between the parties at the time of deregulation of the industry, the newly deregulated institutional environment, and the inadequacies of the existing legislation, required that transactions within the industry be ruled by contracts.[9]

Due to the temporal factors involved, the slowness of the Brazilian legal system greatly complicates the administration of justice in the case of litigation between sugarcane suppliers and producers of sugar or ethanol. However, the existence of a contract at least allows the parties to attempt to enforce the agreement. Despite the early difficulties, the CONSECANA-SP model has now been adopted throughout the state of São Paulo, as well as in some other states.

The Competitive Difference Between Sugarcane Suppliers and Producers of Sugar or Ethanol

The difference cited between the number of suppliers and producers, together with the difference in "power" between the two categories at the time of the interviews, could indicate a market failure. In view of that, it is interesting to analyze data from the 1998–1999 harvest season for the main producing states, presented by the *Organização dos Plantadores de Cana do Estado de São Paulo* (ORPLANA, São Paulo State Sugarcane Growers Association).

As can be seen in Table 12.1, independent sugarcane suppliers, on average, accounted for approximately 27% of nearly 285 million t of sugarcane processed in Brazil in the 1998–1999 harvest season. In the main sugarcane-producing state (São Paulo, which accounts for 70% of the sugarcane delivered), the 11,570 sugarcane suppliers accounted for approximately 26% of the sugarcane processed. Table 12.2 shows the proportional distribution and contribution of individual sugarcane suppliers in the state of São Paulo, by production level, in that same harvest year.

As shown in this table, approximately 78% of the sugarcane suppliers in the state of São Paulo were small (producing no more than 4,000 t per year). The small suppliers accounted for approximately 21% of the sugarcane delivered for processing in the state. Mid-sized suppliers (producing 4,000–10,000 t per year) represented 13.1% of the total and accounted for 18% of the sugarcane delivered. The remaining 61% of sugarcane processed was delivered by the 9% who produced more than 10,000 t per year.

In 1999, the average size of a sugarcane plantation in the state of São Paulo was 52 ha, compared with 87 ha within the region of the state served by the Sertãozinho Association of Sugarcane Growers, which is the largest ORPLANA affiliate

[9] It should be made clear that that does not necessarily mean adopting the CONSECANA-SP model but rather any type of contract that is amenable to both parties.

Table 12.1 Number of suppliers and their participation in the sugarcane harvest of 1998–1999, by state. (Source: ORPLANA)

State	Independent sugarcane suppliers(*N*)	Sugarcane processed		Total(tons)
		Source		
		Processing facilities (tons)	Independent suppliers (tons, % of total)	
São Paulo	11,570	147,925,613	51,595,640 (25.86)	199,521,253
Pernambuco	8,390	11,289,699	6,536,000 (36.67)	17,825,699
Alagoas	5,202	19,073,078	5,853,467 (23.48)	24,926,545
Minas Gerais	497	11,415,130	3,652,724 (24.24)	15,067,854
Rio de Janeiro	11,003	2,235,270	2,826,989 (55.84)	5,062,259
Paraíba	980	3,230,307	1,415,064 (30.46)	4,645,371
Paraná	145	17,242,000	1,353,000 (7.28)	18,595,000
Espírito Santo	356	187,430	630,989 (77.10)	818,419
Rio Grande do Norte	238	2,035,652	361,597 (15.08)	2,397,249
Sergipe	40	387,454	316,778 (44.98)	704,232
Mato Grosso	6	1,241,657	120,159 (8.82)	1,361,816
Amazonas	120	22,420	86,123 (79.34)	108,543
Bahia	144	1,717,000	71,000 (3.97)	1,788,000
Pará	103	68,478	17,645 (20.49)	86,123
Total	38,815	207,011,062	77,539,559 (27.25)	284,550,621

in terms of production (accounting for 18 million t, representing 35% of the total delivered by ORPLANA affiliates in the 1998–1999 harvest season). Within the region of the state served by the Piracicaba Sugarcane Growers Association, which is the second largest (accounting for 8.5 million t, or 35% of the total delivered by ORPLANA affiliates in the 1998–1999 harvest season), the average size of a sugarcane plantation was 28 ha.[10]

At that time in Brazil there were 324 sugarcane processing facilities (producing sugar or ethanol), 133 of which were in the state of São Paulo. Therefore, in São Paulo, independent sugarcane suppliers greatly outnumbered producers of sugar and ethanol. Nevertheless, the relative contribution of the independent suppliers to the overall quantity of sugarcane processed in the state was much smaller than was that of the processing facilities themselves. The competitive difference between the suppliers and producers creates the possibility of market failures and inefficiencies within a free market environment. Certain structural characteristics of the relevant markets for sugarcane[11] (which differ widely among regions, even within the state of São Paulo) are indicators of market failure.

[10] Source: http://www.udop.com.br.

[11] It is of great importance to establish an accurate definition of the market within which a given enterprise operates (i.e., for what market the concentration indices are being calculated). Market concentration indices are used in order to determine the structure and power of a given market. If the market is defined too broadly, so that enterprises are seen not to be truly in competition with each other, the concentration indices will be underestimated, whereas they will be falsely elevated if the market is defined to narrowly, indicating market power that does not really exist.

Table 12.2 Proportional distribution and contribution of individual sugarcane suppliers in the state of São Paulo, stratified by production level, in the 1998–1999 harvest season. (Source: ORPLANA)

Production level (tons)	Suppliers (*N*, % of the total)	Sugarcane delivered (tons, % of the total)
< 200	1,116 (9.6)	128,697 (0.2)
201–800	3,023 (26.1)	1,422,540 (2.8)
801–4,000	4,836 (41.8)	9,235,755 (17.9)
4,000–10,000	1,514 (13.1)	9,333,874 (18.1)
> 10,000	1,081 (9.3)	31,474,538 (61.0)
Total	11,570 (100.0)	51,595,404 (100.0)

Sugarcane is a homogeneous product. Therefore, in regions where there are many small suppliers and few processing facilities (or only one), buyers of sugarcane can exercise oligopsony (or monopsony) power, paying prices lower than those paid in a competitive market. That might be the case, for example, in some parts of northeastern Brazil (in the states of Piauí and Maranhão), or even in parts of the south-central region where there have been mergers of processing facilities (in the Piracicaba, Barra Bonita, and Jaú regions of the state of São Paulo), limiting the options for suppliers looking to sell their sugarcane. At the other end of the spectrum, if there were many processing facilities competing for the sugarcane offered by one or a few large suppliers, the suppliers could charge higher prices for sugarcane that those charged in a competitive market. This had previously occurred in the Ribeirão Preto and Sertãozinho regions of the state of São Paulo, where the prices paid for sugarcane and the value of land leases were always higher than in other sugarcane-producing regions. Although, there are numerous intermediate situations to be analyzed between those two extremes, government intervention might be necessary in order to prevent the conduct of the parties, due to concentrated market structures, from deviating from the competitive ideal, which would be detrimental to the well-being of society as a whole. However, government intervention in such cases would not be to establish fixed prices for the product, nor to regulate the relationship between the parties. According to Farina et al. (1997), when the exercise of monopoly power derives from oligopolistic market structures, government intervention should be aimed at controlling the abuse of economic power through the use of an antitrust policy. In such cases, the state should apply the antitrust laws existing in the country. Therefore, if there is evidence of abuse of economic power, the issue should be analyzed within the Brazilian Antitrust System.

The temporal specificity of sugarcane makes it difficult to use the justice system, given the perishable nature of the product and the slow pace of litigation in Brazil.

Another way to resolve disputes between suppliers and producers is by establishing sectorial councils at the state level, composed of representatives of the parties involved and of the respective state governments. In such councils, contentious issues can be discussed and negotiated, with government officials acting as coordinators and mediators.

According to Farina et al. (1997), the sectorial councils, with the participation of representatives of the entire production chain and of the government, can act as

forums to identify areas of cooperation between the parties and can help resolve distributive conflicts. According to the author, although there are situations where the benefits of a coordinated and cooperative effort throughout the production chain are evident, inappropriate distribution of those benefits can promote bargaining and even invalidate the benefits themselves. Within the state of São Paulo, the São Paulo State Chamber of Commerce for the Sugarcane Ethanol Industry, created in December 1995, could be a forum for discussions on these issues, placing the government, as previously mentioned, in the role of conflict mediator for the production chain as a whole.

Interestingly, in the state of São Paulo, the "Pact for Full Employment in the Sugarcane Ethanol Industry" (which originated from discussions in the São Paulo State Chamber of Commerce for the Sugarcane Ethanol Industry) provides for the use of the CONSECANA-SP model and is therefore yet another forum in which parties may try to find solutions to problems, in this case with the participation and coordination of the state and the federal governments. In the 1998–1999 harvest season, the CONSECANA-SP model was a new model of private self-management to administrate the marketing of sugarcane and to resolve potential conflicts between the parties. However, it must be noted that adoption of the model was voluntary and only applied to participants who adopted the new formula for remuneration of sugarcane stipulated in the contracts.

At that time, the participation of the government as a conflict mediator appeared to have the endorsement of the sugarcane supplier associations. In January 1999, the main leaders of those associations held a roundtable discussion in the city of Piracicaba and drafted the "Piracicaba Letter,"[12] which was distributed to federal government officials and to the general public. One of the demands made in that letter was the establishment of a federal agency that would mediate the relationship between sugarcane suppliers and producers (a demand that was not met).

Regarding the power imbalance between the two categories (sugarcane suppliers and ethanol producers), which could influence the negotiations, it must be remembered that the bargaining power depends on the establishment of parity between them. For suppliers to improve their situation, they must organize themselves so that the negotiations are conducted in a more equitable manner.

According to Neves et al. (1999), various institutional arrangements can be used in order to offset the increased market power of processors and distributors in agribusiness systems, including cooperatives, producer associations, marketing orders, as well as to improve quality indicators. According to the authors, producers organized in cooperatives have greater bargaining power to negotiate prices and contract terms, offsetting the market power of firms that are upstream and downstream within that agribusiness system. Therefore, supplier associations also had (and still have) an important role to play. In addition, it was crucial that they adapt to the new institutional environment, increasing their capacity and supplying their members with information regarding the market, pricing trends, and production decisions in order to minimize the existing information asymmetries. The way in which the as-

[12] *The ORPLANA Newsletter*, Year VI, No. 1, January of 1999, p. 1

sociations of sugarcane suppliers in Brazil broadened their focus after deregulation was impressive. If they had previously been concerned with the technical issues of production itself (because trade issues and market issues had been settled by the government), they now began to make major changes in order to deal with the new demands of the deregulated environment.

For this link in the production chain, the role of the government changed substantially because the new institutional environment, supported by the Federal Constitution of 1988, made it impossible for the government to apply the earlier model of intervention.[13] Previously, the apparent role of government intervention in this link of the sugarcane ethanol production chain was to coordinate activities and mediate disputes between suppliers and producers, considering the issues of employment and income, as well as the specificity of the assets involved, which made it difficult to use the common-law courts. However, in recent years, the strengthening of the sugarcane supplier associations (which are generally most well-suited to negotiating with sugar and ethanol producers) combined with broader use of the CONSECANA-SP model (which undergoes periodic revisions agreed upon by the parties involved) seems to have greatly reduced the number of conflicts between the parties. Therefore, government mediation of those negotiations is no longer required.

The Sugar Market

Our analysis of the production and marketing of sugar was aimed at identifying market failures that might indicate the need for some form of government intervention, and at determining the most effective ways of marketing the product. Out of the 18 producer representatives interviewed in 1999, 14 (78%) gave an opinion about the question of trading sugar on the free market (which is now a reality). Out of those 14 interviewees, 12 (86%) were in favor of such trading and cited a number of reasons why government intervention was not necessary in this link of the supply chain:

- Sugar is a commodity produced across the world (in rich and poor countries; in temperate and tropical climates; from beets or sugarcane).
- When there is a sugar shortage in one country, sugar can be imported from other countries.
- In Brazil, the sugar market is balanced because there are many producers (at that time, there were approximately 300 sugar mills in Brazil as a whole) and many buyers (thousands of buyers on the domestic market—supermarkets, the food industry, the beverage industry, etc.—and on the external market).

[13] Establishing prices for the inputs of outputs of the sugarcane ethanol production chain, as well as setting production levels for sugarcane suppliers and processing facilities.

- The marketing mechanisms already existing at that time (including commodities and futures trading) allowed sugar to be traded freely without a free market having been officially established.

More than one interviewee stated that certain concepts previously unrecognized within the sector—customer relations, product quality vis-à-vis consumer expectations, delivery contracts (with reliable delivery schedules), logistic models, private labeling, etc.—should become part of everyday life for the producers (which has actually come to pass). In addition, some producers had begun to employ strategies to differentiate their products (by quality, private labeling, packaging, etc.—seeking alternatives to the commodities market) as well as to establish themselves in niche markets.[14]

The producer representatives also cited the need for a discussion forum within the sugar industry for planning the availability of product, because there is a global consumption limit, and if production and export levels are too high, the consequences for prices are immediate. That is especially true for Brazil, which, in 1999, accounted for 20% of all sugar exported to the world market.[15]

Another factor mentioned by the producer representatives interviewed is that the availability of sugar depends on the prices of the alternative product (fuel ethanol), and that a balanced ethanol market is essential for sugar prices to remain at acceptable levels. Although, production can be shifted to one or the other product according to their relative prices, there is a certain limit to this production flexibility (it is not possible for all of the sugarcane planted for ethanol to be processed into sugar, because that would require sizeable investments). However, according to the interviewees, controlling the supply of sugar would be achieved by an industry agreement through self-management (without government interference, that is, cyclical pricing difficulties should not be taken as an indication that the government should regulate the sugar market). Clearly, the success of self-regulation mechanisms would rely on major associative changes in the industry, because engaging in joint efforts toward a common goal is not characteristic of its history.

Out of the 18 producer representatives interviewed, 3 (16,7%) thought the government should intervene, because they believed that the strong interdependence between sugar and ethanol requires government planning, and even stated that the

[14] Among the many examples of such niche markets are that for are organic sugar (produced without pesticides), which is widely accepted in Europe: the São Francisco sugar mill, in the city of Sertãozinho, has sold organic sugar on the European market since 1997 and began selling it on the domestic market in April of 1999; and Univalem Sugar and Ethanol Inc. introduced an organic sugar with the Greenpeace seal of approval. In addition, the União company began to market sugar in cube form, in order to use the weight of its brand to sell products with higher added value; the Nova América company introduced "Dolce" refined sugar in packages of various sizes; two companies (Guarani Sugar and Cargill) developed a mixture of sugar and began to export it to Canada, Japan, and the Middle East; the Albertina company introduced "Sucareto" (sugar in 250-g disposable packages); and the Barra company developed a new type of sugar ("Lowsugar").

[15] In the 2010–2011 harvest season, Brazil was the world's largest sugar supplier (producing 38.35 million t, which accounted for 23.8% of the worldwide production), as well as the largest exporter, with 46% of the world market, exporting 67.3% of its overall production.

government should mandate the volumes of exportable sugar (those exceeding domestic consumption) for each processing facility.

The 14 producer representatives who were in favor of trading sugar on the free market were unanimous in their opinion about the role of the government in this link of the supply chain, stating that it was important to adopt a more aggressive policy on the international market in order to break down barriers and open markets for the products of industries in which Brazil has competitive advantages, such as the sugar industry.

In 1999, the USA and the European Union both adopted policies that restricted imports of Brazilian sugar. The American policy was to limit the quantities of imported sugar, maintaining domestic prices at levels high enough to protect domestic production. To meet domestic demand, the import volumes were distributed among select exporting countries, for which preferential limits were set. In addition to those limits, there was a sugar tariff that made imports prohibitive. The Brazilian limit for access to the lucrative United States sugar market was met with sugar produced in northeastern Brazil. Some other countries that had access to that market could not supply their limits and imported sugar for re-export to the USA, sugar for which those countries paid prices higher than those prevailing on the international market. The European Union had a complex system of limits (stratified into levels A, B, and C, a different price being set for each level), which resulted in varying degrees of profitability. The European surplus (approximately 50% of the level of consumption) was exported at prices below those on the domestic market (to make them competitive internationally), which was possible only because high subsidies were paid to European sugar producers. In both cases, the policies were generally accepted by consumers in the importing countries. Pressure to change those policies came from consumer groups, taxpayers, researchers, and even from branches of the governments imposing those policies. However, at that time (in 1999), it was understood that, although possible, changes in those systems of limits would not come about quickly, especially in view of the special interest groups involved and the aggressive lobbying by producers in the importing countries. Therefore, it was believed that Brazil needed to adopt aggressive policies in order to eliminate subsidized exports, the systems of limits, and the preferential tariffs. That would give Brazil greater access to those markets based solely on the competitiveness of its sugarcane industry. That was also the opinion of the government official interviewed in 1999, who stressed that international agreements are made between countries, therefore being the responsibility of the government, and that the Brazilian government was ideologically opposed to preferred markets (in this case referring to the lucrative United States sugar market).

Regarding the most efficient ways to transact the product, there were no asset specificities important enough to justify the adoption of hierarchical forms (in the parlance of Williamson 1985). Thus, it was expected that use of the market was the most effective for this product.

The Fuel Ethanol Market

In analyzing the market for fuel ethanol (anhydrous and hydrous), our objective was, as it was for the sugarcane and sugar markets, to identify the characteristics that might indicate a need for government intervention in this link of the supply chain. Among the individuals interviewed in 1999, it was the producers, legislators, and government officials who raised issues that could indicate the need for government intervention at that time: ethanol was not competitive with gasoline in a free market environment, there were environmental externalities associated with the production and use of ethanol, there were competitive differences between ethanol producers and distributors, and there were problems related to fuel adulteration and tax evasion within the ethanol market.

The Lack of Price Competitiveness of Hydrous Ethanol Relative to Gasoline

The first issue raised by the interviewees was that fuel ethanol, at market prices (without considering the environmental costs embedded in the use of fossil fuels), was not price competitive with gasoline, because the production costs were lower for the latter. The prices that made ethanol production viable were higher than those associated with the production of gasoline, making it difficult for ethanol to gain acceptance on the free market.

According to Ribeiro (1997), due to gains in efficiency and productivity in the industry, the cost of ethanol production had been declining at a cumulative rate of 3% per year (from US$ 75.00 to US$ 45.00 per barrel between 1976 and 1993), and there was the potential of reducing it by an additional 22% with the technology available at that time. Nevertheless, as explained by Ribeiro, it continued to be more costly to produce ethanol than to produce gasoline. He also stated that, in comparing the cost of ethanol with that of gasoline, it should be borne in mind that hydrous ethanol is consumed more rapidly than is gasoline (the former generating 20% less energy in an Otto cycle), although anhydrous ethanol and gasoline are equivalent in that respect.

Again according to Ribeiro (1997), the price of gasoline was, at that time, determined on the basis of the price of oil. This calculation, which took into consideration the refining costs (9% of the price of oil plus a fixed amount of US$ 2.50 per barrel) and the cost of transportation (US $ 2.50 per barrel), was made by applying the following equation:

$$Price\ of\ gasoline = price\ per\ barrel\ of\ oil \times 1.09 + US\$5 / barrel$$

Therefore, although there was a downward trend in the cost of ethanol production, and there was a working projection for an average production cost of US$ 35.00 a barrel by the end of the 1990s (Ribeiro 1997).The production costs remained higher

for ethanol than for gasoline and price competitiveness between the two was not guaranteed, especially in view of the weakening of the monopoly held by Petrobras and the lifting of price controls (in August 2000) on fuel sold by refineries.

In addition to the higher direct costs, seasonality is another competitive disadvantage related to the production of ethanol (ethanol production follows the agricultural cycle of sugarcane cultivation), which results in high tankage costs in order to ensure supplies throughout the year (Serodio et al. 1998). Out of the 18 producer representatives interviewed during the survey, 15 (83%) believed that the government could not disengage itself without establishing parity for the pump prices of the two fuels.[16]

As previously mentioned, government determination of the relative prices of liquid fuels at that time followed a model of indirect price support for hydrous ethanol, through the *Parcela de Preço Específica* (PPE, Specific Price Proportion) account (administered by the National Petroleum Agency), which made ethanol competitive with gasoline.

Ethanol price supports (and other government programs) were funded by an add-on to the price of petroleum-based fuels, in accordance with Law no. 9,478 (passed in 1997), which regulated the national energy policy with the aim of establishing a free market system for petroleum-based fuels. The add-on was discontinued in August 2000. In that same month, with the weakening of the Petrobras monopoly, the PPE account was closed. In addition, the mechanism of price support for fuel ethanol was discontinued, because, in the free market environment, the new refineries would not accept an add-on to the price of their product and support competition from fuel ethanol.

Among the interviewees, there was a consensus that, to be attractive to the consumer, the pump price of hydrous ethanol should be no more than 75% of the price of gasoline.[17] Given the pump price of gasoline in August 2000, when price controls on the fuel market were lifted, maintaining that relationship between the pump prices often resulted in the price of hydrous ethanol being too low to cover the production costs. Therefore, market forces might be insufficient for a government energy policy to reach the goal of promoting the use of renewable fuels, requiring a tax mechanism in order to make the use of hydrous ethanol attractive to consumers.

The unanimous opinion of those interviewed was that the solution to the lack of competitiveness of fuel ethanol was the creation of an excise tax on fuels, which would be charged at different rates on different fuels in order to allow gasoline and ethanol to be price competitive in the free market environment.[18] The tax on fossil fuels, which are more polluting, would be higher than that imposed on biomass

[16] Profitability of producing hydrous ethanol continues to be a problem, due to the current Petrobras pricing policy for gasoline in Brazil.

[17] Although ethanol-powered engines are more powerful than are gasoline-powered engines (to compensate for the lower calorific value of the biomass-based fuel, ethanol-powered engines have higher compression ratios, which increase power), fuel consumption is also higher. Therefore, the pump price of ethanol has to be lower in order to attract consumers.

[18] The Contribution for Intervention in the Economic Domain (an excise tax) was established on December 19, 2001 (http://www.receita.fazenda.gov.br/Legislacao/Leis/2001/lei10336.htm).

fuels, resulting in a higher pump price for gasoline and higher prices for other petroleum-based products. The price differential established by the excise tax would be an instrument of intervention in order to meet government planning objectives in the areas of energy, economics, agriculture, and the environment. Therefore, the prices of fossil fuels (gasoline, diesel, naphtha, fuel oil, and liquefied petroleum gas) would be determined by the import price of crude oil in order to remunerate the refineries, plus the differentiated tax rates. The tax on fuel ethanol (hydrous and anhydrous) would be lower as a way to encourage its use and to achieve the objectives mentioned, given the positive externalities for the product.

The interviewees considered the excise tax modern, efficient, and transparent, stating that, rather than creating a new tax, it would simply replace the existing taxes—the *Programa de Integração Social* (PIS, Social Integration Program) tax, *Contribuição para o Financiamento da Seguridade Social* (Cofins, Social Security Contribution), *Imposto sobre Circulação de Mercadorias e Serviços* (ICMS, tax on the movement of goods and services—similar to the Canadian goods and services tax and the European value-added tax), and PPE. Other countries, such as the USA and England, have also adopted variable-rate taxes on fuels.[19] However, for the Brazilian excise tax to be approved, a constitutional amendment was required because the Brazilian Constitution did not allow petroleum products to be taxed by the federal government, allowing such taxation only at the state level. Therefore, extensive lobbying of congress was necessary. It is of note that other actors in the production chain, such as the *Sindicato Nacional das Empresas Distribuidoras de Combustíveis e de Lubrificantes* (Sindicom, National Association of Fuel and Petroleum Product Distributors), also approved of the excise tax as a means of reducing tax evasion, because the way in which it was applied hindered evasion and facilitated enforcement.

Out of the 18 producer representatives interviewed, 15 (83%) were clearly in favor of the implementation of a mechanism to solve the problem of price competitiveness between ethanol and gasoline. Out of those 15 interviewees, 3 (20%) were of the opinion that after this issue had been resolved, the government would have nothing more to contribute and should let the industry function independently in the free market. Three of the producer representatives remained undecided on the issue. One of those stated that, in discussions regarding the question of a mechanism that would replace the PPE as a way of providing price support for hydrous ethanol,

[19] According to the Brazilian Ethanol Industry Association (1997), there were three types of fuel taxation in the United States at that time: a federal excise tax of US $ 0.184 per gallon; a state tax, ranging from US $ 0.31 to US $ 0.90 per gallon; and certain municipal taxes. However, after the passage of the Clean Air Act in 1990, incentives were given to promote the use of ethanol as a way to improve performance and reduce air pollution: if the gasoline is mixed with 10% ethanol, the federal excise tax is reduced to US $ 0.13 per gallon, and mixers would be exempt from paying US $ 0.54 per gallon on ethanol imported from Brazil. In some American states, corn growers were granted additional incentives to produce ethanol, which was subsidized, on average, at US $ 0.045 cents per gallon. In England, although the government did not interfere directly in the fuel market (through price fixing or subsidies), a differentiated tax structure directed the fuel market, with reduced taxes on unleaded gasoline, natural gas, and fuels used in public transport. In addition, leaded gasoline was taxed at a higher rate.

it had been assumed that the technological variables of ethanol production were immutable, which was not necessarily the case. Investments in new technologies aimed at increasing productivity and, consequently, reducing production costs for ethanol, as well as for other revenue-generating products of sugarcane—including the generation of electricity from the burning of sugarcane leaves and sheaths (*bagasse*)—that could have made ethanol price competitive with gasoline, depending on the behavior of oil prices on the international market. However, at that time (in 1999), the industry was going through the crisis of oversupply (low profitability), which hampered the adoption of new technologies. The lawmakers and government officials interviewed in 1999 were also in favor of a tax mechanism that would enable the use of fuel ethanol in a free market environment.

The Positive Externalities of the Production and Use of Fuel Ethanol

During the interviews, the positive externalities of fuel ethanol were often cited as a justification for government intervention to encourage its production and use. There are positive and negative externalities associated with the production and use of biomass fuels. Chief among the positive externalities is the fact that the combustion of ethanol, in comparison with that of fossil fuels, creates less air pollution and therefore has fewer negative effects on human health and the environment.

Serodio et al. (1998, p. 11) cited other benefits of renewable fuels, such as "the direct and indirect jobs generated and sustained, the advantage of having a renewable alternative to petroleum-based fuels, and the positive effects that reducing imports of oil and petroleum-based products has on the trade balance."

Since the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, the problem of air pollution caused by global emissions of carbon dioxide (CO_2) from the burning of fossil fuels (coal, oil, and natural gas) has been moved up on the agenda of countries that attended the conference, as have the issues of deforestation and soil erosion. At that time, it was decided that the risk of global warming, which could have serious consequences for many countries, should be reduced.

It is of note that worldwide measures for the control and reduction of CO_2 emissions created a new market, "international emissions trading," which can benefit the countries where CO_2 emissions are low and where there is potential to reduce them further (including Brazil), through the trading of carbon credits. Negotiations would take place between such countries, and those that have a need to reduce their emission levels (having already exhausted their domestic options) or deem it advantageous to invest in reducing emissions in less developed countries (because the cost of financing projects is lower in such countries) would participate. Therefore, Brazil could expect foreign investment from countries that have a need to reduce their emission levels, contributing to reducing emission levels worldwide. In this

context, Brazil has major comparative advantages because of its renewable natural resources, such as hydropower, charcoal, and fuel ethanol.

Macedo (1997) estimated the contribution of the sugarcane ethanol industry to reducing carbon emissions. According to the author, this analysis should take into consideration the balance between two factors: the increased concentration of atmospheric CO_2 resulting from the use of fossil fuels and petroleum-based products in agricultural and industrial production as well as the reductions in atmospheric CO_2 brought about by using greater numbers of ethanol-powered vehicles (i.e., fewer gasoline-powered vehicles) and by substituting sugarcane *bagasse* for fuel oil in the production of sugar and other industrial products. The author also took into consideration the magnitude of emissions of other greenhouse gases related to the production, processing, and use of sugarcane: methane emissions from the burning of sugarcane fields, the burning of *bagasse* in the boilers, the use of fertilizer, and N_2O emissions from soil. In addition, the comparison between the burning of ethanol and the burning of gasoline, in terms of greenhouse gas emissions, was included in the analysis. As estimated by Macedo (1997), the net emissions associated with the sugarcane ethanol industry in 1996 were quite low. According to the analysis, the use of fuel ethanol reduced annual carbon emissions by 12.74×10^6 t, which is equivalent to 46.70×10^6 t of CO_2 and corresponds to approximately 20 % of all annual emissions from the burning of fossil fuels in Brazil.

Meira Filho and Macedo (2011) estimated that, in 2006, the use of ethanol (in lieu of gasoline) resulted in a 22 % reduction in the final greenhouse gas emissions attributable to the transportation and electricity generation sectors in Brazil, and the authors predicted that the proportion would reach 43 % by 2020. According to the authors, in relation to Brazil's total energy consumption (for industry, transportation, residential, and other uses), large-scale consumption of ethanol reduced total annual emissions by 10 % in 2006,and could rise to 18 % by 2020. Therefore, the measurement of emissions allows the positive environmental externalities of the production and the use of fuel ethanol to be quantified, and it creates the opportunity for countries with high levels of emissions to invest in Brazil through the mechanisms of joint implementation.[20]

In addition to the positive environmental externalities that justify the use of fuel ethanol, one interviewee pointed out that the distribution network for ethanol in Brazil, which was available from 26,000 filling stations at the time, was an asset of extraordinary value. The interviewee stated that the creation of the current ethanol distribution network had occurred for historical reasons that would hardly be repeated, had been possible only due to the existence of Petrobras (a state-owned company that had maintained control over the tankage and distribution of the product), and had been sponsored by a federal government that was a military dictatorship at the time. Therefore, it is unlikely that such a distribution network would be created in another country that does not have the same characteristics of centralized

[20] A process that began in 2000, with the entry of the French groups Louis Dreyfus, Tereos, and Sucden, who purchased ethanol plants unilaterally or through partnerships established with national sources of capital, and continues today.

planning that Brazil had at the time of the *Programa Nacional do Álcool* (Proálcool, National Ethanol Program), because private distribution companies would be reluctant to create or expand the distribution network for ethanol without demand for the product and, conversely, there would be no demand for automobiles that run exclusively on ethanol if there were no ethanol distribution network. The interviewee gave the example of the USA which, although it was the second largest ethanol producer (in 1999, when the interviews were conducted), had only 46 ethanol filling stations and faced resistance from distributors against deploying a large network of such stations. The interviewee felt that the devaluation and elimination of the hydrous ethanol-powered fleet, with the resulting loss of equity, would constitute a step backward in view of the need to replace oil on a large scale. However, in a newspaper editorial published in 1996,[21] Novaes identified negative externalities of the production and use of hydrous fuel ethanol. The author stated that opponents of the Proálcool plan listed a number of drawbacks: the monoculture of sugarcane, which occupied 7.5 % of all arable land in the country[22]; the widening of regional disparities, primarily between the northeastern and south-central regions (between 1975—when the Proálcool plan was first implemented—and 1999, sugarcane cultivation, as a proportion of the national total, fell from 37.4 to 21.0 % in the former, whereas it rose from 62.6 to 78.9 % in the latter—plantations in the state of São Paulo being responsible for most of that increase); the concentration of sugarcane plantations in the Ribeirão Preto and Campinas regions of the state of São Paulo (together accounting for 65 % of the national total); and the debts of refinery owners, who owed, in Brazilian reals (R$), R$ 4.4 billion to the Bank of Brazil and an additional R$ 1.6 billion to other sources.

In another such editorial, also published in 1996,[23] Rosa evaluated the use of ethanol as fuel. The author concluded that the positive aspects of the ethanol industry outweigh its negative aspects and that the industry should be sustained in the context of the Brazilian national energy policy. The author also listed 26 pros and cons of the use of fuel ethanol, from a social, environmental, institutional, technological, economic, and energy policy perspective. Out of those 26 aspects, 11 were considered positive, 8 were considered negative, and 7 were considered neutral. According to the author, the positive aspects of the production and use of fuel ethanol included the following: job creation, having another (alternative) fuel in the energy matrix of the country, its nature as a renewable energy source, the ability to produce electricity from *bagasse*, the existence of a pricing policy (at the time of study), the reduction in air pollution in urban areas, the reduction in CO_2 levels, the increase in productivity achieved over time, power generation through biomass gasification, and the possibility of using combined cycle gas turbine technology. The author also

[21] Novaes, W. "Proálcool is not cops and robbers movie". Gazeta Mercantil (newspaper), March 5, 1996: p. A-3.

[22] In 2010, sugarcane cultivation occupied an area of 8.14 million ha, or 2.5 % of all arable land in Brazil. The portion of the sugarcane crop earmarked for ethanol production accounted for 1.5 % of all arable land (4.88 million ha).

[23] Rosa, L.P. "Ethanol should be maintained, study reveals". Folha de São Paulo (newspaper), Financial section, April 6, 1996: p. 2.

listed the following negative aspects: poor working conditions for laborers in the sugarcane industry, the fact that, liter for liter, ethanol generates less energy than does gasoline, the higher production costs (in comparison with those of gasoline), the competition for raw materials between the sugar and ethanol industries, the difficulties in obtaining financing and attracting investment, the problems related to deregulation that leaves a product that needs government support at the mercy of the open market, the unfavorable government policies affecting the industry, and the contrary stance of the World Bank in relation to ethanol production. The negative aspect raised in relation to the environment was the production of waste. Among the aspects considered neutral were wages, the land-use competition between the cultivation of food crops and sugarcane for ethanol production, and the use of public and private transportation.

From a social perspective, the issue of jobs generated by the sugarcane ethanol industry is an important factor to be considered. In 1999, the industry was directly responsible for 1.1 million jobs (Serodio 1999), 600,000 of which were in the state of São Paulo, and workers in the industry earned wages that were 70 % higher than the minimum wage.[24] However, it must be borne in mind that a significant proportion of these jobs are threatened, because the ban on burning sugarcane fields makes it necessary to use mechanical harvesters, consequently reducing the demand for manual labor. Moraes (2011) showed that improvements in socioeconomic indicators of the sugarcane ethanol industry in Brazil (schooling, formal jobs, reduction in child labor) have been observed since the implementation of the Proálcool plan. However, the number of workers on sugarcane plantations (approximately 532,000 in 2006) has been on the decline since the beginning of the process of mechanization of sugarcane harvesting.[25]

From a theoretical perspective, the positive externalities of the production and use of fuel ethanol are market failures that justify government intervention by social regulation. Prices generated by the free market, without considering the market failures, might be insufficient to provide appropriate returns on investments, resulting in sub-optimal production. The first question to be answered was whether Brazilian society would truly benefit from the inclusion of ethanol in the energy matrix.[26] If so, public policies should promote not only an adequate supply of ethanol but also a greater demand for the product.

On the supply side, the interviewees stated that the buildup of strategic reserves by the government was essential in order to ensure a steady supply and to influence market prices. They pointed out that the ethanol required for the buildup of those stocks could be purchased at a reference price set by the government (and consistent with the production costs), which would regulate stocks according to market

[24] Brazilian Sugarcane Industry Association Newsletter, year 2, no. 23, August, 1999.

[25] There are employer associations and worker unions within all three of the industries analyzed (sugarcane, sugar and ethanol). According to the author, the activities of those associations vary from state to state, the most active being the associations in the state of São Paulo.

[26] The energy matrix defines the use of various forms of energy: that provided by the burning of petroleum-based fuels, natural gas, or biomass; and electricity (generated in a variety of ways). The energy matriix can vary from state to state, depending on the regional availability of fuels.

needs, matching supply with demand in order to control market prices.[27] According to the interviewees, another factor that made the buildup and maintenance of strategic government reserves critically important is the fact that ethanol is obtained from raw material that has a long agricultural cycle (subject to adverse weather conditions), which would require coordinated interventions along the production chain in order to avoid the mismatch between supply and demand. Therefore, unlike fossil fuels, whose production can be increased or reduced over a relatively short time, sugarcane cultivation, and consequently ethanol production, requires long-range planning. To underscore the importance of strategic reserves, the interviewees stated that there were other countries capable of supplying the market with hydrous ethanol in times of shortage.

Other considerations regarding the buildup of government strategic reserves are worthy of mention. Although the existing legislation (Law no. 8,176, passed in February 1991, which instituted the National Fuel Inventory System)[28] stipulated that the government should build up strategic reserves, it was necessary to determine whether this was the most economically efficient option. The development and implementation of new methods of government intervention in the ethanol market (interventions that are more consistent with the current political and economic environment) should be considered. The strategy would be to compare the costs involved in the buildup of government stocks with the effectiveness of government interventions and to evaluate the use of other possible mechanisms, such as providing financing for the buildup of private reserves (which is the strategy currently employed).

Having the flexibility to produce either sugar or ethanol is an advantage for plant owners, as it allows them to switch production according to the relative prices of the two products on the domestic and international markets. However, that also makes it extremely difficulty to maintain appropriate supply levels for both products on the free market.

According to the interviewees, if it becomes necessary to redirect production to ethanol (to ensure the supply given the resumption of the Proálcool plan)[29], private

[27] The issue of ethanol stocks and their financing is currently a source of concern for ethanol producers, and government policies in this regard seem to fall short of the demands of those producers.

[28] As previously mentioned, it is the National Petroleum Agency that is responsible for overseeing the proper functioning of the National Fuel Inventory System and maintaining compliance with the Annual Strategic Fuel Reserves Plan (in accordance with Law no. 9,478, enacted in August of 1997). Provisional Measure no. 1690–1 (passed in June of 1998) established the national fuel supply as a public utility and set administrative sanctions for violators of the rules laid down for activities related to the fuel market. Provisional Measure no. 554 (passed on December 23, 2011) amends Law no. 11,110 (enacted on April 25, 2005) by authorizing the granting of economic support, in the form of equalization of interest rates for the financing of ethanol storage, as well as amending Law no. 10,453 (enacted on May 13, 2002).

[29] In 1999, the demand for hydrous ethanol was declining, sales of automobiles that run exclusively on ethanol representing less than 1 % of total car sales. The perception was that the market for hydrous ethanol was going to disappear. That situation was completely reversed after the introduction of flex-fuel vehicles in 2003.

sector initiatives, self-management, or the government (through the public policy instruments available such as the imposition of tariffs on sugar exports) could be utilized.

As previously noted, although Directive no. 46 (handed down in April 1997) had reset the tax rate on exports, the tax still exists, and the government can increase it (up to a maximum rate of 40 %) as necessary (e.g., to maintain an adequate supply of sugar on the domestic market or to redirect sugarcane supplies from the production of sugar for exportation to the production of ethanol). However, as already discussed, one cannot disregard the faults of government, which often cause its interventions to be less than appropriate, nor the pressures of those actors that depend on the external market for the execution of their strategies, who will certainly influence policy decisions regarding the export tax.

At that time (in 1999), the positive externalities of using renewable sources of energy (i.e., fuel ethanol) were well known. There were a number of options available as means of intervening in the fuel industry if the government intended to promote the use of fuel ethanol. These included the establishment of incentives for the use of ethanol and the taxation of fossil fuels, both of which were measures effectively taken by the government at the time. Incentives for the use of ethanol could be provided at the various levels of government (municipal, state, and federal), and such incentives were already being implemented in certain states and municipalities.[30] Among the possible municipal interventions cited by interviewees were making ethanol-powered vehicles exempt from municipal traffic rotation schedules, which are implemented in some large urban centers with the aim of reducing air pollution, and rebates of municipal property taxes on ethanol-powered vehicles. State governments could reduce the sales tax on ethanol as well as make ethanol-powered vehicles exempt from state property taxes. At the federal level, the interviewees mentioned the following examples of potentially helpful policies (some of which had already been implemented): adopting a "green fleet" policy (requiring that all official government vehicles be powered by ethanol), increasing the proportional quantity of anhydrous ethanol in the ethanol-gasoline blend, approving the addition of anhydrous ethanol to diesel, exempting ethanol-powered taxis and rental vehicles from the Industrialized Products Tax, and adopting an excise tax on fuels.

From an environmental perspective, Carlton and Perloff (1994) stated there are two forms of government intervention to reduce pollution: the first is restricting the production that generates pollution, and the second is imposing a fee (on polluting firms) equal to the marginal cost of pollution, which functions as an internalization of the social cost of the externality.[31] Therefore, the imposition of a tariff on the root cause of pollution (in this case the use of fossil fuels), which could be the adoption

[30] In São Paulo, the signing of the "Pact for Full Employment in the Sugarcane Ethanol Industry", in August of 1999, formalized commitments between the various actors in the chain in order to rescue the credibility of ethanol and strengthen an important economic activity for the state.

[31] According to the authors, since the passage of the Clean Air Act in the United States in 1990, which mandated a substantial reduction in the levels of emissions from fuel burning and industrial processes, there was a decrease in the atmospheric levels of total particulate matter and sulfur dioxide, which fell by 13.4 % and 15.7 %, respectively, between 1970 and 1977.

of a variable-rate excise tax, with a higher rate for gasoline, would be one way of reducing the use of oil (and consequently emissions of CO_2) and simultaneously encouraging the use of the cleaner fuel (ethanol).

The Competitive Imbalance Between Ethanol Producers and Fuel Distributors

The producer representatives, lawmakers, and government officials interviewed raised various issues relating to the fuel distribution market, which could require government intervention because they indicated the existence of market failures. Such issues included the concentrated structure of the distribution market, tax evasion, fuel quality, and the government agency responsible for regulating the activity.

In terms of the structure of the distribution market, in order to assess the competitive difference between ethanol producers and distributors, it is interesting to remember that, prior to 1990, the distribution market was a closed market, composed only of distributors affiliated with Sindicom, and the barriers to entry for new distributors were related to the existing legislation, which was very rigid in terms of the prerequisites for the official registration of distributors. The concentrated structure of the distribution market and the resulting competitive imbalance with ethanol producers (in 1999, five major Sindicom distributors—Esso, Texaco, Shell, Petrobras and BR-Ipiranga—controlled approximately 80% of the distribution market and there were approximately 320 ethanol producers) was not evident when the sector was under intervention because ethanol was marketed via the trading desk of the federal government between two agents of equal strength, Petrobras and Sindicom.

However, with deregulation underway at that moment and with the simultaneous opening of the distribution market, this imbalance became clear. According to one interviewee, before deregulation of the sugarcane ethanol industry, the main concerns of sugar and ethanol producers were oversupply and the imbalance of competitiveness among companies within the industry itself, which many thought would be resolved by the liberalization of the market as this would favor the most efficient producers and would match production with current demand. In addition, it was expected that, after deregulation, ethanol sales would be made through contracts between ethanol producers and distributors, solving the problems of the producers who were "tied" to the government trading desk, making it possible to furnish distorted information, to the detriment of those producers.

However, with economic liberalization came two market problems that had not previously been evident: the lack of price competitiveness of ethanol in relation to gasoline (as previously mentioned), and inter-sectorial imbalance due to the highly concentrated structure of the distribution market.

The 18 producer representatives who gave an opinion regarding the competitive difference in the distribution market fell into four subgroups. The first comprised the 8 (45% of the group) who believed that, although there was concern regarding the power of the large Sindicom-affiliated distributors, the biggest problem was

the deregulation of the distribution market and the innumerable companies that emerged as a result, many of which were out of compliance with the law in terms of tax collection, etc. The second subgroup comprised the 6 interviewees (33 %) who stated that the greatest difficulty was the enormous power of the large distributors in relation to the ethanol producers. The third was composed of two interviewees (11 %), both of whom believed that large and small distributors both functioned in a manner detrimental to the industry. The fourth and final subgroup comprised another 2 interviewees (11 %) who believed that the greatest challenge was the current surplus, rather than the problems facing distributors.

The interviewees in the first subgroup—those who felt that the biggest problem in the distribution market stemmed precisely from the opening created by the *Agência Nacional do Petróleo* (ANP, National Petroleum Agency), which sought to make that market more competitive—recognized the importance of small distributors in order to reduce the power of large grouped in Sindicom. However, they noted that the lack of legislation at the time of deregulation together with the difficulties that the tax auditors and the ANP encountered in monitoring the fuel market had serious consequences for ethanol producers and consumers. Although those interviewees did not specifically identify which new companies they considered harmful to the industry, they credited various small, independent distributors with a number of infractions:

- tax evasion
- the use of shell companies
- a black market for fuel ethanol
- the creation of an "injunction industry"
- adulteration of fuels

Those same interviewees argued that large distributors, whose costs were higher and who worked within the law (collecting the taxes due and providing quality fuels), suffered unfair competition from the multitudes of smaller companies, which knocked down pump prices, forcing the large distributors to lower prices in order to avoid losing market share. Consequently, there was a flattening of prices paid to ethanol producers. Therefore, the interviewees in the first subgroup believed that tax evasion and the adulteration of fuels were the principal factors responsible for reducing incomes within the sugarcane ethanol industry. The interviewees noted that the high tax burden in the fuel market encouraged tax evasion, as did a lack of supervision by tax auditors, which allowed some distributors and filling stations to avoid collecting the taxes due (ICMS, PIS, and Cofins). They stated that the tax structure for hydrous ethanol (at that time) promoted tax evasion in the distribution market[32] because distributors were taxed at 29.3 % whereas ethanol producers paid only 1.8 % (overall tax on ethanol sales, 31.1 %). Conversely, most of the taxes on gasoline and diesel were collected from the oil refineries. Taxes accounted for up

[32] According to Sindicom estimates, the taxes collected on hydrous ethanol at that time amounted to R $ 2 billion per year, with a potential increase of R $ 600 million, which was the total value of the uncollected taxes (R $ 222 million in PIS/Cofins and R $ 382 million in ICMS).

to 35% of the final price of gasoline and ethanol, as well as up to 20% of the final price of diesel. Therefore, the difference between ethanol and gasoline in terms of the tax structure was a crucial factor in determining the competitiveness of companies in the industry because, for distributors and filling stations, gasoline sales came to be more profitable. That was one of the factors cited by the interviewers as being responsible for the major change in the degree of participation of distributors in the fuel ethanol market at the time. The evolution of the participation of distributors in sales of hydrous ethanol between 1995 and 1999 can be seen in Table 12.3.

As can be seen in the table, the participation of distributors in the hydrous ethanol market changed dramatically between 1995 and 1999.[33] The participation of Sindicom-affiliated distributors decreased by 41.3% whereas the participation of other distributors increased by approximately 343% and the black market for hydrous ethanol came to account for 23.6% of sales in 1999. However, the strong growth shown by new distributors cannot be explained by unfair competition alone. There was a competitive difference in relation to some traditional distributors. In addition to operating with comparatively low overhead (small facilities and minimal infrastructure), the new distributors were small and well managed. Furthermore, regional (as opposed to national) distribution provided certain logistical advantages. Moreover, the legislation in force in 1999 allowed the small distributors to deliver their product to filling stations that operated under the "flag" of the large fuel brands (linked to the distributors of those brands). Although all of the costs involved in constructing and maintaining the networks of stations and for branding (marketing, maintaining contracts with authorized stations, etc.) were borne by the larger distributors, these small distributors "invaded" the name-brand filling stations, which resulted in a market failure (asymmetric information between the filling stations and consumers, who believed they were buying brand-name fuel from those stations).

Other factors raised by interviewees to justify the change in the distribution market, in terms of the division of market shares, were the court injunctions brought by some non-name brand distributors due to "loopholes" in the existing legislation. Those injunctions[34] were intended to prevent Petrobras from including the value of the ICMS on invoices for fuel sales, allowing distributors to pay that tax after the fuel had been sold to the consumer, rather than at the time of its purchase from the refinery. Therefore, according to Sindicom estimates, distributors to which such injunctions had been granted paid prices that were 12% lower than those paid by other companies.

In the state of São Paulo, the issuance of all such injunctions was suspended by court order in January 1999. In a suit brought by the Ministry of Finance against the

[33] The fuel distribution market moved more than 5 billion L of fuel (diesel, gasoline, and ethanol) per month and handled approximately US $ 25 billion of product per year. Source: Gazeta Mercantil (newspaper), August 5, 1998: p. C1.

[34] The companies that filed the injunctions claimed that the collection of the tax was illegal for two reasons: the replacement of the figure of the tax withholder; and the legal prohibition against such taxes on interstate fuel sales.

Table 12.3 Evolution of the proportional participation of distributors in the hydrous ethanol market. (Source: Sindicom[a])

Year	Distributor participation (%)		
	Sindicom	Other	Black market
1995	95.4	4.6	0
1996	91.9	8.1	0
1997	85.3	11.0	3.8
1998	64.5	12.4	23.2
1999	56.0	20.4	23.6

[a] "Proposal for the marketing of hydrous ethanol." Sindicom, March 1999

independent fuel distributors who refused to collect the ICMS on sales of fuel by tax substitution, as determined by law, the courts ruled in favor of the prosecution. However, in the states of Espírito Santo, Pernambuco, Pará, Maranhão, and Rio de Janeiro, the courts continued to grant or issue continuances for such injunctions until April of that year.

The interviewees in the first subgroup believed that most of the drop in income observed in the sugarcane ethanol industry was attributable to the way in which the industry was deregulated, and that there was a need for greater intervention by the government in terms of monitoring (of product quality and of tax collection) in order to prohibit and prevent the problems cited. Those interviewees also stated that there should be a formal rule requiring contractual obligations for a certain amount of the estimated demand for ethanol, including supply guarantees. In the 1998–1999 harvest season, the market was supplied by purchases made almost entirely on "spot" markets, where prices were quite depressed due to the surplus existing at that time.

However, in view of the provisions of the Federal Constitution of 1988, the imposition of contractual obligations for a certain amount of fuel ethanol through regulation would be a legally questionable measure. Although the use of supply contracts would probably have long-term benefits for both parties (producers could schedule their production, and distributors would be assured of having adequate stocks to supply their filling stations), it was felt that this decision should be made by the interested parties themselves.

As previously mentioned, the six interviewees in the second subgroup were all of the opinion that the greatest difficulty in the fuel distribution market was the enormous power of the large distributors in relation to the ethanol producers, principally because the distributors had the power to set prices. According to those interviewees, there was a clear oligopoly in the fuel distribution market, which took advantage of the oversupply to flatten existing ethanol prices. There was a massive transfer of income from producers to distributors because the lower prices were not passed on to the consumers.

The interviewees in the third subgroup, as previously mentioned, believed that large and small fuel distributors both operated in a manner that was detrimental to

the industry. Those interviewees believed that all fuel distributors appropriated the income of farmers.

Finally, the interviewees in the fourth group believed that the problems facing the industry were not the fault of fuel distributors, but were instead attributable to the existing surplus. They were of the opinion that no government intervention (even a requirement for ethanol supply contracts) would function if there was a mismatch between supply and demand. According to those interviewees, the market would function well when policies aimed at increasing demand provided a balance between supply and demand. In relation to the concentrated structure of the fuel distribution market at that time, some of the interviewees believed that it was too soon to determine whether the conduct of the large distributors was detrimental to the sector, given the fact that free market regimes had been in force for such a short time.

Some considerations on the issues presented by the interviewees are important for the identification of market failures and the possible need for government intervention in the fuel distribution sector. Starting with the reported problem of the highly concentrated structure of the distribution system for hydrous ethanol, we found that the participation of Sindicom-affiliated fuel distributors, although have been reducing dramatically (from 100 % prior to economic liberalization, to 95.4 % in 1995, to 56 % in 1999), remained considerable, making it possible that the Sindicom block exerted significant market power. However, when market power derives from oligopolistic market structures, government intervention must be aimed at enforcing antitrust policies and curtailing anti-competitive behavior by applying the relevant legislation. Therefore, if economic misconduct is observed, action must be made by the appropriate governmental body, in this case the *Conselho Administrativo de Defesa Econômica* (CADE, Administrative Council for Economic Defense). Specifically in relation to the fuel sector, Law no. 9,478 (passed in August 1999) provides that when the regulator of the fuel industry (the ANP), in the course of exercising its powers, fears that its activity constitutes or might constitute an economic infraction, it must notify the CADE so that the latter can adopt appropriate measures, as prescribed by Law no. 8,884 (passed in 1994).

As previously mentioned, there was a major change in the fuel distribution sector at that time (the number of distributors increased from 10 to 169 in less than 5 years). The expectation was that, within the new scenario and in the medium term, competition between fuel distributors would be strengthened by changing the relative shares of incumbents in the sector and reducing their market power.[35] However, until there were greater changes in structure and the competition profile of the market, that period would be characterized by a market failure that merited the attention of the official regulatory agency (the ANP).

There have been several reports in the media regarding the problems of tax evasion and the adulteration of fuel. The overall merits and effectiveness of ANP ac-

[35] Beiral (2011) found no evidence that market power was exercised in the ethanol market in the state of São Paulo between 2000 and 2009, neither by ethanol producers (in sales to distributors) nor by fuel distributors (in sales to filling stations).

tions aside, it is noteworthy that, in September 1999, 23 fuel distributors (accounting for 3 % of the domestic supply) were shut down after irregularities were found, including counterfeit "clearance certificates"—which prove that the company has no outstanding tax debt (such as unpaid ICMS, PIS, or Cofins)—submitted to tax authorities.

Sixteen of the producer representatives answered the question regarding the role of the ANP. Of those 16 interviewees, 8 (50 %) believed that there should be a separate regulatory agency specifically for ethanol. They stated their opinion that the ANP had marginalized ethanol and was primarily focused on fossil fuels, ethanol being the only obstacle to complete domination by those fuels, therefore resulting in a conflict of interest within the agency at that time (in 1999). The other half of those producer representatives believed that the ANP would be able to deal with the issues of regulation and market surveillance of all fuels (including ethanol), but acknowledged that it was necessary for the ANP to give more attention to ethanol. Some believed the problem was the poorly defined national energy policy and role of ethanol in the energy matrix, which would guide the actions of the agency.

The situation at that time was quite unfavorable to ethanol—because of deregulation, the ethanol surplus, economic liberalization, the above mentioned distribution problems (the adulteration of fuel and tax evasion), the sharp drop in the demand for hydrous ethanol, etc.—and ethanol producers believed that government intervention was necessary. However, from our point of view, these problems could have been solved through better organization of the sector and through collective bargaining with the major fuel distributors under better conditions, which could have provided greater benefits than the individual negotiations with small distributors, who were at that time charging lower prices.

The Creation of the Brazilian Ethanol Exchange and Brazil Ethanol Inc.

As previously mentioned, the *Bolsa Brasileira de Álcool* (BBA, Brazilian Ethanol Exchange) was intended to act as a marketing center, allowing producers to negotiate on a more balanced footing with fuel distributors.

However, just as the Sindicom-affiliated distributors had been able to exercise their market power because they controlled a major share of the market, the producers affiliated with the BBA came to control the marketing of 78 % of the ethanol produced in the south-central region, which altered the concentration of the market.

The creation of the BBA was preceded by consultations with the CADE (which, as previously mentioned, did not approve the creation of the company), as was that of Brazil Ethanol Inc. According to one interviewee, several arguments were presented to CADE to justify the creation of the BBA and to show that the company was intended not to exercise market power to raise prices to unacceptable levels, but as a form of self-management to replace the previously existing government mechanisms. The arguments presented to the CADE in 1999 were as follows:

- The formation of an association of ethanol producers had the objective of protecting them from the marketing difficulties encountered in the free market, especially considering the fact that ethanol was produced during the 6-month growing season but was marketed throughout the year.
- That ethanol had a competitor (gasoline), which dominated the market, had competitive advantages in relation to ethanol, and therefore would not allow the practice of abusive pricing for ethanol.
- That there was interest in encouraging the sale of ethanol-powered automobiles and the consumption of fuel ethanol, and that it was essential to assure consumers that they were purchasing a quality product, with a steady supply throughout the year, and that a producer association was needed in order to improve marketing efficiency.

In any theoretical analysis of the agreement made among the producers for the joint marketing of ethanol, which could be characterized as the formation of a cartel (given that the bargaining power of the producers increased considerably), certain factors must be taken into consideration. Best (1990) argued that cooperatives or stabilization cartels should be seen not only as a way to market power—although that is typically the case—but also as a way of promoting the long-range development of a sector. According to the author, agreements among companies, as well as mergers and cartels, can and therefore should be accepted when they are aimed at the rationalization of production or at seeking negotiated reductions in production capacity in order to avoid predatory competition. However, the author also notes that these types of agreements should be established for a limited period of time, in the context of an industrial policy[36] aimed at the long-range development of a given sector, and must be accompanied by a restructuring plan in order to streamline production and eliminate imbalances that can lead to excess supply and predatory competition. Nevertheless, the author recognizes that cooperation among firms can, as traditional economic theory predicts, hinder the performance of the sector. The central issue is the establishment of a means of cooperation that generates common benefits for the firms involved without jeopardizing the economic performance of the industry as a whole, which occurs when such cooperation is in response to competitive pressure. Cooperation between firms should be supported on a public or a private institutional foundation to develop a collective identity and promote incentives for cooperation in order to avoid the opportunistic behavior of "free riders." In reviewing the arguments presented to CADE for the creation of the BBA in 1999, we found that some of the points raised by Best (1990) could justify the union of producers. First, there is the issue of competitive pressure and predatory pricing. The fact that ethanol was produced over a 6-month period and sold over a 12-month period, resulting in higher storage costs, coupled with higher production costs dur-

[36] According to Farina et al (1997), industrial policies should allow existing industries to maintain their competitiveness against foreign competitors, considering issues of economies of scale and scope, which can imply acceptance of concentrated sectors of the market and the consequent market powers. The challenge is to lay the groundwork for cooperation between firms while encouraging competition among them.

ing the harvest months, was indicative of the need for a mechanism of control over its marketing. Without a control on marketing, there would be predatory competition among producers (because the neediest could offer larger quantities and lower prices), which could lead to an overall decrease in income across the industry and might even hinder its activity. To avoid this problem, the BBA could manage inventories and optimize distribution throughout the year. Therefore, the BBA, if placed within the context of an industrial policy, could be a way for ethanol producers to collectively cope with the competitive pressure faced at that time, in terms of the concentrated structure of the distribution market as well as the practice of predatory pricing, which arose from the cash flow needs of producers and the ethanol surplus at that time. However, this union of producers via the BBA, in addition to deserving special attention from the regulatory agency (which would have to be attentive to the issue of economic performance), should, as stipulated in consultations with the CADE, be allowed to operate only as long as the problems persisted. At that time (in 1999), the question of supply[37] was another factor that required considerable interaction among the parties (especially because of the ongoing process of deregulation of the sugarcane ethanol industry), as well as between ethanol producers and the government (the latter interaction potentially facilitated by Brazil Ethanol Inc.), which could help the producers organize themselves and fulfill their supply responsibilities. In relation to economic performance, the central issue was the monitoring of the activities of these companies (Brazil Ethanol Inc. and the BBA) that were created in the era of deregulation. During the period of their operation,[38] the ANP would need to assess the strategies adopted, and in the case where conduct was detrimental to the general welfare, the agency should report that to the CADE, so that appropriate action could be taken.

Creating an institutional foundation (to develop a collective identity and promote incentives for cooperation, in order to avoid the opportunistic behavior of "free riders") seemed to be the greatest challenge for the two companies.

Both companies would have a sound legal basis, with a system of penalties in case of breach of contract. However, an industry that, for 60 years, had operated under the aegis of the state, which acted as a conflict mediator, and whose history had been punctuated by differences between and among interests (for example between the producers in the northeast region and those in the south-central regions; and between the Proálcool plants and traditional plants) needed to organize its production in order to adapt it to the market while reconciling the interests of the various producers. In addition, given the new institutional environment, the government also seemed to have difficulties in defining the Brazilian energy matrix, the role of ethanol within this matrix, and a long-term industrial policy for the sector.

[37] In 1999, there were as yet no flex-fuel automobiles, and the existing fleet of automobiles running exclusively on ethanol required hydrous ethanol. The introduction of flex-fuel vehicles, which can use any proportion of fuel (fuel C or hydrous ethanol), came to solve the supply problem.

[38] Both companies petitioned the CADE for authorization to operate for a determined length of time: one year, extendable to two in the case of the BBA; and three years in the case of Brazil Ethanol Inc.

It is interesting to note that among the reasons cited in the Resolution of the *Conselho Interministerial do Açúcar e do Álcool* (CIMA, Inter-Ministerial Council on Sugar and Ethanol), those affecting the purchase of ethanol for the formation of government stocks during 1999 were the following: preventing the unemployment and resulting social tension caused by the loss of income for producers; improving the health of the ethanol market with a consequent rise in prices; ensuring the continuity of the Proálcool plan; and ensuring the income and employment generated. In addition, the CIMA took measures to stimulate demand in order to balance the market. The CIMA made purchases and promoted incentives for demand in order to improve the health of the market and thereby make it more profitable. However, when producer prices and, disproportionately, consumer prices began to recover in late 1999, government officials themselves criticized the production sector, blaming it for increases in the price of hydrous ethanol at the fuel pumps. During that period, the actions of the government were inconsistent, which made it difficult to draw up a long-term policy for the ethanol industry.

The Problem of Asymmetric Information

Another important market failure mentioned by the interviewees (and confirmed by reports in the media at that time) emerged after the economic liberalization of the distribution market: the serious problem of the adulteration of fuels. In order to lower the cost of gasoline, various types of fraud were reported. Those fraudulent schemes, including the use of an excessive proportion of anhydrous ethanol in the ethanol-gasoline blend (above the 24% allowed by law), and the addition of solvents or other chemicals to the gasoline, were not perceived by consumers at the time of purchase and caused serious problems in the medium term. This adulterated gasoline could cause certain engine parts to corrode, resulting in high consumption and engine failure, as well as clogging of fuel pumps. This issue constituted a problem of asymmetric information, as did the existing ordinances that allowed "branded" filling stations to buy ethanol from any distributor to offer to end users (meaning that the product purchased at those filling stations did not necessarily originate from the brand whose "flag was being flown" there).

On the theoretical side, the moral hazard was related to the asymmetry of information between parties, which prevents market mechanisms from operating efficiently and requires government intervention, because the parties involved, if given an insufficient amount of information, will make decisions that are less than ideal. Therefore, the marketing of products subject to asymmetric information, as was the case for fuels, required government regulation because of the risks that asymmetric information or the receipt of flawed information imposed on consumers. Items 6.23 and 6.24 of the "Pact for Full Employment in the Sugarcane Ethanol Industry" were aimed at correcting problems of asymmetric information of fuel quality and of product identification at the filling stations in the state of São Paulo. Resolving these issues, under the jurisdiction of the federal government, called for norms in

the retail marketing of hydrous ethanol so that the filling stations that chose to be identified with a particular brand would be able to sell only ethanol provided by the distributor for that brand and those who chose to sell more than one brand of ethanol would be required to segregate the pumps and tanks by supplier in order to avoid mixing products from different sources. In addition, it was important that the federal government make every effort to ensure that hydrous ethanol was purchased only from ANP-authorized distributors (which was not the case at that time) in strict compliance with the law governing that activity, in particular Article 66 of the Consumer Protection Code and Article 194 of Decree-Law no. 7,903.

The existing legislation relevant to the issues of marketing, distribution, and monitoring of fuel was very broad. Decree no. 2,455, handed down in January 1998, stipulated that the ANP was responsible for authorizing and regulating activities related to the national fuel supply, monitoring those activities directly or through agreements with agencies at the federal, state, or municipal level.

Regarding supervision, Provisional Measure no. 1,883-16, revised and reissued in August 1999, held forth on the monitoring of activities related to the national fuel supply (covered under Law no. 9,478, passed in 1997) and established administrative sanctions for the marketing of fuel ethanol outside the context of government regulations. The changes introduced in this new version of the Provisional Measure did not dispense with the need for authorization in the marketing of fuel ethanol, which was also the object of ANP Directive no. 29, issued in February 1999. Under that Directive, which established rules for fuel distribution, fuels could be purchased only from authorized suppliers and the monthly limits set by ANP or other political body responsible for marketing of fuel ethanol had to be observed.

Regional Differences: Subsidies for Sugarcane Cultivation and Freight Costs

One major issue related to the need for government intervention in the sugarcane ethanol industry in 1999 was the fact that there were structural differences between sugarcane-producing regions, resulting in inequities not only in terms of agricultural costs, but also in terms of the logistics of ethanol distribution to the larger markets. These differences in competitiveness caused much discussion in the sector, because the government was providing subsidies (for sugarcane production and for freight costs) to the less competitive regions.

Government Support for Sugarcane Production

Because there were differences between sugarcane-producing regions in terms of agricultural productivity (in the 1998–1999 harvest season, the south-central region produced 81.6 t of sugarcane per hectare, compared with only 62.2 t of sugarcane per hectare for the northeastern region), the federal government provided economic

support to growers in the northeast who were cultivating sugarcane for ethanol production.[39] As previously mentioned, the government had been providing support for sugarcane cultivation in the northeast since 1971 with the objective of equalizing production costs between the two regions. That support was expected to continue for only 7 years, the period within which the new varieties of sugarcane would be developed via the *Programa Nacional de Melhoramento da Cana de Açúcar* (National Program for the Improvement of Sugarcane). That, together with the planned modernization of the national sugarcane ethanol industrial park, was expected to be sufficient to make government support unnecessary. However, the reality showed that, despite the excellent results obtained with the national program for the modernization of the sugarcane ethanol industrial park and the development of new sugarcane varieties, it was not possible to implement the government's ambitious plan to eliminate sugarcane subsidies in the northeast, which are still being provided.[40] In 1999, that support was expanded to include other states, in accordance with CIMA Resolution no. 10 (passed in February 1999). The opinion of the government officials interviewed in relation to providing economic support to growers in the northeast who were cultivating sugarcane for ethanol production was that such support should be maintained in order to ensure ethanol production in that region, which was considered indispensable to the national ethanol supply. At that time, the government believed that there was no convincing justification for replacing the energy production in the northeast (which was producing a clean, renewable fuel that was in demand in the rest of the world) with another culture. In that region, there was no crop that could replace, on an adequate scale,[41] the sugarcane used in the production of ethanol. In addition, the sugarcane ethanol industry of the northeastern region was competitive with that of other regions of the world, despite not being so in comparison with that of the south-central region.[42] Furthermore, it was considered a matter of government policy that no industry should be allowed to fail without a provided economic alternative to maintain the level of employment in a given region. Among the interviewees who were not affiliated with the government, there was no consensus on this issue, which caused much controversy at the time. One interviewee, who was a sugarcane producer representative, argued that without economic support for sugarcane cultivation in the northeast, the sugarcane suppliers

[39] The cultivation of sugarcane for the production of sugar was not subsidized by the government. According to CIMA Resolution no. 10, the following states (some in the northeastern region and some in the south-central region) were entitled to support: Mato Grosso, Mato Grosso do Sul, Minas Gerais, Rio de Janeiro, Espírito Santo, and Goiás.

[40] Law no. 10,453 (May 13, 2002).

[41] The climate of the region causes fruit to ripen quickly, making it difficult to deliver to the market in a timely manner. Therefore, fruit crops would hardly represent a viable replacement for sugarcane.

[42] According to Serodio, the cost of sugarcane cultivation in the northeast was the fourth lowest of any region in the world. In 1999, the countries with the lowest sugarcane cultivation costs were Brazil, Australia, and South Africa. Although those costs were lower in the northeastern region than in any other region of Brazil, it should be borne in mind that the industrial yield of sugarcane cultivation, in terms of ethanol/ton of sugarcane, was also lowerin the northeast.

in that region would not survive in the free market, because of the differences in productivity related to differences in soil and climate.

That interviewee stated that sugarcane cultivation was the only major source of employment in the region, that there was no other crop that could replace sugarcane, and that the manual laborers required in the sugarcane fields could hardly be allocated to another activity, because of their low level of education. However, the various sugarcane grower associations in the other, more productive, regions of Brazil, although recognizing the difficulties faced by growers in the northeast, noted that the level of support given to producers in the northeast (R$ 5.07/t in 1999) represented, in the 1998–1999 harvest season, over 30% of the price of sugarcane established for the south-central region.

Among the producer representatives interviewed, opinions were divergent and quite explicit. There was a group holding that, considering the lower competitiveness of the northeastern region (which increased the cost of production in that region), and the social issues involved (the number of jobs at stake, the low per capita income, the lack of alternative crops, and the inability to re-allocate the manual labor force), subsidies should be maintained but for a specific amount of cropland so as not to encourage expansion into regions of lower productivity. One producer representative was of the opinion that such support should not only be based on the volume of sugarcane processed, but should also be linked to ongoing increases in comparative productivity (within the same region) so that the support could not be used as an instrument of stagnation in productivity.[43] The producer representatives who were against providing agriculture subsidies in the northeast noted that the price of raw materials accounted for a significant portion of the cost of the end product, and, because the market was becoming increasingly competitive as a result of the expectation of deregulation (which would occur in the near future), any support that the government provided to one producing region had a major negative effect on the other producing region(s). Those producer representatives also felt that such support was no longer warranted because conditions were different in 1999 than in the 1970s. In 1999, the northeast had competitive advantages over other regions in the export of sugar (due to its geographic location and investments made in its ports).

According to Pindyck and Rubinfeld (1994),[44] even if the benefits provided to consumers and producers are given equal weight, a policy of price support that shifts the surplus from one group to another usually results in a net loss of well-being for society as a whole,[45] and economic efficiency must be considered when such policies are developed and implemented. Those same authors stated that, when

[43] According to the interviewee, despite recent intemperate weather in the northeast, productivity had increased by 4.5–5.0% per year between 1985 and 1999.

[44] The authors addressed the loss of well-being resulting from various government policies, such as setting minimum prices, providing economic support for set production levels, setting import levels, and imposing import duties.

[45] When analyzing the variations in consumer surplus and producer surplus under the price support regime, one finds that there was a net loss of surplus, known in microeconomics as a "deadweight loss."

the objective is to provide additional income to a given segment of the society, it is less costly to make the payment directly, rather than via a price support policy (which implies a loss of welfare). However, despite being the most economically efficient option, such entitlements are not always the preferred option because they are politically unappealing. Therefore, considering that there was no intention to allow sugarcane cultivation to flounder in the less competitive regions, the government policy in 1999 that, as an alternative to price supports, would have best preserved the well-being of society and increased the income of sugarcane suppliers would have been to give those suppliers cash payments based on the market price. However, no such policy was adopted.

It is of note that, in 1999, regional subsidies for sugarcane suppliers in the northeast, in place since 1971 (21 years longer than expected) were expanded (by CIMA Resolution no. 10) to include the states of Mato Grosso, Mato Grosso do Sul, Minas Gerais, Espírito Santo, Goiás, Pará, Tocantins, and Rio de Janeiro. Provisional Measure MP554 (passed on December 23, 2011) established a federal program, funded by the Contribution for Intervention in the Economic Domain (an excise tax), to provide financing for the storage of fuel ethanol (at an annual interest rate of 8.7%) and to subsidize sugarcane cultivation, paying R$5.00/t of sugarcane to all suppliers in the region overseen by the Office for Development of the Northeast, as well as to other suppliers in the state of Rio de Janeiro. This benefit, incorporated in the 2007–2008 harvest season, represented a revised version of an earlier government policy designed to guarantee a minimum price for various crops, including sugarcane.

Economic Support to Offset Shipping Costs

The economic support given by the government to ethanol producers in the states of Mato Grosso and Mato Grosso do Sul, pursuant to CIMA Resolution no. 10, was valid for a period of 5 years (from 1999 to 2004), decreasing in value from the second year onward. The objective was to allow ethanol producers in those regions to compete on the domestic market, which was problematic in the new free market environment because most were far from metropolitan centers (areas of high consumption) and blending facilities (refineries), requiring time to establish a market for their products given that the government itself had previously denied them access to specific regional markets.[46] Producers whose facilities were located farther from distribution centers and from the larger cities, such as the 21 stand-alone or co-located ethanol plants in the Araçatuba region of the state of São Paulo, created in 1978 under the Proálcool plan (with strong government support) and still in operation in 1999, had a disadvantage compared with those whose facilities were better situated. Despite having invested successfully in the industry, in sugarcane production and in logistics to reduce costs, the Araçatuba plants were unable to be

[46] For instance, prior to 1999, the ethanol trading desk could not sell ethanol produced in Mato Grosso to market in the north of the country. Therefore, after economic liberalization of the industry, ethanol producers in Mato Grosso would be slow to conquer new markets.

competitive with those located closer to the blending facility, which was in Paulínia and also closer to the largest markets. The opinion of the government representative interviewed in 1999 was that these ethanol producers (those located in the Araçatuba region) had, during the implementation of the Proálcool plan, responded to the call of the government, which for political reasons (agricultural expansion, distribution of income, etc.) had encouraged the construction of such plants in distant regions, guaranteeing that they would be able to deliver their products to a blending facility (one of which was in the Paulínia region) or distribution center. According to the interviewee, although those facilities had high yields, they also had additional transportation costs. Because they had not yet gained access to the regional markets, they needed government support (in a temporary and tapered form) in order to organize themselves, be it to conquer new markets or to reduce costs by using new modes of transportation (including waterways)so that investments in infrastructure (factories, tankage, etc.) and job creation would not be wasted.

On the issue of economic support to offset freight costs, the ethanol producer representatives were divided into four camps: those who were radically opposed to such support; those (the majority) who believed that the companies would be able to compete in the free market after 5 years, at which point the support could be withdrawn; those who were unconditionally in favor of that support, believing that it was necessary to ensure the survival of those facilities; and those who felt that, even if economic support was deemed no longer necessary after past 5 years, political interests would prevent its discontinuation.

Those who were radically opposed to such support noted that the government had provide numerous incentives at the beginning of the Proálcool era, such as creating a market reserve for anhydrous ethanol (linked to the consumption of oil) and providing financing programs for the purchase of machinery and equipment (agricultural improvements being financed at particularly attractive interest rates). They pointed out that, because 20 years had passed, the investments that had been made by the plant owners in that region would have already been amortized. Therefore, any government responsibility for the success of those plants would have ended by 1999. They also argued that the greatest risk for entrepreneurs is the market itself, and that if the government continued to support the less competitive producers, the industry would always be tainted with oversupply and high default rates, which would harm the more efficient producers. Therefore, they believed that the government was giving such producers a competitive advantage over those who were near the larger consumer markets, and that if the former had not reached the point of functioning independently (without government support) by 1999, they should be allowed to fail.

The majority of the producer representatives interviewed believed that those producers would be able to compete in the free market after 5 years, at which point the support could be withdrawn. They felt that, by that time, many of the problems faced by the producers in the more distant regions would have dissolved.

Nevertheless, they also felt that, although it was important to maintain the industrial park constructed, as were the number of jobs and regional development generated by the industry, the economic support to offset freight costs should not be ex-

panded. Their opinion was that the amount of support should be defined on the basis of regional characteristics, productivity, freight costs, and social issues—without stimulating growth in those regions—and that such support should be well-planned and gradually tapered off in the regions where costs were lower.

Those who were unconditionally in favor of that support, believing that it was necessary to ensure the survival of those facilities and to ensure their competitiveness in a free market environment, gave the example of the state of Mato Grosso, which, at that time, was producing more ethanol than the regional consumption demanded. Therefore, according to those interviewees, there was a need for a mechanism that would draw down those stocks while maintaining the balance of the energy matrix. They stated that, in a free market environment, those facilities would not be able to compete with ethanol plants located near the larger consumer markets.

The last group of the interviewees believed that encouraging the construction of ethanol plants in regions that were far from the larger consumer markets (at that time) represented a lack of foresight on the part of the government. However, they felt that political pressure would prevent the government from withdrawing its support for those plants. The belief was that the government would not allow fuel production to be concentrated in one region, and, given the structural differences between regions, the support would not be withdrawn in all states. Whether or not the support was withdrawn would depend on how economically important the industry was in the respective states.

The producer representatives also stated that freight costs represented only a fraction of the final price of ethanol, and might even be completely offset by the lower cost of raw materials in the more remote regions (where land lease prices are typically lower). They pointed out that fuel distributors bought product throughout the year, in a coordinated manner (i.e., not buying up all of the ethanol stocks from a given region before buying ethanol from another region), and were more concerned about supply than about price. However, they also stressed the importance of each producer matching the volume produced and its production profile (hydrous ethanol, anhydrous ethanol, or sugar) to the needs of regional markets, or to those of the larger consumer markets to which it has access and in which it can be competitive without government support.

During this period, several alternatives to road transportation began to emerge. That allowed ethanol producers to reduce costs and gain access to new markets, bringing Mato Grosso and the other states in the central-west region of Brazil into the national development process.