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## Impact of mergers and acquisitions on the performance of the sugar and alcohol industry in Brazil

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The aim of this paper is to verify how mergers and acquisitions occurred in the sugar and alcohol industry since 2007, identifying the reasons that may have generated financial difficulties for some of the traditional companies and large national and foreign groups, and how these transactions have behaved in the last years. It was noted that from 2007 to 2013 many groups bought many traditional industrial plants in the sugar and alcohol sector, which were experiencing financial difficulties, mainly due to the international financial crisis of 2008. From 2013, many of these large buyer groups did not have the expected return and have been experiencing the same difficulties as traditional groups, and have been acquired by others more discerning groups in their choices.

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### 1. Introduction

The process of mergers and acquisitions in Brazil enhanced after the 1990s, with the commercial opening and the emancipation of the Real Plan. It allowed the inflation stabilization and the significant amount of foreign direct investment (FDI) due to high interest rates. From 1994 to 2015, there were 10,594 mergers and acquisitions (KPMG, 2014; 2016), with a geometric growth rate (GGR) of 6.95% per year, significant at 1%. From this total, 893 mergers and acquisitions occurred in the food, beverages and tobacco sector.

In this context, the sugar and ethanol sector has been experiencing an intense concentration and centralization of capital. From 1995 to 2008, the professionalization of the sector with the hiring of market executives and the greater capitalization of the mills, in front of the recovery of the international market from 2000, were the key components for the acceleration of the merger and acquisition process in the sector, mainly after Brazil has clashed with the European Union over subsidies to the sugar in the World Trade Organization (WTO) (Agriannual, 2013).

Along with this increase in mergers and acquisitions there was an increase in the share of foreign capital in the sector, in which the groups Louis Drey-

fus Commodities (LDC) and Tereos (formerly called Béghin-Say) came to Brazil from 2000. In 2006, foreign companies accounted for 4.5% of the national production of sugarcane, or 18.5 million tons, and they had 11 units (Unica, 2016).

In this period, there was still a strong expansion of sugar and alcohol production in new non-traditional areas in sugarcane production, mainly in the states of Minas Gerais, Rio de Janeiro, Goiás, Mato Grosso and Mato Grosso do Sul. Furthermore, from 2006, 115 new mills and distilleries were built in Brazil in non-traditional areas of São Paulo and other states (Chaddad, 2010).

Nevertheless, from 2008 there was the international financial crisis, in which several mills were forced into bankruptcy. In 2015, 13 processing units underwent judicial recovery, most of which are large and medium-sized with the participation of two multinationals: the Renuka Group (controlled by the Indian Shree Renuka Sugars), and Abengoa Bio-energy (belonging to the Spanish Abengoa). Together, these 13 units have bank debts that account for about R\$ 8 billion (Batista, 2016).

Mergers and acquisitions could cause some problems not only in organizational terms, but also in cultural terms. Because of this, this paper seeks to understand: how do the mergers and acquisitions occurred in the sugar and alcohol industry in Brazil? To answer this question, the aim is to verify how mergers and acquisitions occurred in the sugar and alcohol industry since 2007, identifying the reasons that may have generated financial difficulties for some of the traditional companies and large national and foreign groups, and how these transactions have behaved in the last years.

This paper is structured in five sections, in which the first one is this introduction. The second one presents some aspects of mergers and acquisitions specifying some occurred in the sugar and alcohol industry. In the third one it is described the methodology highlighting the linear regression model used to understand the consequences of the mergers and acquisitions in the sugar and alcohol industry. The fourth one describes the results and discusses them. The last section is the conclusion.

## **2. Mergers and acquisitions**

Firms can increase their size in the market through investments in the construction of new units, which is called organic growth. Companies acquire full or partial shareholding control of another company through mergers, which is a combination of two or more businesses, in which there is exchange of shares or money to share rights and obligations; and / or through acquisitions (Carlton and Perloff, 1999; Shepherd, 1999).

Mergers and acquisitions have been more and more used as a business growth strategy. Some important factors that spurred this process from the 1980s were: globalized commercial economy; competitiveness growth due to the de-regulation of many sectors; changes in factors related to the operations efficiency; economic and financial favorable conditions; and significant differences of wealth and income between companies (Weston *et al.*, 2003). According to Penrose (2006), when there is merger or acquisition the company can achieve a good position in the market with less effort, acquiring an administrative team, an experienced workforce and technical staff, obtaining the productive services and the necessary knowledge to settle in a new activity.

In addition to contributing to companies growth, mergers and acquisitions can both result in value gains / positive synergies<sup>1</sup> (Seth, 1990; Fahey and Randall, 1999; Carlton and Perloff, 1999; Shepherd, 1999; Weston *et al.*, 2003; Penrose, 2006), as well as in neutral returns or value losses / negative synergies<sup>2</sup> (Seth, 1990; Weston *et al.*, 2003; King *et al.*, 2004; Brito *et al.*, 2013; Halkos and Tzeremes, 2013; Rahman and Lambkin, 2015). This value loss / negative synergy is mainly caused by the euphoria in analysis of the potential returns resulting from the transaction in periods when there are many mergers and acquisitions, i.e. periods when the economic conditions contribute to companies seek to grow rapidly (Banal-Estañol *et al.*, 2010; Schmidt and Duchin, 2013).

Seth (1990) says that there are basically two hypotheses that explain the reasons for the acquisitions, which are: (i) maximizing the value of the company to the shareholders, assuming that the wealth of the acquirer and acquired companies increases with the acquisition due to the positive synergy or the value created; or (ii) maximizing the benefits for the managers at the expense of the shareholders, perhaps because their reward is tied to the size of the company in terms of sales or assets, resulting in fall in the wealth of the shareholder from the acquirer company and increase in the wealth of the acquired company, and no amount is necessarily created because of the acquisition.

With regard to the advantages and disadvantages in the process of mergers and acquisitions for companies, Weston *et al.* (2003) describe that some authors have argued that mergers and acquisitions increase value and efficiency and move resources to their optimal use, thus increasing the value of the shares. Other authors are skeptical, saying that the acquired companies would al-

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<sup>1</sup> Positive synergies are the advantages resulting from mergers and acquisitions, such as lowering costs by dilution of expenses between companies, advantages using the same distribution channel, market expansion, and so on.

<sup>2</sup> Negative synergies are the disadvantages resulting from merger and acquisition, such as cultural differences, high premium by the control, fees from investment banks, lawyers and accountants, and the allocation of corporate expenses to the acquired unit.

ready be efficient and their performance after the acquisition does not increase. There are still other authors that argue that the gains of the stocks simply represent redistribution to workers and other shareholders. Another point of view is related to the fact that mergers and acquisitions are mechanisms of speculation that cause frenzy, like in a casino, generating undue losses, which destroy the net equity, resulting in increase in vulnerability and economic instability.

Fahey and Randall (1999) argue that exploring positive synergies should be the main goal of mergers and acquisitions. As the merger and acquisition activity is complex, the challenge is to try to understand what would be the factors that could result in more efficient transactions, avoiding negative post-merger results.

Although the study of Healy *et al.* (1992) has shown that firms increased the return on operating cash flow on the asset after mergers, Ghosh (2001) did not identify any increase in efficiency after acquisition. He compared the cash flow operating performance before and after the acquisition of the companies that went through this process with the companies that are equivalent in size and performance.

Banal-Estañol *et al.* (2010) observed that mergers increase during the period of economic growth, due to factors such as technological innovations or increased demand. In this period the efficiency gains are relatively less important and, therefore, high-level mergers are relatively similar to low-level mergers. Thus, during the period of economic growth, the screening process for the best merger deals is more inefficient. On the other hand, in periods of low economic activity, the acquirers will consider paying the lowest reserve price to acquire the target company in their screening process, and the higher that price, the less predisposed they will be in acquiring the target company. At the same time, target companies use relatively more defensive tactics in recession periods, when acquirer firms are more cautious or less willing to buy.

King *et al.* (2004) found in their study that both acquirer and acquired firms obtained positive return on asset (ROA), return on net equity (ROE), and return on sales (ROS) in the transaction period. In addition, the returns of the acquired companies were extremely high in relation to that of the acquirer companies, which showed the existence of an initial positive expectation regarding to the possible synergy in the transaction. However, the returns of the acquirers in the subsequent periods were insignificant or negative, that is, the anticipated synergies of the acquisition were not carried out by the acquirer companies. These authors concluded after decades of research that merger and acquisition activity, on average, did not contribute positively to the acquirers' performance.

The study carried out by Brito *et al.* (2013), with 13 insurance companies, found no evidence of increasing in market share through the coordinated ef-

fects, neither the growth in the efficiency level of the companies and social welfare, calculated by the consumer surplus. Halkos and Tzeremes (2013) found that the possibilities of mergers and acquisitions among Greek banks would not result in efficiency gains for these banks, at least in the short term.

Among the reasons that can make acquirer companies less efficient post-merger and post-acquisition, maybe the main one would be the carelessness of serving their customers during the integration phase.

### *2.1 Mergers and acquisitions in the sugar and alcohol sector*

Since the 2000s, the world has had an intense growth in ethanol production caused by the possible solution of the so-called green fuels. According to Point and Gutierrez (2009), rapid growth in global biofuel production, which was 18.1 billion liters in 2000 increasing to 60.5 billion liters in 2007, was due to high oil prices and favorable government policies.

In this period, prospects for the growing demand for ethanol on the world market were very promising due to increased demand for energy from China and India, the formation of former Soviet Union countries, and the world development, increasing the demand for oil (Conley and George, 2008).

In this sense, different countries have begun to intensify the development of energetic alternatives, and most governments have increased their mixing goals of ethanol in gasoline, and biodiesel in diesel. European Union Directive 2015/1513/EC (European Commission, 2015) required a minimum of 10% of biofuels mixed with fossil transport fuels in 2020.

In the United States, the average production of maize for ethanol production rose from 18 million tons in 2001 to 55 million tons in 2006. Thus, the production of US ethanol between September 1998 and June 2008 rose from 5,299 billion to 34,065 billion liters per year, increasing 543%. The number of mills for ethanol production increased from 50 to 170 in that period, according to data from the Association of Renewable Fuels. As stated in the United States Department of Agriculture, the maize cultivated land increased from 78 million to 92 million acres from 2006 to 2009; the production increased from 249,018 billion to 307,461 billion kilograms from 1998 to 2008 (Altieri, 2009; NG and Golsley, 2010; Lewis and Tonsor, 2011).

In consonance with Lewis and Tonsor (2011), from 1998 to 2008 the percentage of maize used in the ethanol production in the United States increased from 5% to 27%, while the proportion to other components of maize demand remained stable or declined.

In 2005, the US Congress approved a legislation called Renewable Fuels Standard, which determined the production of 28.39 billion liters of ethanol

by 2012. In December 2007, an account of energy that doubled this norm of maize-ethanol to 56.7 billion liters by 2015 was approved by the Congress and sanctioned by the president (Conley and George, 2008).

The opportunities seemed to be more promising for Brazil in front of the growth of world production and consumption. In line with a study carried out by the International Energy Agency, reported by Falk *et al.* (2009), only the production of ethanol from sugarcane can compete with the oil price without causing large-scale environmental problems, since the alcohol from European beets and US cereals can cost 30% more than oil, as well as may not significantly reduce CO<sub>2</sub> emissions.

Conforming to Wheatley (reported by Falk *et al.*, 2009), ethanol production in Brazil is much more efficient than in the United States, where it is almost exclusively from maize. Brazilian production per hectare is twice that of North American and the energy used per unit for the process is more than five times more efficient.

All this global transformation has impacted on the administration of the Brazilian crushing machines. From a strategic point of view, some units focused on diversification and growth close to those of concentrated and competitive oligopolies, such as vertical integration, horizontal integration and investments in increasing production capacity.

On the other hand, this euphoria began to change from 2008. Many groups that bought or acquired shares in other companies have been through financial difficulties and therefore have changed role, from acquirer to acquired. One of the reasons that could have caused this situation was a large number of mergers and acquisitions that occurred from the 2000s, which may have boosted a series of transactions that were not very well analyzed by the managers, as reported by Schmidt and Duchin (2013), making more careful analysis of positive or negative synergies impossible, according to Fahey and Randall (1999).

In addition, in 2007 and 2008 Brazil experienced high rates of economic growth, showing increasing in Gross Domestic Product (GDP) by 6.09% and 5.15%, respectively. Because of the increase in demand brought about by this growth, mergers and acquisitions may have increased independently of efficiency gains, which are relatively less important in these periods, according to Banal-Estañol *et al.* (2010) and Schmidt and Duchin (2013).

### 3. Methodology

This is a descriptive research since it seeks to examine mergers and acquisitions by sugar and alcohol industrial groups to ascertain the reasons that

may have compromised the financial health of these groups, as well as the behavior of those transactions after the crisis period. To carry out this research, the results of other studies were compiled, comparing and contextualizing the results obtained in this paper and in the information in newspapers and magazines, such as *Folha de São Paulo*, *Jornal da Cana*, *Exame Magazine*, and *Valor Econômico*, as well as on consulting and advisory sites, such as KPMG Corporate Finance (2014; 2016).

Furthermore, we did a case study with the most recent acquisition through a linear regression model. There was the acquisition of Santa Cruz Mill by São Martinho Mill (Nova Cana, 2014) in 2014. Thus, the following quarterly values were gathered in order to run the linear regression: Sales Revenue (SR), Operating Expenses (OE), Sales Expenses (SE), General and Administrative Expenses (GAE), Net Income (NI), Return on Assets (ROA), Return on Net Equity (ROE), and Return on Sales (ROS). These financial data are available on BM&FOVESP, which is an official Brazilian Stock Exchange.

Data were divided into two periods: the first one is from the second quarter of 2011 to the fourth quarter of 2013, and the second one is from the first quarter of 2014 to the third quarter of 2016. It was necessary because it was intended to verify whether there were significant changes in these amounts due to this acquisition. For this, the mean and significance level t-test of difference of means were calculated.

The data for the first quarters of each year of São Martinho Mill, which are not directly available online, were calculated by the difference between the annual value and the values of the other available quarters.

As for the case study, in order to verify whether the post-transaction performance was effectively affected by the merger and the acquisition or by a trend, a linear regression analysis of the observations after the merger or acquisition in relation to the observations before them was carried out. The changes caused by the merger and acquisition are estimated by the intercept coefficient ( $\alpha$ ), and the slope coefficient ( $\beta$ ) measures the persistence of the adjustment, a trend. This model was used by Healy *et al.* (1992), Gosh (2001) and Rahman and Lambkin (2015). In this research six linear regression models were estimated, as following:

$$SR_{\text{after}} = \alpha + \beta.SR_{\text{before}} + \varepsilon \quad [1]$$

$$OE_{\text{after}} = \alpha + \beta.OE_{\text{before}} + \varepsilon \quad [2]$$

$$GAE_{\text{after}} = \alpha + \beta.GAE_{\text{before}} + \varepsilon \quad [3]$$

$$ROA_{\text{after}} = \alpha + \beta.ROA_{\text{before}} + \varepsilon \quad [4]$$

$$ROE_{\text{after}} = \alpha + \beta.ROE_{\text{before}} + \varepsilon \quad [5]$$

$$ROS_{\text{after}} = \alpha + \beta.ROS_{\text{before}} + \varepsilon \quad [6]$$

The slope coefficient ( $\beta$ ) measures persistence in sales performance and in profitability indices. Significant slope coefficient ( $\beta$ ) will indicate that the merger or acquisition process did not influence the persistence of the performance, meaning that post-acquisition or post-merger performance is a continuation (persistence) of the performance before the acquisition or merger.

The intercept coefficient ( $\alpha$ ) shows the improvement in sales performance induced by the acquisition or merger. If the intercept coefficient ( $\alpha$ ) is significant, it will confirm that the merger or acquisition process modified the performance of the observed indicators (Tab. 1).

**Tab. 1.** Intercept ( $\alpha$ ) and slope ( $\beta$ ) coefficients meaning in the models

Coefficient	Statistical significance	Performance origin
( $\alpha$ ) Intercept	Statistically significant	Merger / Acquisition
( $\beta$ ) Slope	Statistically significant	Post-merger / acquisition performance is a continuation of performance prior to the merger / acquisition

Source: Authors.

Healy *et al.* (1992) argue that this model is superior to a simple model of comparison of changes, which confronts numbers in post and pre-merger or acquisition, because this model considers the possible persistence in a given cash flow.

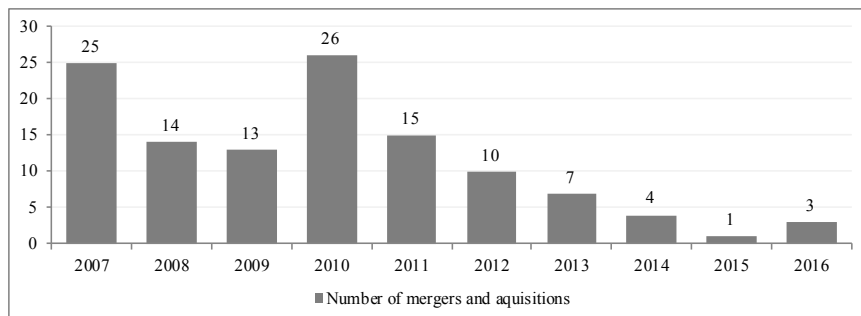
All analysis was performed using the Excel spreadsheet and, then, put to the Gretl statistical software to perform Linear Regression analysis.

#### 4. Results description

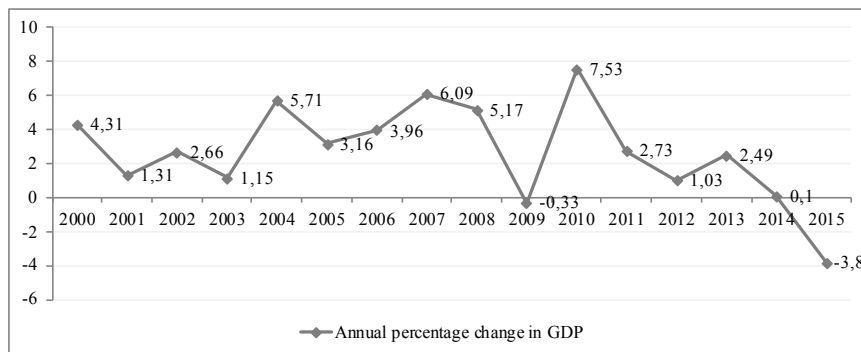
In agreement with data released by KPMG (2016) from 2007 to 2016, the largest merger and acquisition transactions in the sugar and alcohol sector occurred respectively in 2007 and 2010 (Fig. 1). In 2007, foreign groups accounted for 70% of these transactions and private equity funds accounted for 36% (Guimarães, 2009).

The Brazilian economy behavior may have been one of the factors that may have contributed to this euphoria in merger and acquisition transactions in the sugar and alcohol sector (Fig. 2), showing real percentage changes in GDP of 6.09% per year in 2007, 5.17% in 2008, and after a decrease of 0.33% in 2009 the GDP grew 7.53% in 2010.



**Fig. 1.** Number of mergers and acquisitions in the sugarcane sector from 2007 to the first quarter of 2016

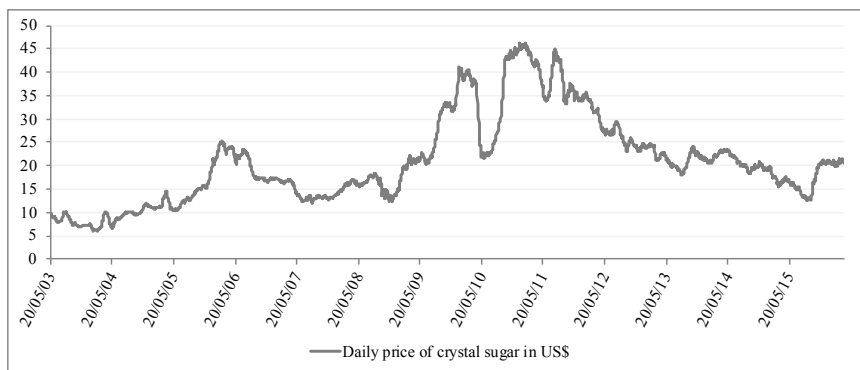
Source: KPMG, 2016.

**Fig. 2.** Annual percentage change in Gross Domestic Product (GDP) from 2000 to 2015

Source: Brazilian Institute of Geography and Statistics (IBGE, 2016), Institute for Applied Economic Research Data (Ipeadata, 2016).

Another important factor was the sugar price fall (Fig. 3) that reduced the prices of the crushing units, making them more attractive for the acquisitions.

When some of the merger and acquisition transactions in the sugar and alcohol mills or groups are analyzed from 2007 to 2013 (Tab. 2), it is noted that the participation of large national and foreign groups is observed, some of which have never been specifically active in the sector. The target companies were usually traditional mills that were through financial difficulties. When transactions from 2013 are analyzed, it is noted that some of the acquirer companies have also become targets as a result of the financial difficulties and the participation of acquirer groups, which are not specifically interested in assets

**Fig. 3.** Daily price of crystal sugar (in US\$) from 2005 to 2016

Source: CEPEA / ESALQ (2016).

that are part of the core business of the sugar and alcohol sector, that is, sugar and ethanol production, but in those focused on electric energy cogeneration.

Transactions that took place between 2007 and 2012 may have been carried out without more careful analysis of the possible positive synergies with the acquisitions. In the period from 2008 to 2015, 79 units have been going through judicial recovery, around 23% of the total of 350 units in Brazil, covering not only traditional mills, but also large national and multinational groups. Three elements contributed to this result, as following (Scaramuzzo, 2015, Batista, 2016):

- *High production capacity*: Renuka Group controls two mills in São Paulo and two ones in Paraná, which have the capacity to mill 11 million tons of sugarcane per harvest. Abengoa Bio-energy has two mills in São Paulo, which have the capacity to process together 7 million tons. Tonon Bio-energy has three mills with capacity to process 8 million tons per harvest;
- *High indebtedness*: in addition to a high indebtedness in dollar, Abengoa Bio-energy invested in expansion, resulting in bank debts of R\$ 900 million in December 2014. In 2015, Renuka Group had indebtedness of R\$ 3.3 billion in Brazil, and Tonon Bio-energy had its credit score lowered by the risk rating agency Fitch;
- *Increase in the exchange rate*: the increase in the price of the American currency in relation to the Brazilian currency, from R\$ 2.20 at the beginning of 2015 to above R\$ 3.90 at the end of 2015, made it impossible to pay the debts of Abengoa Bio-energy, and made Renuka Group try to renegotiate the debt extra-judicially. However, the lack of agreement led creditors to debt settlement, putting pressure on the company to seek judicial recovery.

**Tab. 2.** Transactions in the sugarcane industry, from 2007 to 2016

Year	Company	Acquirer/ partner	Kind
2006 / 2007	Cridasa, Disa, Alcana, Paraíso e Usinavi, Ibirácool, Cepar e Agromar	Infinity Bio-Energy	Multinational company, in which its shares are traded on the London Stock Exchange, acquired distilleries in the states of Minas Gerais, Espírito Santo, Bahia and Rio Grande do Norte.
2007	Vale do Rosário	Santa Elisa Sugar and Alcohol	Merging process between them.
2007	Cocari	Vale do Ivaí	Acquisition estimated at US\$ 70 million.
2007	Alcídia Distillery	ETH Bio-energy	ETH Bioenergy sale, controlled by Odebrecht Sugar and Alcohol.
2007	ETH Bio-energy	Sojitz Corporation	Japanese Sojitz bought a stake in ETH Bio-energy.
2007	Alcoolvale	Clean Energy Brazil (CEB)	CEB acquired 33% of the holding company Unialco MS, which controls the Alcoolvale mill.
2007	Dedini Agro Sugar and Alcohol Group	Abengoa	Acquisition.
2008	Benácool	Cosan Group	Benácool mill acquisition, which belonged to the J. Pessoa group.
2008	Cocari	Vale do Ivaí	Acquisition for US\$ 70 million.
2008	Tropical Bio-energy	BP	British BP bought 50% of the stakes in Tropical Bio-energy
2008	Eldorado Mill	ETH Bio-energy	Acquisition for US\$ 350 million
2008	Esso	Cosan	Cosan group formed Cosan Fuels and Lubricants (CFL) to acquire Esso from Brazil and become the only sugarcane group to be part of the concentrated fuel and lubricant distribution market
2009	Sugar Guarani	Tereos	French Tereos has increased its stake in the Guarani, contributing of R\$ 309 million.
2009	Usaciga	Agrocana Participation Ltda.	Clean Energy Brazil's biofuel investor sold 49% of its stakes in the Usaciga for US\$ 8.7 million.
2009	Santelisa Vale Mill	Louis Dreyfus Commodities (LDC)	Acquisition of 60% of Santelisa Vale. The new joint venture, called LDC-SEV, will control 13 sugar and ethanol units.

Year	Company	Acquirer/ partner	Kind
2009	Vale do Ivaí	Shree Renuka Sugars Ltd. Indian Group	Purchase of the two sugar and alcohol units of Vale do Ivaí Sugar and Alcohol for US\$ 342 million, in São Pedro do Ivaí (Paraná) and Marialva (Paraná).
2009	Manacá	Clarion	Acquisition of assets of the Manacá alcohol distillery.
2009	Bonin	Costa Bio-energy	Acquisition of the company from Umuarama (Paraná) by one from São Paulo.
2009	New America	Cosan Group	Acquisition.
2009	Zanin Mill	Cosan Group	Difficulties to deal with a debt that increased from R\$ 30 million in 2005 to R\$ 300 million in 2009.
2009	Moema Group	Bunge Ltd.	It owns 100% of the stakes in three sugar and alcohol mills. It is the only owner of Moema, Frutal and Ouroeste mills. It has 70% of the Guariroba mill and approximately 44% of Itapagipe mill.
2009	Cerradinho	Noble Group	Group from Hong Kong
2009	Brenco	ETH Bio-energy	Union between ETH Bio-energy and Brenco. Odebrecht holds 65% of the new company's capital, and Brenco's shareholders hold 35%.
2009	Total Sugarcane Agro-industry	Petrobras	It owns 40.4% of the stakes in the Total Agroindústria Canavieira ethanol mill, for R\$ 150 million.
2010	Minas Gerais Company of Sugar and Alcohol (CMAA)	Indo Agri	Purchase of 50% of the mill.
2010	Shell	Cosan Group	They formed a joint venture to gather operations of sugar, ethanol, fuel distribution, and research.
2010	Cofercatu	Alto Alegre Group	It was acquired for R\$ 182 million. The company was being through a serious financial crisis and was not able to expand its activities in the market.
2010	Equipav Sugar and Alcohol	Shree Renuka Sugars Ltd. Indian Group	Acquisition of 50.8% for majority stakes for US\$ 329 million, and debt renegotiation for US\$ 822 million.

Year	Company	Acquirer/ partner	Kind
2010	Coocarol	Santa Terezinha	Acquisition.
2010	Usaciga	Santa Terezinha	Acquisition for US\$ 230 million
2010	Vertente Mill	Sugar Guarani	Sugar Guarani, from French Tereos group, acquired 50% of Vertente Mill, from the Humus Group in the Guaraci city, São Paulo. Vertente Mill was part of the mills from Moema Group that Bunge did not incorporate.
2011	CNAA	British Petroleum	English Oil Company acquired these mills of Minas Gerais and Goiás for US\$ 800 million dollars.
2011	Tropical	British Petroleum	It also purchased this plant from Goiás.
2012	Passos Sugar Mill	Olam International	Trading, which has 13% of the shares belonged to a state company from Singapore and the world's largest sugar exporter, made the acquisition for \$240 million.
2012	Goioerê Mill	Santa Terezinha	Goioerê mill from Paraná was valued at R\$ 370 million, in which R\$ 270 million is being used to pay debts.
2013	Costa Bio-energy	Santa Terezinha	Purchase of a mill from Umuarama (Paraná).
2013	Paraíso Mill	Tonon Bio-energy	Acquisition of the mill located in Brotas (São Paulo), becoming the only shareholder.
2013	Campestre	Cleaco	Acquisition for the purpose of recovery due to financial difficulties.
2013	Floralco Mill	GAM Participation and Undertaking	Purchase of the mill located in Florida Paulista for R\$ 150 million. This mill has the capacity to process 2.5 million tons of sugarcane per harvest, but has milled about 900 thousand in 2012/13, due to the judicial recovery since 2010.
2014	Santa Cruz S.A Sugar and Alcohol	São Martinho	Purchase of R\$ 680 million of additional corporate interest from 36.09% to 92.14% of the company's capital, increasing its sugarcane processing from 17 million tons per harvest to around 20 million tons.

Year	Company	Acquirer/ partner	Kind
2014	Energisa (Tonon Bio-energy)	Brookfield	Purchase for about R\$ 1.4 billion of the renewable energy business, including the cogeneration division of the Tonon Bio-energy sugar and ethanol group.
2015	Ruette Group	Black River private equity fund	Purchase of two sugarcane mills for R\$ 830 million, located in Paraiso (Monterey Mill), and Ubarana (Ruette Mill) with capacity to process 4.6 million tons of sugarcane per harvest. Paraiso unit also produces energy from sugarcane bagasse, having 28 Megawatts installed.
2016	Codora Energy	Albioma French Group	Acquisition of 65% of the cogeneration operation from Jalles Machado de Goiás sugarcane group, which allowed raising the amount of electricity exported to over 170 GWh, representing growth of approximately 75% until the 2018/19 harvest.
2016	Cosan Group	Sumitomo Corporation Japanese Group	Purchase of up to 20% of the capital of Cosan Biomass for R\$ 70 million. It was created in 2010 to produce pellets of sugarcane biomass for electric energy generation.

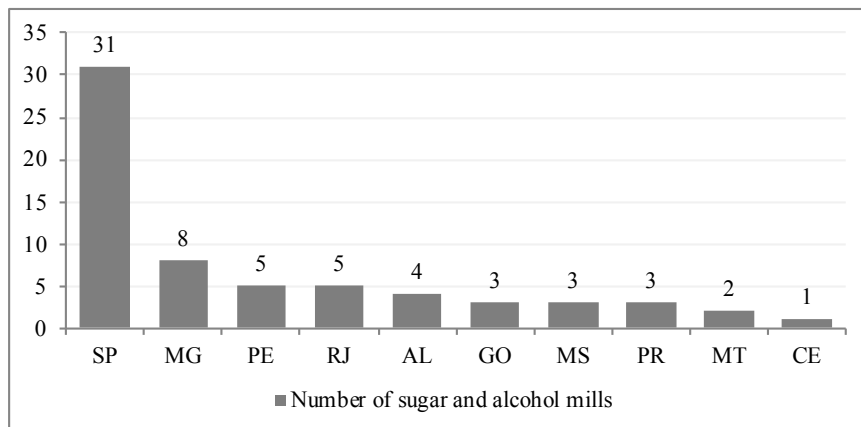
*Source:* Guimarães (2009), Folha de São Paulo (2010), PricewaterhouseCoopers (PWC, 2010), Lago e Rissardi Jr. (2011), KPMG (2014), Jornal Cana (2016), Nova Cana (2016).

From 2008 to 2014, about 65 sugar and ethanol mills stopped their production, which makes it more difficult for these companies to recover financially (Ricci *et al.* 2014). The majority (47.69%) of them is from São Paulo State (Fig. 4).

Therefore, it is noted that these large mills have made a series of acquisitions, greatly increasing their production capacity through financial leverage, in some cases, in dollars. With the subsidies of the gasoline price by the government, which caused the price ratio of ethanol to gasoline to be very close to 70%, gasoline became more competitive in relation to ethanol, reducing its consumption in Brazilian Southeast region, which is the largest producer (Fig. 5). Furthermore, with the exchange rate rise and the financial crisis in 2008, debts would become impossible to pay, resulting in a significant number of requests for judicial recovery.

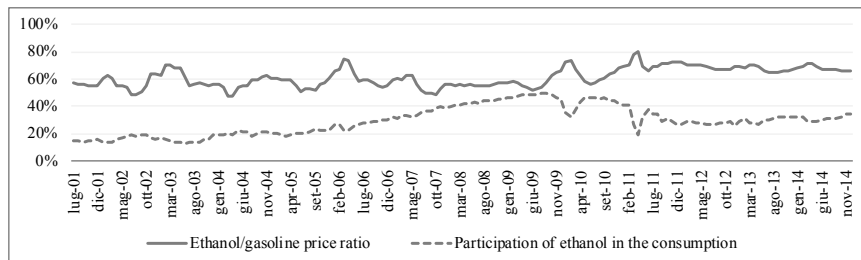
On the other hand, transactions occurred from 2013 seem to have been carried out more carefully, considering that the assets acquired in some of

**Fig. 4.** Sugar and alcohol mills that stopped their production from 2008 to 2014



Source: Ricci et al. (2014).

**Fig. 5.** Comparison between the relative price of ethanol and gasoline with the ethanol market share in the Southeast region (%)



Source: Souza; Pompermayer (2015).

these transactions are from cogeneration of electricity. With the institutional framework evolution of the Brazilian Electric Sector (SEB), in 2003 and 2004, the construction of new industrial plants began to optimize the electric energy production. This institutional framework made it possible to make long-term contracts with the captive market and sell the obtained electric energy in the free market as a by-product of ethanol and sugar production, increasing the national and international demand for ethanol (Castro, Dantas, 2009).

The sale of cogeneration assets has a large capacity to generate cash flow, compared to sugar and ethanol (Scaramuzzo, 2015). Therefore, in addition to acquiring control of mills from groups in crisis to increase their economies of

scale, large capitalized groups tend to be more selective because they are not interested in productive units with a delayed technological standard, since the generation of electric energy assumes a strategic role in this consolidation process, resulting in direct and stable benefits on cash flow (Castro, Dantas, 2009).

Transactions carried out by Sumitomo Corporation and Albioma show that crushing companies are looking to sell separately their cogeneration assets, which are not part of their core business, reducing their indebtedness. Even with the government's announcement in 2015 of the return of the Intervention Contribution in the Economic Domain (CIDE) on fuel operations, with the increase in the ethanol blend in gasoline from 25% to 27.5%, and with the excess of demand in the international sugar market, the difficulties in the sector must continue, which can keep the sale of these assets (Scaramuzzo, 2015).

Pellets made from wood waste are used as fuel in residential heaters, industrial boilers and also by electricity generators in the United States, Europe, South Korea and Japan. The outlook for biomass pellets is that global demand will increase from 25 million tons in 2016 to 40 million by 2021. It is estimated that there is a potential of about 80 million tons of pellets that could be generated only by the sugar and alcohol sector in Brazil, having São Paulo State a potential of 45 million tons. Only Japan may import between 10 and 20 million tons of pellets from biomass by 2030 (Nova Cana, 2016).

More careful analysis can give satisfactory financial returns. According to São Martinho executives, the purchase of Santa Cruz was advantageous because it was a structured asset with so many similarities to those of São Martinho, being possible an annual synergy of R\$ 40 million (Nova Cana, 2014). This result can be seen in the financial information of São Martinho (Tab. 3), which shows significant gains in terms of a reduction in quarterly operating expenses (OE) of 46 thousand from 2014, besides non-significant gains in SR, GAE, NI, ROA, ROE and ROS.

Regression results (Tab. 4) show that the intercept coefficient ( $\alpha$ ) of SR, GAE, ROA, ROE and ROS was statistically significant, indicating that the fall in GAE and the increase in these profitability indices were effectively outcome of the acquisition by São Martinho Mill. The acquisition contributed significantly to the improvement in the company's performance in these indicators.

Since the slope coefficient ( $\beta$ ) measures persistence in sales performance and in profitability indices, that is, a significant slope coefficient ( $\beta$ ) would indicate that the merger or acquisition process would have influenced the persistence of the performance, meaning that post-acquisition or post-merger performance is a continuation (persistence) of the performance before the acquisition or merger. However, the non-significance of the slope coefficient  $\beta$  (Tab. 4) indicates that the post-acquisition performance is not a continuation



**Tab. 3.** Mean, difference of mean, and significance level of SR, OE, SE, GAE, NI, ROA, ROE and ROS of the São Martinho Mill before and after the acquisition of the Santa Cruz Mill

	SR	OE	SE	GAE
Average of the eleven quarters before the transaction	683,149	-86,909	-32,251	-54,186
Average of the eleven quarters after the transaction	734,474	-40,139	-33,366	-51,29
Difference of mean	51,326	46,771	-1,115	2,896
Statistical significance (two-tailed t-test)	0.798	0.078	0.917	0.832
	NI	ROA	ROE	ROS
Average of the eleven quarters before the transaction	64,319	0.00617	0.0146	0.082
Average of the eleven quarters after the transaction	88,137	0.00795	0.0220	0.107
Difference of mean	23,818	0.00178	0.0074	0.025
Statistical significance (two-tailed t-test)	0.505	0.365	0.177	0.422

Source: Calculated by the author with data from BM&FBOVESPA (2015).

**Tab. 4.** Regression analysis results

Performance	Intercept coefficient ( $\alpha$ )	Statistical significance	Slope coefficient ( $\beta$ )	Statistical significance	R <sup>2</sup>
SR	790,914	0.0018	-0.0826175	0.7101	0.02
OE	-33,479	0.3187	0.0766	0.8063	0.01
GAE	-56,815	0.0057	-0.101971	0.6944	0.02
ROA	0.00747	0.0157	0.07694	0.8225	0.01
ROE	0.02192	0.0154	0.011017	0.9792	0.00
ROS	0.1535	0.0189	0.153585	0.6131	0.03

Source: Research results.

of performance prior to the acquisition, that is, the previous performance did not influence the behavior of any of these indicators, showing that the post-acquisition performance is not a continuity of the performance that the mill had before the acquisition.

## 5. Conclusion

The Brazilian economy has experienced a significant increase in mergers and acquisitions since the 1990s, and the main reason for this process is the increase in the competition faced by different sectors.

The increase in competitiveness and the difficulties experienced by some groups and some industrial mills in the sugar and alcohol sector have made merger and acquisition transactions much higher since the 2000s. From 2007 to 2013, many of these transactions were carried out at a time of euphoria in the economy, which resulted in groups that would go through great difficulties due to the high production capacity of their industrial plants, the excess of indebtedness and the devaluation of the Real, as well as the political interference in the sector, which decreases the competitiveness of ethanol in the fuel market.

As a result, business groups, which until then acted as acquirers, became acquisition targets for other groups, which after 2013 have been buying or acquiring these companies only after more careful analysis, considering not only the core business of the sector, but also the technological capacity in the co-generation of electric energy.

A specific analysis of São Martinho Mill, for instance, before and after the purchase of the Santa Cruz Mill, showed a significant decrease in operating expenses and non-significant gains in other indicators, which shows an improvement after the purchase. Moreover, it can be stated that the improvement in the GAE, ROA, ROE and ROS indicators was statistically caused specifically by the acquisition.

Mergers and acquisitions are not always beneficial for the industry and, because of this, they can have some negative impacts on the economy too. On the one hand, mergers and acquisitions increase market concentration, what can result in the increase in prices, causing an increase in the inflation. Since the sugar and the alcohol are very important for the Brazilian economy, this result would have a negative impact on the economy. On the other hand, there is also a chock of culture between the two companies which are merging, what can influence the decisions about the company and can go against the national policies. Most of the industries, which are making acquisitions in the sugar and alcohol industry in Brazil, are not national, which means that the Brazilian industries have lost the control under their companies.

In this sense, the national policy can adapt itself so as not to benefit companies which are from other countries, and benefit those Brazilian in terms of tax and other fiscal incentives.

When it comes to the limitations of this research, it is important to highlight that it was not possible to run a linear regression for all mergers and ac-

quisitions in the sugar and alcohol industry because of the lack of data about the mills.

As for suggestions for future studies, a direct survey could be made in the companies studied in this paper, verifying how decisions were made in merger and acquisition transactions, achieving positive and negative aspects through the interview with these managers.

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