Biofuels for Social Inclusion

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Social indicators of sugarcane, sugar and ethanol sectors

- Number of employees: these sectors employ a large number of people
- Inclusion of low schooling workers
- Official employment: formal contracts
- Age
- Earnings equations: linear regression model
- Job penetration: production is spread all over the country
- Impact of a higher hydrated ethanol demand to the detriment of Gasoline C in the Brazilian Economy
**Sugar Cane Field**

- 70,000 sugar cane producers

50% harvest manually and 50% mechanically

- 75% of sugarcane comes from self-supply of vertically organized mills (which means that the mill owners have the sugarcane fields in addition to the mills)

- From sowing to harvesting, sugarcane production takes up 629,000 employees

**Industrial Sugar and Ethanol Production**

- 422 Sugar Mills/Alcohol Distilleries
- 567,000 employees

From field to industry, economy is based on the labor of a million Brazilians

Agriculture
2,773,885

Sugarcane employees accounts for almost 22.7% of the agricultural jobs, followed by coffee and corn.

It is a very impressive number, indicating inclusion of many low schooling people.

Source: Prepared based on data provided by PNAD 2008
In 1981 there were about 600k workers in the sugarcane production, almost the same amount than 2008.

- In this period, production has risen by 328%.
- These contradictory phenomena are due to both a rise in labor productivity and mainly an increase in mechanization.
- In the recent period we can observe a positive trend in the number of employees, following the important growth observed in the sugarcane production.
Sugarcane burning is a detrashing procedure that helps manual cutters: otherwise it would be too difficult to harvest by hand.

Recently, environmental concerns have established a ban on sugarcane burning.

This change has brought mechanization as an economical and environmentally friendly procedure: the companies can use the dry matter as a source of energy and the environment will suffer much less.

Loss of 114k job positions
Public and Private Strategies

- Green cane: harvest mechanically
- Changes the worker’s profile
- One harvesting machine substitutes for 80 working men
- The aim now is to think of new ways to relocate these people
Private Strategies

- UNICA has proposed a yearly training program for 7,000 workers, to provide necessary skills for other areas of services.
- Will provide training for other jobs.
- To be eligible for this training, a minimum schooling is required.
- Other workers shall count on public policies to improve literacy.
Production and Job Position in 2008

<table>
<thead>
<tr>
<th></th>
<th>NNE</th>
<th>CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Units</td>
<td>78 (20.7%)</td>
<td>298 (79%)</td>
</tr>
<tr>
<td>Ethanol Production</td>
<td>8%</td>
<td>92%</td>
</tr>
<tr>
<td>Sugar Production</td>
<td>13%</td>
<td>87%</td>
</tr>
<tr>
<td>Job Positions</td>
<td>43.6%</td>
<td>56.4%</td>
</tr>
</tbody>
</table>

Both regions are equally important for job generation

With almost as many job positions as offered in the NNE region, the CS produces about 90% of main products

This is explained by the highly efficient production which makes the CS region a benchmark of sugarcane products

274,181 employees

354,797 employees

Jobs in Sugarcane (2008): 628,978

• Operating Sugarcane Mills
• Sugarcane Mills under construction
Traditionally, Brazilian crop workers don’t take schooling and the chart reflects this reality.

The average schooling of agriculture workers is 4 years of study.

The workers of sugarcane sector have about 4.3 years of study.

Citros and soya have the best indicators.

Source: Prepared based on data provided by PNAD 2008.
The percentage of machine operators in agriculture is 7.0%.

In the soya crop this percentage is the highest: 44.3%.

Sugarcane: 11.2%
4.3 years of study is the average, considering both regions under survey

NNE region has the lowest education level

The state of São Paulo has the highest level: 5.4 years of school, which still is very low

Other data on this issue point out that:

23.8% (about 120k workers) are illiterate

Source: Prepared based on data provided by PNAD 2008
The proportion of workers who are formally employed in the Brazilian agriculture is very low: less than 40%.

Sugarcane shows the best indicator: about 81.4% of the employees are formally hired, meaning that they had been hired under a formal labor contract.

These employees have all labor rights established in the legislation:
- Enjoy the right to receive unemployment insurance;
- Remunerated annual vacations;
- Extra month of salary per year;
- Among others.

Source: Prepared based on data provided by PNAD 2008.
Sugarcane: contrasting number of formal and informal Workers.
Brazil, NNE, CS and São Paulo, 2008

- In 2008, the Brazilian sugarcane sector had about 18.6% of informal workers.
- In the North-Northeast region, the proportion of informal workers is higher, though smaller than agriculture as a whole.
- In the Center-South region, there are about 90% of formally hired workers.
- The state of SP has a very impressive proportion of formally hired workers.

Source: Prepared based on data provided by PNAD 2008
The sugarcane sector successfully reduced the proportion of child labor from 15.3% in 1981 to less than 0.1% in 2008.

- Increased the proportion of adult workers.
- These are the results of multiple efforts:
  - Government social programs: Bolsa Familia, Bolsa Escola.
  - Sugarcane Producers’ concern.
  - Better law observance.
  - Requirements of the market itself.

<table>
<thead>
<tr>
<th>Age Bracket</th>
<th>1981</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Employees</td>
<td>Total %</td>
</tr>
<tr>
<td>10-15</td>
<td>95,576</td>
<td>15.3</td>
</tr>
<tr>
<td>15-20</td>
<td>128,578</td>
<td>20.6</td>
</tr>
<tr>
<td>20-30</td>
<td>134,033</td>
<td>21.4</td>
</tr>
<tr>
<td>30-40</td>
<td>106,516</td>
<td>17.0</td>
</tr>
<tr>
<td>40-50</td>
<td>84,041</td>
<td>13.4</td>
</tr>
<tr>
<td>40-60</td>
<td>51,886</td>
<td>8.3</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>24,396</td>
<td>3.9</td>
</tr>
<tr>
<td>Total</td>
<td>625,016</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Prepared based on data provided by PNAD 2008.
Sugarcane: Number of Employees and Wages. 2008

<table>
<thead>
<tr>
<th></th>
<th>Number of Workers</th>
<th>Monthly average salary (US$)</th>
<th>Wage/National Wage *</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZIL</td>
<td>628,978</td>
<td>349.22</td>
<td>1.51</td>
</tr>
<tr>
<td>NNE</td>
<td>274,181</td>
<td>244.83</td>
<td>1.06</td>
</tr>
<tr>
<td>CS</td>
<td>354,797</td>
<td>429.57</td>
<td>1.86</td>
</tr>
<tr>
<td>SP</td>
<td>212,157</td>
<td>456.67</td>
<td>1.98</td>
</tr>
</tbody>
</table>

On average, workers in sugarcane sector earned 51% above the national official minimum salary. The workers in the sugarcane sector in the state of São Paulo earned the highest salaries, almost double the national minimum salary.

* National Minimum Salary for 2008 was US$ 230.56

Source: Prepared based on data provided by PNAD 2008
The wages of soya sector are the highest ones. Earning Equation estimated showed that:

- After controlling the effects of other variables that influence wages:
  - schooling, age, region, color, gender, etc
- the average monthly wage of other crops workers in comparison with sugarcane wages are:
  - Coffee: 9.9% lower;
  - Cassava: 23.2% lower;
  - Corn: 30.1% lower;
  - Soya: 0.2% lower;
  - Rice: 30.1% lower
SOCIAL EXTERNALITIES OF DIFFERENT FUELS IN BRAZIL

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Objective

Comparing social indicators in the following activities

I. Ethanol production (sugarcane and ethanol)
II. Extraction and production of petroleum by-products

Methodology

I. Survey of socio-economic indicators
II. Penetration assessment: location quotient calculation
III. Measurement and analysis of impacts of variations in the demand for ethanol and gasoline on the economy (production and jobs): Input Product Matrix
**SUMMARY OF INDICATORS FOR THE ANALYZED INDUSTRIES (2007)**

<table>
<thead>
<tr>
<th>Industry</th>
<th>UF*</th>
<th>Municipalities</th>
<th>Jobs</th>
<th>Establishments</th>
<th>Average age</th>
<th>Average schooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugarcane</td>
<td>23</td>
<td>990</td>
<td>274,342</td>
<td>16,262</td>
<td>33.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Ethanol</td>
<td>24</td>
<td>229</td>
<td>190,894</td>
<td>567</td>
<td>35.8</td>
<td>7.7</td>
</tr>
<tr>
<td>TOTAL Sugarcane &amp; Ethanol</td>
<td>25</td>
<td>1,042</td>
<td><strong>465,236</strong></td>
<td><strong>16,829</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petroleum Extraction</td>
<td>21</td>
<td>113</td>
<td>54,847</td>
<td>894</td>
<td>37.7</td>
<td>11.7</td>
</tr>
<tr>
<td>Oil By-products</td>
<td>23</td>
<td>100</td>
<td>18,228</td>
<td>345</td>
<td>36.5</td>
<td>11.3</td>
</tr>
<tr>
<td>TOTAL Petroleum extraction &amp; By-products</td>
<td>24</td>
<td>176</td>
<td><strong>73,075</strong></td>
<td><strong>1,239</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: RAIS (2007) and IBGE (2007)

* Unit of the Federation
JOB PENETRATION - 2007

Sugarcane and ethanol

Petroleum extraction and oil by-products

IMPACT OF A HIGHER HYDRATED ETHANOL DEMAND TO THE DETRIMENT OF GASOLINE C IN THE BRAZILIAN ECONOMY
INPUT PRODUCT MATRIX – IMPACTS

- Increasing ethanol consumption
  - To what extent economic output increases
  - To what extent the number of jobs in the economy increases
  - To what extent gasoline consumption is reduced: \((\text{ethanol volume} \times 0.70) \times \text{gasoline price}\)
  - To what extent economic output is reduced
  - To what extent the number of jobs in the economy is reduced

Result for the Brazilian economy

Impact on production

Impact on jobs
Number of jobs generated and Increase in the remuneration value in the Brazilian economy as a result of a 15% increase in the demand for hydrated ethanol and of an equivalent reduction in the consumption of gasoline C, considering direct and indirect effects and the income effect

117,701 jobs positions
R$236 millions (US$131 millions)
Internationalization of ethanol and better exposure to the external market induced companies to adopt stricter norms

- Better observance to labor and environmental legislation

Labor laws applied: reduction in underaged workers and improved labor conditions

- Greater number of formal jobs in sugarcane sector
  - Better than the agriculture national average
  - SP state stands out from the other states

As highlighted in the literature, the effect of schooling on income was also captured in the estimated regression

- Considering the low schooling level of workers in the sector, the need to rely on *private strategies* and *public policies* stands out

- Public policies: for ensuring the literacy and improving the schooling of workers in sugarcane fields
FINAL CONSIDERATIONS

- High job generation in the two links of the ethanol production chain
  - BR: the sugarcane & ethanol industry employs more than 6 times the number of workers employed in petroleum production

- High penetration and interiorization of generated jobs:

- Multiplying effect on the economy: a 15% substitution of gasoline with ethanol generates almost 120,000 additional jobs and almost R$ 240 million in total income

- These results show that public policies designed to stimulate ethanol consumption result in significant social and economic benefits when the location and number of jobs generated are considered


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Thanks for your attention

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