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## Socio-economic impacts of Brazilian sugarcane industry



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### ABSTRACT

This paper analyzes the socio-economic impacts of the Brazilian sugar cane industry, examining the characteristics of the workforce, pay and working conditions. It also examines the role of the family on socio-economic indicators, comparing the indicators for first generation sugar cane workers with those for the second generation of workers, as well as comparing these indicators with those for workers in the agricultural sector as a whole. We draw on data from *Relação Anual de Informações Sociais (RAIS)* and also from *Pesquisa Nacional por Amostra de Domicílios (PNAD, or National Household Sample Survey)*. The findings show that together, the three key sectors that comprise the sugarcane industry in the country (sugar cane cultivation, sugar production and ethanol production) employed about one million workers in 2012. The results also show that family background plays a role on the choices made by second generation workers relative to work and thus impacting on the socio-economic indicators for the sectors. The comparison between indicators for the sugar cane sector and the overall agricultural sector showed differences, with the sugar cane sector being better off than the agricultural sector. Finally, the assessment of indicators for the second generation shows that they have face better choices and conditions than first-generation workers.

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## 1. Introduction

The prospect for increased use of bioenergy in many countries has brought to the international debate concerns about environmental impacts (pollution, deforestation, and reduction in biodiversity); health problems (particularly due to water quality and pollutant emissions to the air); quality of labor and competition for arable land (which could rise food insecurity for the poor).

There is no consensus in the literature about whether the impacts of increased biomass production for bioenergy use are positive or negative, mainly because of the variety of raw materials and technologies used, leading to a wide range of impacts on land use, ecosystem services and labor market, among other issues. Additionally, impacts vary among countries and regions within the countries, while policy drivers also exert a great influence on energy security, rural development, national economic development, environmental quality, climate change, and job creation.

Potential benefits that bioenergy production include rural and economic development, energy security, and

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improvement of balance of payments (Lynd and Woods, 2011; Diaz-Chavez, 2011; Walter et al., 2008). Other social benefits include job creation and enabling access to the labor market by people with little or no education, provision of training and skills certification, labour market regulation (Sallum, 2007; Moraes and Zilberman, 2014; Diaz-Chavez, 2014).

This paper aims to contribute to the discussion of the social impacts of the sugarcane ethanol industry in Brazil. It reviews research carried out about this sector, along with an assessment of social impacts of the Brazilian Sugarcane Ethanol Program, focusing three criteria – education, job creation and work conditions. It also provides an analysis of the role of education and working conditions on second generation workers. We compare social indicators of employees of the sugar cane sector with those from the agricultural sector as a whole (excluding the sugar cane sector) in order to examine whether they attain higher levels of education and better formal employment in two regions in Brazil.

## 2. The Brazilian experience

The Proalcool program that was set up in Brazil in 1975 was designed to stimulate production of ethanol as an alternative to gasoline and significantly altered the profile of sugar and ethanol production in Brazil (Rosillo-Calle, 1987; Goldemberg, 2006; Moraes and Zilberman, 2014). Brazilian ethanol production has grown from approximately 555 million liters in 1975 to 23.2 billion liters in 2013, leading to increased sugarcane production, from 88.9 million tonnes to 588.5 million tonnes in the same period. Growth in these sectors is said to have had a positive impact on jobs, including the creation of agricultural jobs (see Moraes, 2011a).

A number of studies have demonstrated the positive socio-economic impacts of sugarcane ethanol industry in Brazil (Assato et al., 2011; Chagas et al., 2011; Satolo and Bacchi, 2013; Neves et al., 2013, Bacchi and Caldarelli, 2015). The studies have emphasised different socioeconomic aspects such as job creation, the improvement of the human development index (including education) and income, and the improvement in working conditions and corporate social responsibility in the factories.

The opening of the Brazilian economy in the late 1990s was successful in attracting foreign capital into several sectors of the country. According to Moraes and Zilberman (2014) foreign capital has been invested in the sugarcane, sugar and ethanol sectors since 2000 (French groups Louis Dreyfus, Tereos, and Sucden having acquired ethanol plants in Brazil that year). After 2007 there was a greater still influx of foreign investment from various countries. Foreign investment largely came not only from sugar-producing companies in other countries (such as Shree Renuka Sugars, India's largest sugar refiner), but also from companies with extensive experience in the production and trading of agricultural commodities, such as Bunge Limited, Cargill, Louis Dreyfus, Tereos, Abengoa, Glencore, and the Noble Group (Moraes and Zilberman, 2014). Large oil companies, including companies such as Shell and British Petroleum, along with the Brazilian state-company Petrobras, have invested in the sugarcane ethanol sector (Moraes and Zilberman, 2014).

Along with the influx of foreign capital, a process of consolidation has taken place with profound changes in the organization of production, along with the professionalization of management, which can be attributed in part to the presence of new players in the industry. New technologies and new forms of coordination of the production chain, as well as production management systems that are economically and environmentally more efficient, have been adopted, in order to meet the growing list of sustainability criteria required by the market (Moraes and Zilberman, 2014).

### 2.1. Supply chain

The benefits of the bioenergy sector can also be seen through its impacts on some economic indicators. Chagas et al. (2011) analysed the effects of the increased sugarcane production on municipal revenues of São Paulo state. They showed that the value of agricultural production of sugarcane is higher per hectare than for most crops, thus accruing a greater value of agricultural income to the municipality in terms of tax revenue. Satolo and Bacchi (2013) assessed the effects of the sugarcane sector expansion over the municipal per capita Gross Domestic Product (GDP), noting that the GDP for one municipality and that of its satellite neighbouring municipalities grew from 24% in 2000 to 55% in 2010.

Assato et al. (2011), in turn, analyzed the socio-economic impacts of the expansion of the sugarcane sector in two municipalities (Nova Alvorada do Sul and Rio Brilhante), located in the Mato Grosso do Sul state. They found that an increase in aggregate income followed the establishment of sugarcane processing plants at the two municipalities. They also noted that real state sector experienced a particularly large expansion in the years following the arrival of sugarcane processing plants. Their research pointed out improvements in education in the period after the installation of the sugarcane industry, which can be seen in Fig. 1. Nevertheless, there does not seem to be a clear correlation with an economic positive impact.

Additional models can be used to complement the assessment of the impact of biofuel supply chain on the economy, for instance Computable General Equilibrium (CGE) models and Input–Output (IO) analysis.

Martinez et al. (2013) used an input–output model to assess the socio-economic impacts in terms of value added, imports and employment of sugarcane-derived bioethanol production in the Northeast (NE) of Brazil. The model showed significant positive socioeconomic impacts achieved in developing and expanding the sugarcane–ethanol sector in the region under the conditions studied in their research. Despite I/O models are generally applied to a national level, regional levels can also be assessed as demonstrated by Martinez et al. (2013).

Santos (2013) analysed the impacts on the Brazilian economy of the expansion in the production of ethanol and biodiesel in substitution of part of fossil fuels between 2010 and 2030, based on the *Plano Nacional de Energia – PNE (National Energy*

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