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Research paper

Economic-financial performance of the Brazilian sugarcane energy industry: An empirical evaluation using financial ratio, cluster and discriminant analysis

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ABSTRACT

This study is intended to characterize the economic and financial status of the sugarcane energy industry in Brazil, providing relevant information for new investors, directors of companies and government to make more appropriate decisions. The data used in the study was obtained from financial statements issued by about 150 plants in the 2014/2015 and 2015/2016 harvest seasons. Following the logic proposed by the approach known as financial ratio analysis, financial indicators were calculated to measure the liquidity, profitability and debt of the plants. A cluster analysis was applied to define representative groups of companies in the 2014/2015 harvest season and a discriminant analysis was used to classify companies in the 2015/2016 crop season. The results showed high heterogeneity in the industry, marked by the presence of four different groups of companies. The first group includes high-liquidity and low-debt units. The fourth group is characterized by companies with high debt, low liquidity and negative operating margins. The two intermediate groups are made up of plants with moderate leverage and liquidity, but with operational performance levels varying from high to low. It should be noted that higher revenues in the 2015/2016 harvest season made it possible to improve the financial performance of the companies, except of those with in the fourth group. The results indicate difficulties to expand production capacity in the short term, but also recovery possibilities in the medium and long term if market conditions are favorable and the institutional framework in the country's fuel industry is lasting and predictable.

1. Introduction

The Brazilian sugarcane energy industry has very unique characteristics and has been experiencing significant changes over the past 40 years.

After a lengthy period of state intervention, this industry experienced a slow process of deregulation during the 1990s that culminated in full market liberalization as a result of the new role taken on by government as a regulatory agent from the early 2000s (for more details see Moraes & Zilberman [1]).

In this free-market scenario, a completely atypical dynamic was observed in sugarcane production. Between 2000 and 2008, the industry experienced a moment of euphoria as new production units were built and sugarcane crushing rose to unprecedented levels, more than doubling from 256.8 million tons in the early months of 2000 to 569.2 million tons in the 2008/2009 crop season (Fig. 1).

This expansion reflected the favorable business environment that prevailed in those days, marked by excellent prospects brought on by the introduction and consolidation of flex-fuel vehicles in the domestic market (vehicles that run on hydrous ethanol, gasoline or any mixture of these fuels), by the low cost of producing ethanol, by a trend of rising oil prices, by the differentiated tax rates levied upon ethanol relative to its fossil competitor in the Brazilian market and by increasing international interest in biofuels [4].

Several changes have altered this promising scenario. These include: i) the global financial crisis, which has reduced credit availability and increased the cost of raising funds in a period when production is expanding; ii) the use of the domestic price of gasoline to control inflation and the reduction of the tax differentiation between the by-product and ethanol in the Brazilian market - which, from an economic perspective, has made biofuels significantly less attractive to consumers and less remunerative to producers; iii) climate-related problems, which have hampered production in several years; and, iv) an increase in ethanol production costs [5–7].

This combination of global economic turmoil, a credit crunch and rising financial costs compounded by non-remunerative prices forced some of the mills to build up unsustainable debt levels.

Initially, this situation led to a broad process of consolidation, with

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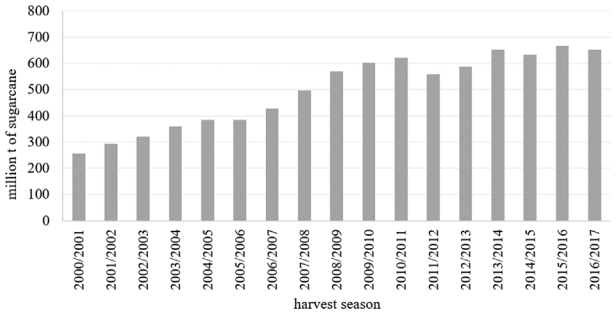

Fig. 1. Annual processing of sugarcane for producing sugar and ethanol in Brazil.
Source: MAPA [2] and UNICA [3].

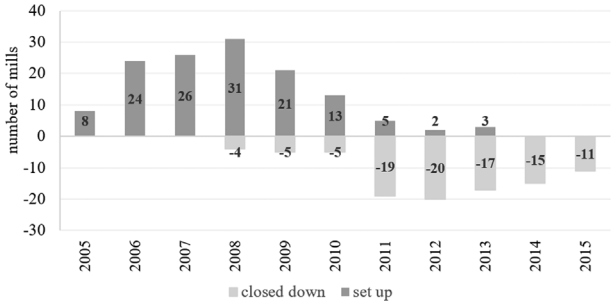

Fig. 2. Historical flow of producing units that were set up and closed down in the 2005–2016 period.
Source: EPE [8].

merger and acquisitions operations involving about one-third of the companies operating in this industry. From 2011 onwards, however, as the economic crisis faced by companies worsened, production units began to close, leading to one the harshest crises ever experienced by the national sugarcane energy industry. As such, more than 90 units closed in Brazil between 2008 and 2015 (Fig. 2).

This crisis has generated losses in the entire sugarcane chain. Data from the Ministry of Labor and Social Security [8], for example, indicates that more than 200,000 direct jobs in producing companies were lost between 2013 and 2016.

Besides the economic and social impacts, the situation experienced by the sugarcane industry reflects on the domestic energy sector and contrasts with the need to expand the supply of ethanol and electricity produced from burning sugarcane bagasse and straw (bioelectricity) in the coming years.

Accounting for about 16% of the Brazilian energy matrix [10], sugarcane energy products stand out in ensuring compliance with the commitment made by Brazil at the 21st Conference of the Parties (COP 21) to the UN Framework Convention for reducing greenhouse gas emissions (GHG) causing the global warming.

Ratified by the National Congress in 2016, the agreement indicates that the bioenergy share in the Brazilian energy matrix is to be increased to about 18% by 2030 [11], requiring ethanol production to expand [12]. The goal that was set also ensures a significant increase in bioelectricity supply, which along with wind and solar energy must account for at least 23% of the energy matrix by 2030.

In addition, increasing the domestic supply of ethanol is seen as one of the few options for Brazil to reduce the deficit of light fuels. In this context, analysis conducted by ANP [13] and by EPE [9] predict a significant increase in imports of light fuels in a scenario of economic recovery and stagnation of the production capacity of the national sugarcane industry.

From all the above, the need to understand the current economic and financial problems experienced by producing companies in Brazil is apparent. According to SANTOS et al. [14], the persistent financial difficulties, high debt levels and low profitability of plants are some of the issues that have been permeating the most important discussions on the sugarcane energy industry held in recent years.

Despite the relevance of the topic, few studies have sought to analyze this set of problems. The available studies consist in limited assessments made by financial consultants and institutions or specific case studies whose results cannot be extrapolated to the industry as a whole. Among the available analyzes are those conducted by Noriller et al. [15], Nascimento [16], Nastari [17], Martins et al. [18] e Guedes et al. [19].

Aware of this fact, this study is intended to characterize the economic and financial situation of the sugarcane energy industry based on a multidimensional approach that includes a joint assessment of the debt, liquidity and profitability of companies.

For this purpose, it uses data from balance sheets issued in the last two harvest seasons for about 150 sugarcane mills and distilleries, financial ratios based on the literature known as FRA (Financial Ratio Analysis) and multivariate statistical modeling defined by cluster and discriminant analysis techniques.

Given the above-described scenario, the paper is justified because it generates key information for proposing public policies and for better planning on the part of agents of this industry. The results obtained also provide elements to improve the decision-making of those currently in charge of managing plants in operation, of investors interested in investing in this industry and of Brazil's main financial institutions.

2. Empirical strategy, data and computing resources

2.1. Conceptual logic and statistical procedure

The starting point of the empirical strategy is using financial indicators that were calculated based on the balance sheets issued by producing companies in the last two crop seasons (2014/2015 and 2015/2016).

Conceptually, the mentioned indicators are based on the approach known as Financial Ratio Analysis (FRA), which began to be used in the late 20th century [20]. This analytical practice has been used in academia and the private sector for comparing different companies or the same company under different time periods [21–25].

Based on this approach, 11 indicators were used to rank the performance of Brazilian mills and distilleries (Table 1). On the assets side, the selected indices include information on investment efficiency, return on capital employed and profitability. On the liabilities side, these measures make it possible, for example, to quantify the level of indebtedness and financing decisions based on the companies' solvency capacity.

The joint analysis of these indicators exclusively focused on the subjective perception of the researcher can lead to weak and potentially confusing interpretations. To work around this problem, in addition to a general assessment of the added values of each indicator, multivariate statistical techniques associated with FRA were applied to allow for a systemic examination of conditions in the industry based on a more robust analytical framework.

Many examples of multidimensional assessment using similar strategies can be found in the international literature, combining FRA with factor analysis [26–28], with discriminant analysis [29–32], with regression analysis [33,34], with data envelopment analysis [35–37] and cluster analysis [38–41]. For this study, cluster analysis and discriminant analysis techniques were selected.

Initially, cluster analysis was applied to the companies included in the sample for the 2014/2015 harvest season with the aim of defining groups of plants facing similar economic-financial situations.

For this purpose, the financial indicators shown in Table 1 were quantified and standardized using the min-max method, as specified in Equation (1).