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Mismatches between mill-cultivated sugarcane and smallholding farming in Brazil: Environmental and socioeconomic impacts

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ABSTRACT

Brazil is a country historically characterized by high levels of capital and land ownership concentration, and some areas where family farming is traditionally strong are potentially impacted by the expansion of sugarcane, through land renting contracts between farmers (landowners) and sugar mills (tenants). This paper examines the socioeconomic and environmental impacts of mill-cultivated sugarcane expansion on family farming in the municipality of Ipiranga de Goiás, Goiás state, Brazil, where sugarcane plantations compete with corn, pasture and dairy cattle. Using a questionnaire composed of closed-and open-ended questions, we interviewed 28 family farmers, which were divided into two groups: those with and those without land renting contracts with the ethanol and sugar mill. The results show differences between both groups, such as average area size, main source of income, past and current activities, and perceptions about the pros and cons of sugarcane expansion. Land leasing emerged as a short-term solution to the shortage of on-farm labor and other economic difficulties small farmers continue to face. There are some farmers, however, who have resisted leasing their land for a number of reasons, including revenue is too low due to the small area in question; they also want to avoid loss of autonomy in production and the deep transformation of their rural way of life and landscape.

1. Introduction

Agriculture is an activity that both supplies and demands energy, consequently markets in both sectors have always adjusted to one other. The recent growth and expansion of energy markets in most developed countries, and in several developing countries, have reshaped the role of agriculture as a provider of feedstock for the production of liquid biofuels for transport - ethanol and biodiesel (FAO, 2008). Despite remaining small in relation to total primary energy demand in the world,[1] biofuel production is significant, considering current levels of agricultural production. The environmental and socioeconomic impacts of its constant growth, therefore, must be recognized (FAO, 2008), especially in Brazil, where approximately 40% of the total energy supplied comes from renewable sources, with sugarcane products corresponding to 15.7% of the domestic energy supply in 2014 (EPE, 2015).

Brazil, in this context, is at the centre of the debate, given that sugar and ethanol production are key components of rural development and energy strategies (Martinelli et al., 2011) and the country is the world's leading producer of other agricultural commodities such as sugar, coffee, soybeans, poultry and beef. Brazil's well known production of liquid biofuels began in 1975 with the creation of the National Alcohol Program— Proálcool—the most extensive and well known program in ethanol being produced commercially as a fuel. It was a way for Brazil to face the collapse of international sugar prices and the first oil crisis in 1973. Thus, the Brazilian government developed Proálcool to reduce the historic high dependence on imports of fossil fuel and also to revitalize the sugarcane industry. The program established a highly regulated market through price control and increased subsidies for alcohol production to replace gasoline. The program also invested in research and development to generate new technologies (Novo et al., 2010). See Nogueira and Capaz (2013), Novo et al. (2010), Moreira and Goldemberg (1999) for a detailed explanation of all

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[1] Fossil fuels are still the dominant source of primary energy in the world, with oil, coal and gas together supplying more than 80% of the total. Renewable energy sources represent only 13% of total primary energy supply, with biomass and waste dominating with 10% the renewable sector (FAO, 2008).

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Proálcool phases, up to the deregulation of the sector in the late 1980s and early 1990s and other internal and external factors resulting in what Novo et al. (2010) called an “ethanol crisis”.

Back in the 1970s, environmental concerns were not an important issue driving the shift to alcohol. Since the beginning of the 21st century, however, the main arguments behind policies supporting biofuels based on agricultural commodities have been the potential to mitigate global climate change through reduction of greenhouse gas (GHG) emissions, to contribute to energy security and support agricultural producers, and to reduce rural poverty in developing countries, where 75% of the world's poor depend on agriculture for their livelihoods (FAO, 2008). Furthermore, in the case of Brazil, the introduction of flex-fuel technology in 2003 created a domestic demand for a new expansion of the sugarcane industry, boosted by the growing middle class population with access to durable consumer goods (Castillo, 2015). Flex-fuel cars were well accepted by consumers because they offered the options of using gasoline (with 20–25% anhydrous ethanol), hydrated ethanol (pure) or any blend of both fuels, depending on relative prices and availability along with consumer desire for autonomy and performance (Nogueira and Capaz, 2013).

Such circumstances combined triggered a rapid expansion of sugarcane planted area in Brazil from 2003 to 2008, concentrated in the Central-South region (states of São Paulo, Goiás, Minas Gerais, Paraná, Mato Grosso do Sul and Mato Grosso). The expansion process decreased in 2009 after the 2008 financial crisis brought an end to new investments in the sector. Government intervention in gasoline prices, to keep inflation under control, decreased ethanol's competitiveness. Consequently, ethanol demand decreased as consumers switched to putting gasoline in their flex-fuel vehicles (Nogueira and Capaz, 2013; Angelo, 2012). After that decline, the government included in the 2011/2012 Annual Harvest Plan a specific credit line for expansion and renewal of sugarcane fields (MAPA, 2011). In addition, as part of a set of policies for the sugar-energy industry recovery, the government has encouraged the acquisition of new vehicles by reducing the tax on industrialized products, which resulted in a rapid growth of motorization rates (Castillo, 2015). At present, flex-fuel cars represent around 90% of new car purchases (ANFAVEA, 2015).

A horizontal expansion of sugarcane production (increase in planted area) rather than a vertical expansion (increase in productivity) (Castillo, 2015) met the demand for ethanol in Brazil, as shown in Fig. 1. We observe that sugarcane productivity varies very little, while the cultivated area increased by about 2.5 times in the period.

Such horizontal expansion, together with particular characteristics of sugarcane, entails important consequences to the region around ethanol and sugar mills. This feedstock cannot be stored for a long time, since it begins to degrade and should be processed soon after the harvest. Then, once the mill has been implemented, there will necessarily be cultivation of sugarcane nearby. This constraint results in a rigidity in the land use, making the diversification of production more difficult. It follows a deeper regional productive specialisation, in which the economy of municipalities dedicated to sugar and ethanol production becomes more vulnerable by relying largely in a single economic sector (Castillo, 2015).

Despite the ups and downs of the sugarcane industry over time, it is undeniable that the rapid horizontal expansion of a large-scale monoculture causes a number of impacts. Leal et al. (2013) estimated the land demand in global terms to produce the amount of 300 billion litres of ethanol forecasted for 2030, considering first- (1G) and second-generation technologies (2G) of sugarcane ethanol in Brazil and corn ethanol in USA. With respect to sugarcane, the estimated demand of land is 29 Mha considering 1G technology and 22 Mha when combining 1G and 2G technologies. Taking into account that the Sugarcane Agroecological Zoning for Brazil indicates 65 Mha of land adequate for cultivation of sugarcane, without major impacts on food production and on the environment, those values seem to be feasible (Leal et al., 2013). However, keeping in mind that the benefits promised by biofuel proponents may differ from what actually happens on the ground, the production of biofuels may generate negative impacts depending on the complexity of the local conditions (Ribeiro, 2013).

Researchers have prioritized environmental and economic impacts in studies addressing biofuel sustainability in the past few years, while social impacts have not yet received much attention. Nevertheless, the efficacy of biofuels in terms of carbon savings is yet a controversial issue (Fischer, 2010). Many different elements should be included in the environmental impact assessment of biofuels, making the analyses very complexes: the type of crop and the crop yield, the amount and type of energy embedded in the fertilizer and in the water used, emissions from fertilizer production, the energy used in the gathering and transporting the feedstock to the biorefinery, the energy intensity of the conversion process, changes in the land use, and farming techniques (IEA, 2007). Therefore, climate benefits and GHG balances for crop-based biofuel depend on local conditions, calculation methods, and the expansion pathways (Gibbs et al., 2008; Börjesson, 2009). Studies have investigated the GHG emissions associated with direct and indirect land use changes, and have also quantified the “carbon payback time” under different scenarios. For example, Gibbs et al. (2008) concluded that biofuel expansion into tropical forests leads to net carbon emissions for decades to centuries in most cases, but the expansion of high-yielding crops, such as sugarcane,

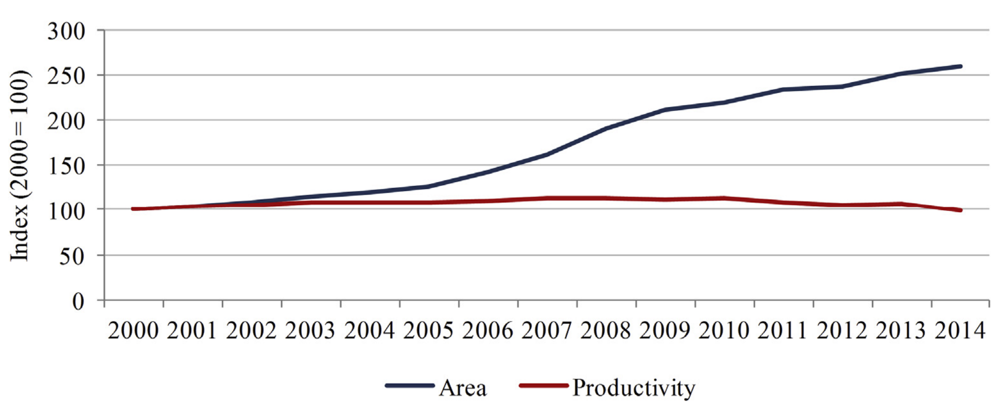

Fig. 1. Sugarcane cultivated area (ha) and productivity (tons/ha) in Central-South region, 2000–2014. The Index shows the relative evolution of area and productivity considering the year of 2000 as the starting point (2000 = 100). Source: IBGE, 2016.