Socioeconomic of Biofuels

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- PhD Thesis (1999): *Deregulation of the Sugarcane, Sugar and Ethanol Sectors*

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Topics

1) To present socio-economic indicators of the sugarcane, and ethanol sectors

2) To analyze socio-economic indicators for the sugarcane, ethanol, oil drilling and oil derivatives sectors with respect to job and income creation, as well as regional development

3) Impact on the Brazilian economy of the simulation: Replacement of 15% of the gasoline consumed in Brazil for ethanol

Sector Main Agents

Sugar Cane Fields

70,000 sugarcane growers

50% harvest manually and 50% mechanically

542,588 employees

Industrial Sugar and Ethanol Production

440 Sugar Mills/Ethanol Distilleries

600,000 employees

Sugar cane field

✓The sector comprises 70k independent producers , accounting for 25% of national sugarcane production

✓75% of sugarcane comes from self supply of vertically integrated mills

(mills have sugarcane fields plus processing plants)

Sugarcane processing plants in Brazil can produce sugar and/or ethanol – 2009:

-60% were sugar and ethanol producing units

-36% were ethanol distilleries

-4% produce sugar only

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

Source: MAPA – MME – MDIC – 2005
PNAD (2008) , GEMT (2010)

Sector Main Agents

Brazil is the only country that produces two types of ethanol:

- *anhydrous ethanol*, which is blended with gasoline
- *hydrated ethanol*, used in ethanol-powered cars
- Since 2003 substituted by flex-fuel cars which can run both on ethanol or gasoline at any blend level

Gas Stations

- **32,030 sell both hydrous ethanol and blended gasoline**

Prices: free market

Ethanol Exportation (anhydrous)

Fuel Distributors

160 Fuel Distributors

-The gasoline ethanol mixture can only be made by distributors

- Laws do not allow mills to sell straight to gas stations

Fonte = MAPA – MME – MDIC

Biofuels For Social Inclusion

Socio-economic indicators of the sugarcane, sugar and ethanol sectors

- Number of Employees
- Schooling
- Age
- Employment formalization
- Income

Database

PNAD - National Household Sample Survey

• Conducted by the Brazilian Institute of Geography and Statistics (IBGE) - (Federal Government)

•Annual Survey of socioeconomic information on *formal and informal* workers

• Obtained through questionnaires applied to a sample number of households

• Data available for sector of activity - state level

RAIS - Report of Social Information

• Conducted by the Brazilian Ministry of Labor

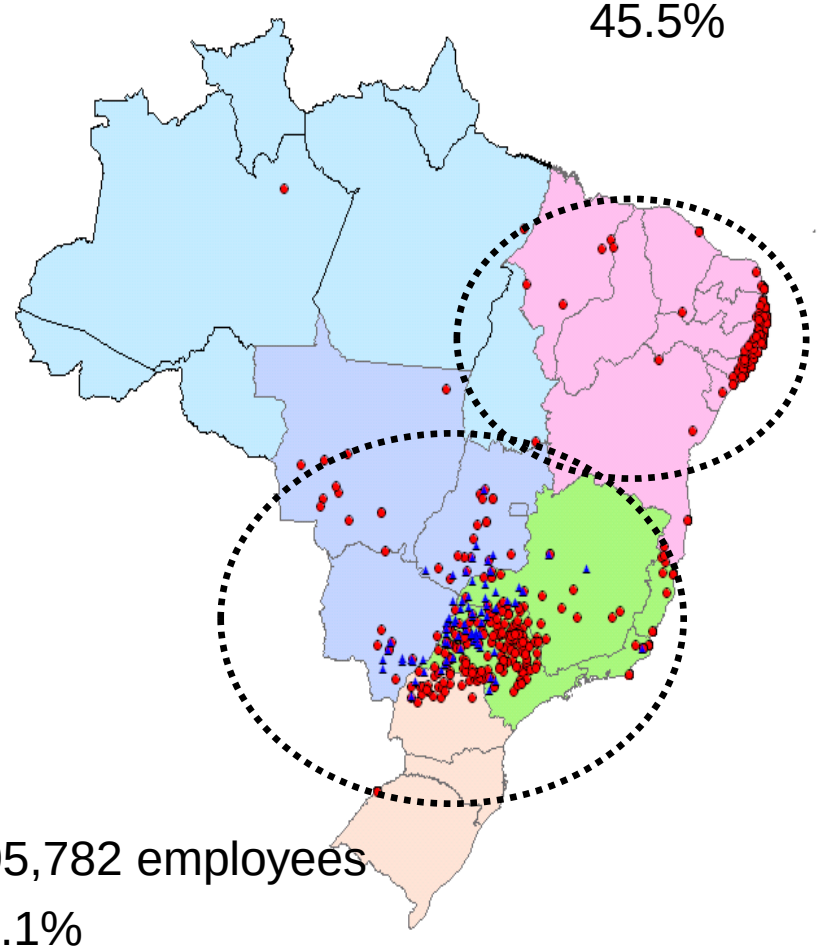
• Annual census on the *formal* labor market based on information provided by companies

•Data available for sector of activity – municipality level

Production and Job Position in 2009

Jobs in Sugarcane (2009): 542,588

246,806 employees
45.5%

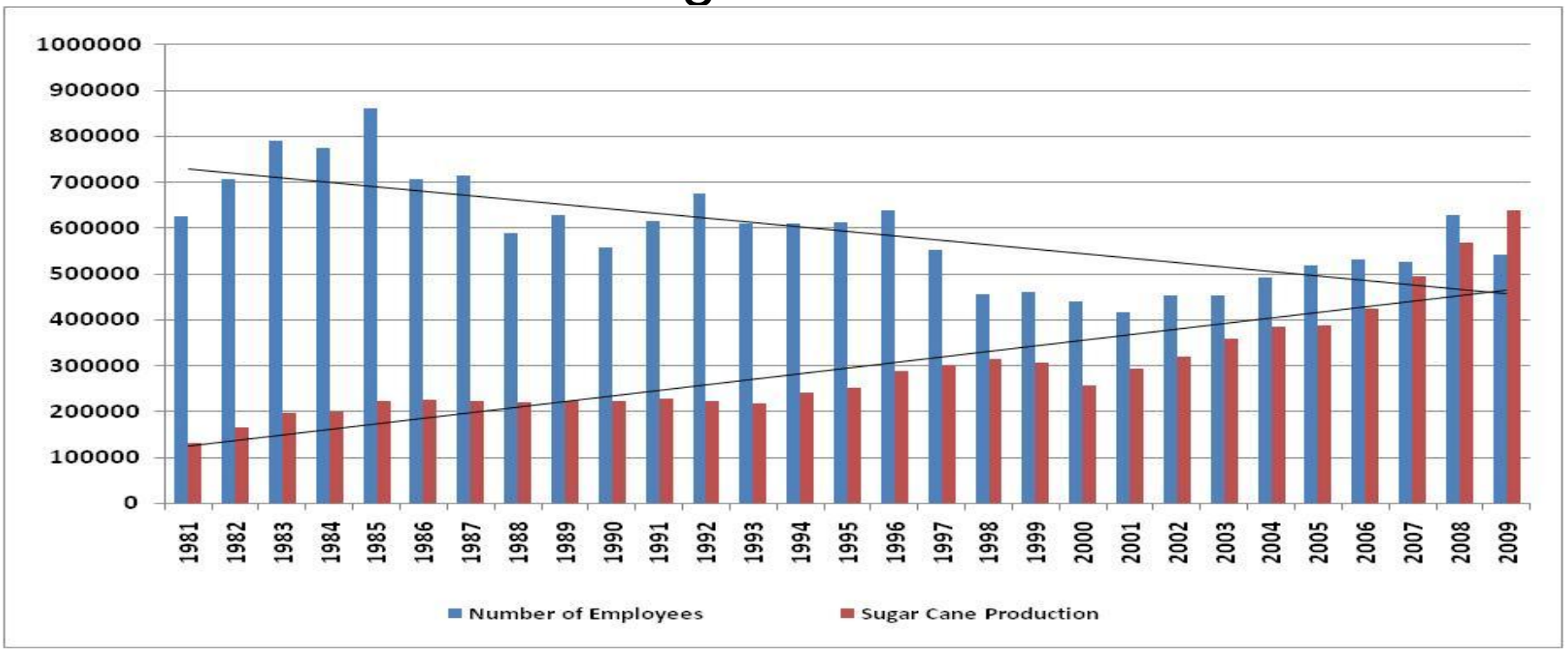


295,782 employees
54.1%

- ✓Both regions are equally important for job generation
- ✓Center South region:
  - ✓ Produces about 90% of main products
  - ✓ Accounts for 56.5% of job positions
- ✓Explained by the highly efficient production and also by more intensive usage of mechanization of agriculture activities

Source: Prepared based on data provided by PNAD 2009

Evolution of the Number of Employees and of the Sugar Cane Production



- Production has risen by 328%
- Number of Employees: 600 thousand workers almost the same number as the beginning
  - Increase in labor productivity and in harvest mechanization

THE PROBLEM

- Deadline to stop the sugarcane burning in the state of Sao Paulo
  - green cane: mechanization more efficient
- Prohibition of sugarcane burning: advance in environmental terms
  - sharp decrease in jobs (70,000 - poorly educated workers)
  - changes in the worker's profile
- Besides environmental laws that forbid burning other factors have encouraged harvest mechanization:
  - ✓Mills invested in electric power co-generation from sugarcane bagasse, in order to trade electric power in the market

Institutional and economic aspects affecting the end of sugarcane burning

THE BANNING OF SUGARCANE BURNING

➢Rules and Norms

Norms: federal, state and municipal

-SP state

- State Law # 11.241, 2002 – Deadlines for the end of Sugarcane Burning
  - Mechanized areas (flat): 2021
  - Non mechanized areas: 2031

Environmental Protocol

-June, 2007: SP state and UNICA signed a cooperation Protocol

- Although non mandatory, producers' adhesion was close to 100%

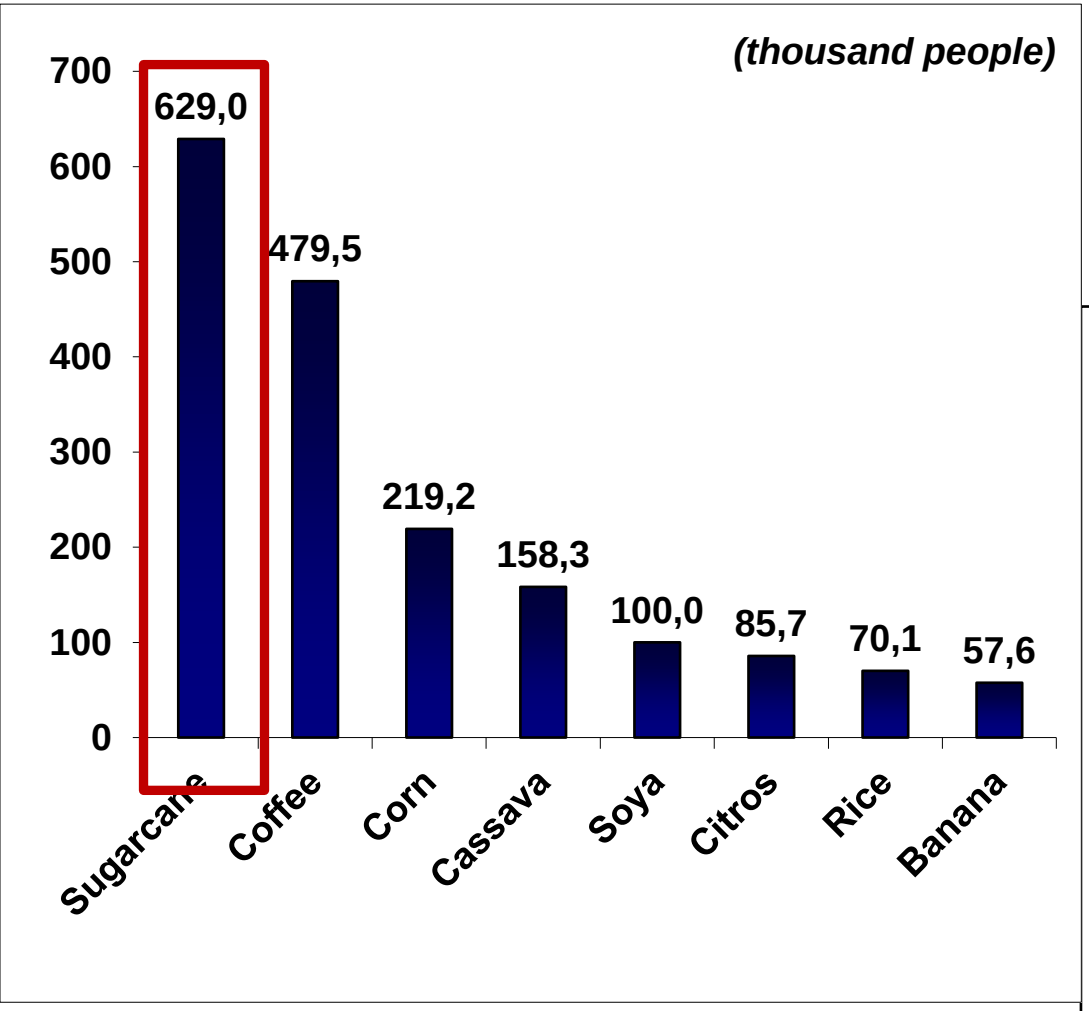
New deadlines for sugarcane burn halt are:

Flat areas: 2014

Non flat areas: 2017

Agricultural workers in Brazil, 2008

2,773,885 agricultural workers in Brazil



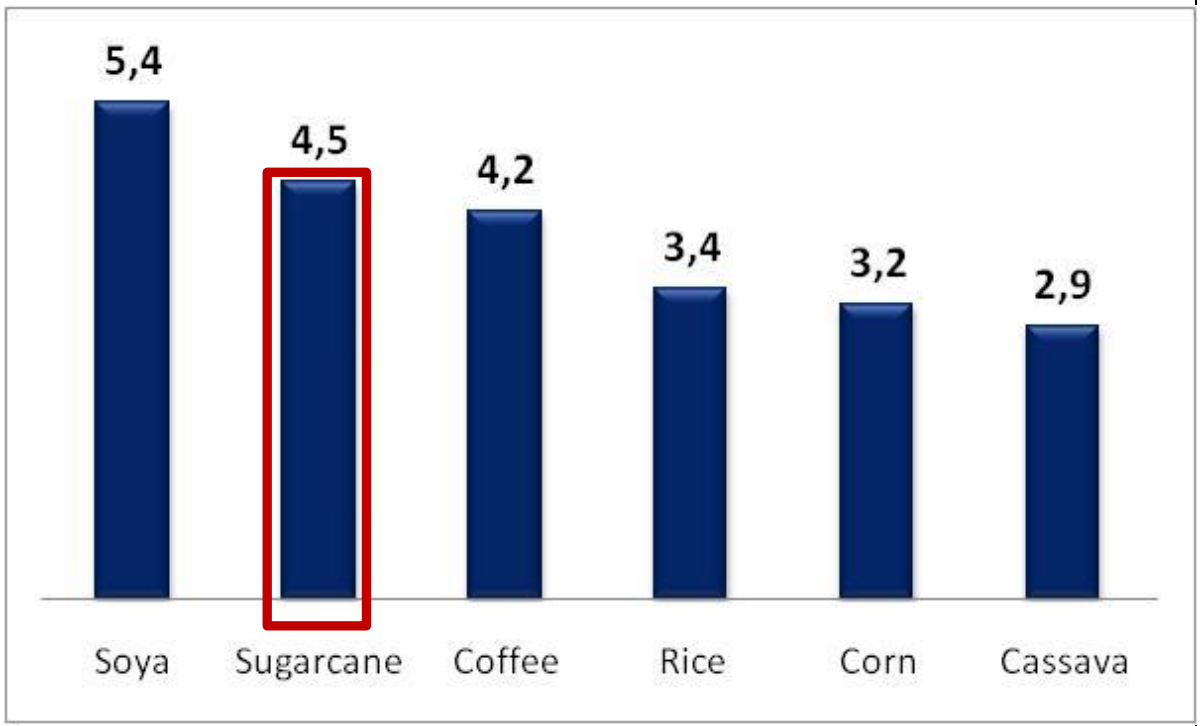
- 23% in sugarcane
- 17% in coffee
- 8% in corn

- ✓Sugarcane:
  - ✓very impressive number
  - ✓inclusion of many low schooling people

Source: Prepared based on data provided by PNAD 2008

Average Schooling of Crop Workers Brazil, 2009

Agriculture 4.0

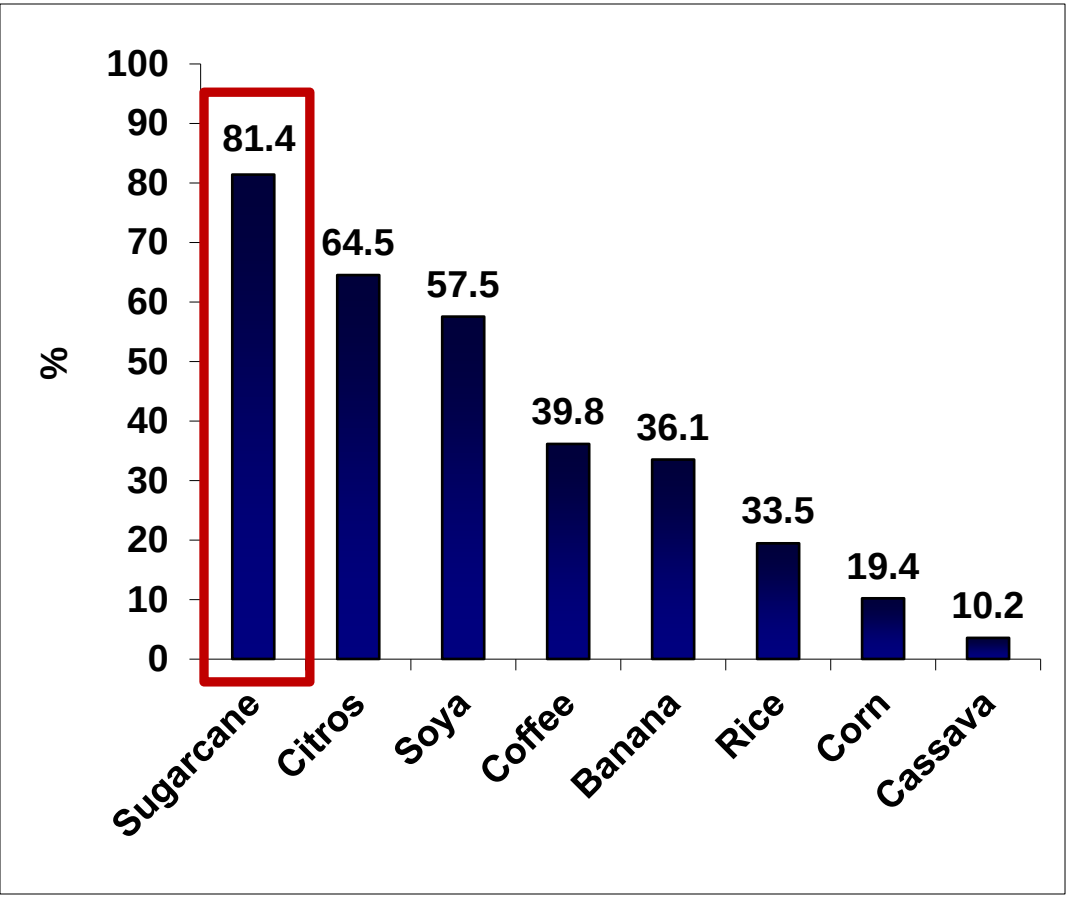


Source: Prepared based on data provided by PNAD 2009

- ✓The average schooling of agriculture workers is 4 years of study
- ✓Sugarcane:
  - ✓The workers of sugarcane sector have about 4.5 years of study
  - ✓About 24% are illiterate

Labour Rights - Brazil, 2008

Agriculture 38.8%

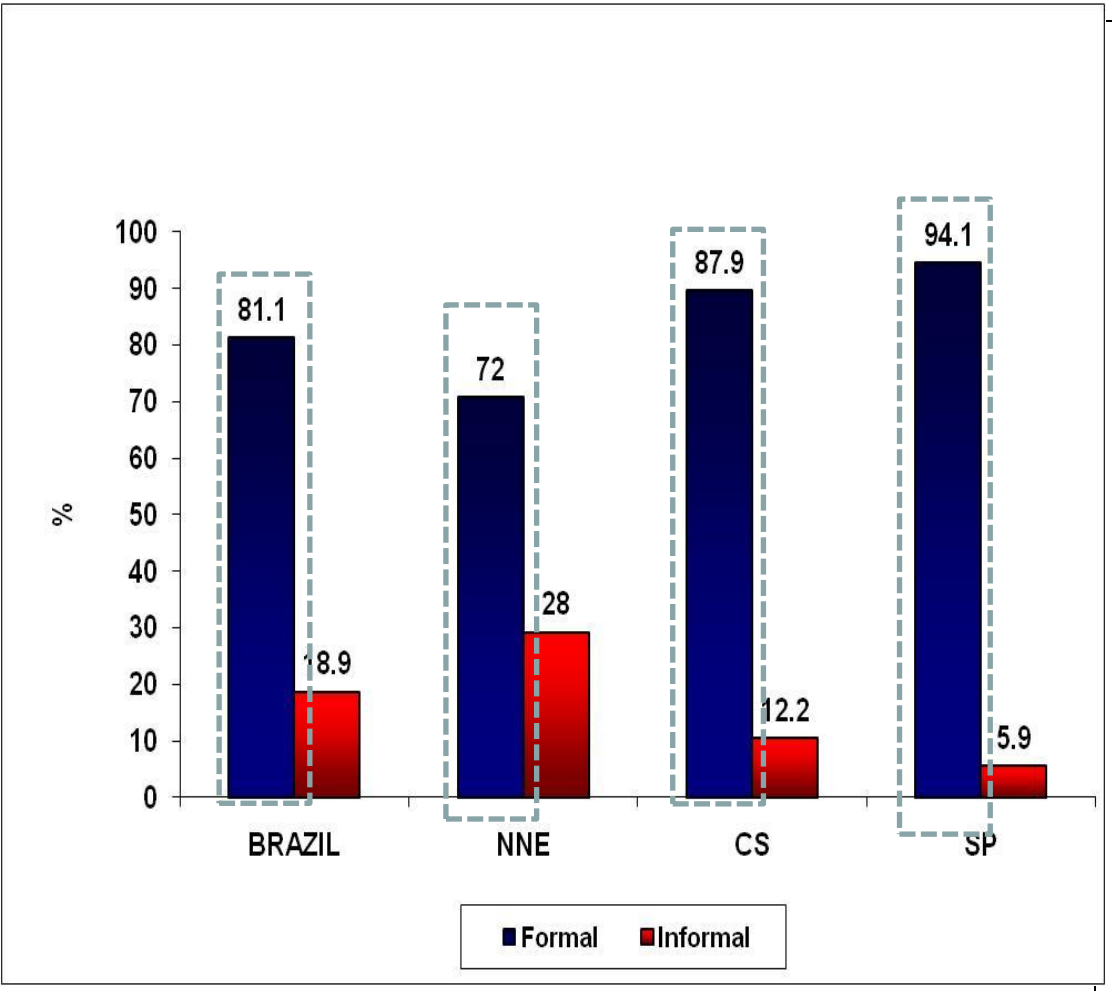


Source: Prepared based on data provided by PNAD 2008

The proportion of workers who are formally employed (hired under a formal labor contract):

- in Agriculture: less than 40%
- In Sugarcane: about 81.4%
- In Sugarcane in São Paulo: 95%
- These employees have all labor rights established in the legislation:
  - Unemployment insurance;
  - Paid annual vacations
  - Extra month pay per year (13º)

Sugarcane: contrasting number of formal and informal workers. Brazil, NNE, CS and São Paulo, 2009



- ✓ In 2009 brazilian sugarcane sector had about 81.1 of formal workers
- ✓ In the North-Northeast region the proportion of formal workers is lower, though higher than agriculture as a whole
- ✓ The state of SP shows the highest number of formally hired workers

Source: Prepared based on data provided by PNAD 2009

Sugarcane: Number of Employees by Age Bracket

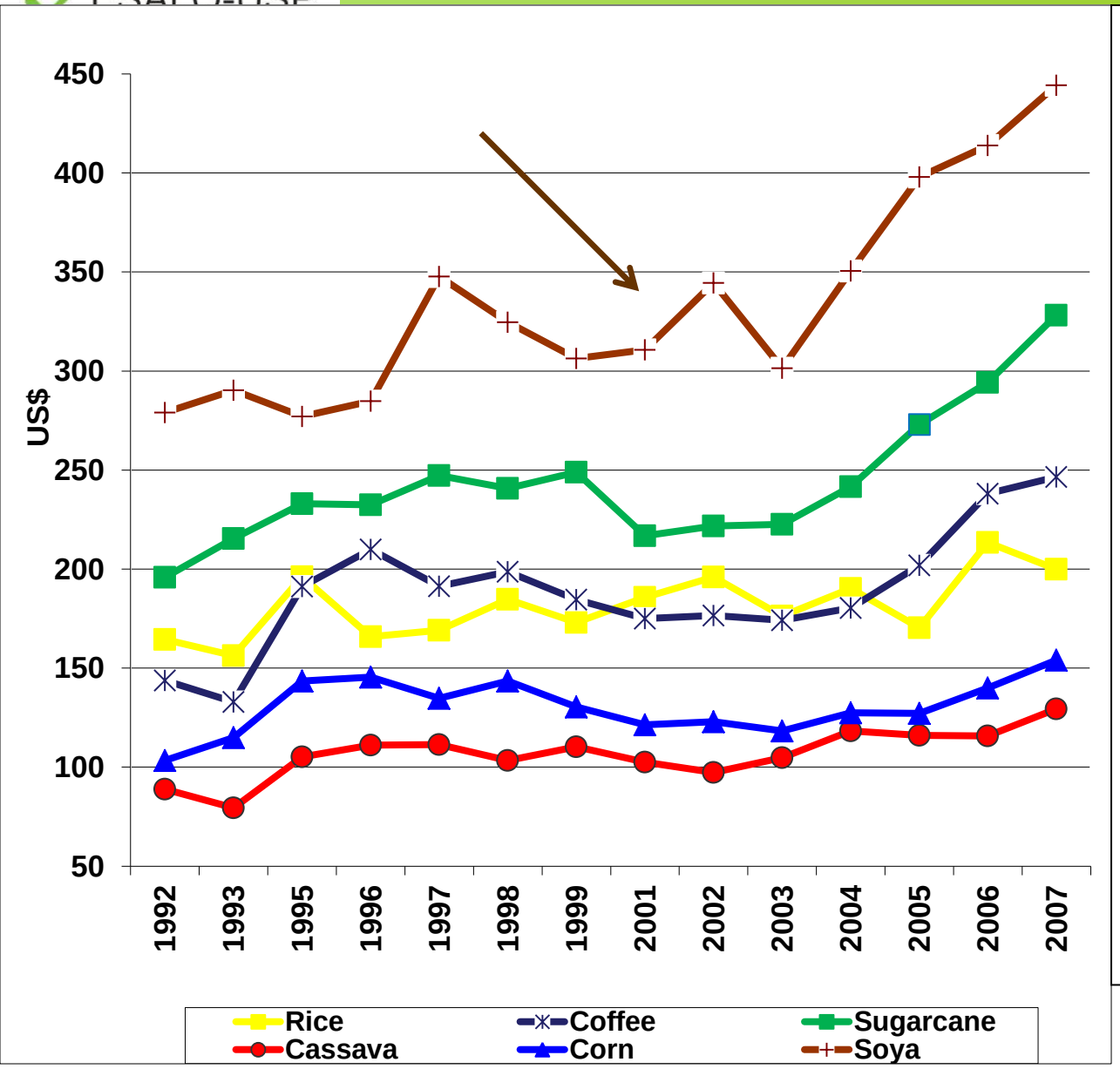
Age Bracket	1981		2009	
	Number of Employees	Total %	Number of Employees	Total %
10-15	95,576	15.3	1,642	0.3
15-20	128,578	20.6	44,492	8.2
20-30	134,033	21.4	187,374	34,5
30-40	106,516	17.0	141,859	26,1
40-50	84,041	13.4	107,130	19,8
40-60	51,886	8.3	46,806	8.6
> 60	24,396	3.9	13,285	2.5
Total	**625,016**	**100.0**	**542,588**	**100.0**

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 0.3% in 2009
- ✓ Increased the proportion of adult workers
- ✓ These are the results of multiple efforts:
- ✓ Sugarcane Producers' concern
- ✓ Better law observance
- ✓ Requirements of the market itself
- ✓ Government social programs

  Bolsa Familia, Bolsa Escola

Wages: sugarcane and other crops



✓The wages of soya sector are the higest ones

✓Estimated earning equation showed :

- ✓After the control of other variables that influence wages (schooling, age, region, color, gender):
- ✓The average monthly wage in other crops in comparisson with sugarcane are lower in:
  - Soya: 0.2%
  - Coffee: 9.9%
  - Cassava: 23.2%
  - Corn: 30.1,%
  - Rice: 30.1%

Key Points

- ✓ Internationalization of ethanol and better exposure to the external market induced companies to adopt more strict norms
  - ✓ Better observance to labor and environmental legislation
- ✓ Labor laws applied: reduction in underaged workers and betterments in labor conditions
- ✓ Greater formalization in sugarcane sector
  - ✓ Better than the agriculture national average
  - ✓ SP outstands the other states
- ✓ Ban of field fires and consequent mechanization of harvesting procedure: reduction in work force
  - ✓ Reduction in the number of employees, despite growth in production

Key Points

- ✓ Considering the low schooling level of workers in the sector, the need to rely on ***private strategies*** and ***public policies*** stands out in a scenario of harvest mechanization
- ✓ Public policies: for ensuring the literacy and improving the schooling of workers in sugarcane fields
- ✓ Private Strategies
  - ✓ UNICA has proposed a yearly training program for 7,000 workers, to provide necessary skills for many activities
  - ✓ To be elegible for this training, a minimum schooling is required
    - ✓ Ineligible workers shall count on public policies

SOCIAL EXTERNALITIES OF ETHANOL PRODUCTION IN BRAZIL

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GeNt ESALQ-USP

BBEST

1st Brazilian BioEnergy Science and Technology Conference

Campos do Jordão - August - 14 to 18, 2011

SOCIAL EXTERNALITIES OF ETHANOL

- The positive environmental externalities caused by the use and production of ethanol are encouraging its use worldwide

- However, benefits of ethanol over gasoline go beyond environmental issues: it is important to analyze the job creation and the impact in the rural development

OBJECTIVE

- To analyze socio-economic indicators for the sugarcane, ethanol, oil drilling and oil derivatives sectors with respect to job and income creation, as well as regional development

- To measure the impact of increased demand for hydrous ethanol, substituting demand for Type C gasoline, on the level of jobs and total income in the Brazilian economy

MATERIAL AND METHODS

DATABASES:

- RAIS - Brazilian Ministry of Labor's Annual Report of Social Information
- Input-Output Matrix (IBGE)

METHODOLOGY:

- Descriptive statistics: data collection (RAIS) regards number of workers, educational level, age and wages;
- Location of production: identifying the main producing regions and corresponding municipal districts in order to compare the capacity for creating jobs and income (RAIS);
- From the multipliers and the coefficients of employment and wages of industries (IBGE), we calculated the direct, indirect and induced (income effect) effects resulting from simulating an increase of 15% in the ethanol consumption as replacement for gasoline C on levels of employment and remuneration (wages and social contributions) in the economy.

SUMMARY INDICATORS

SUMMARY INDICATORS TO ANALYZED SECTORS (2009)

Sector	FU	Municipalities	Employment	Establishment	Avarage Age	Average Wage (R$)
Sugarcane*	22	1,026	242.606 (425.027)	29.187	34,4	958.26
Ethanol	25	248	213.317	608	33,4	1,188.17
TOTAL Cane & Ethanol	**26**	**1,095**	**455.923**	**29.795**	**34,1**	**1,035.09**
Oil drilling	21	125	75,519	1.085	39,3	8,293.48
Oil derivatives	24	124	22,308	359	38,9	6,035.20
TOTAL Oil drilling and derivatives	**25**	**208**	**97,827**	**1.444**	**39,2**	**7,778.51**

*The value presented is only sugarcane used in ethanol production, the total value is in parenthesis.

Source: RAIS (2009).

EDUCATIONAL LEVEL

Sector	Illiterate	Basic education	High School	Higher Education	Total
Sugarcane	26,610	329,030	62,081	7,306	425,027
Ethanol	7,857	146,195	49,974	9,291	213,317
TOTAL Cane & Ethanol	**34,467**	**475,225**	**112,055**	**16,597**	**638,344**
Oil drilling	18	3,831	39,697	31,973	75,519
Oil derivatives	18	2,791	12,070	7,429	22,308
TOTAL Oil drilling and derivatives	**36**	**6,622**	**51,767**	**39,402**	**97,827**

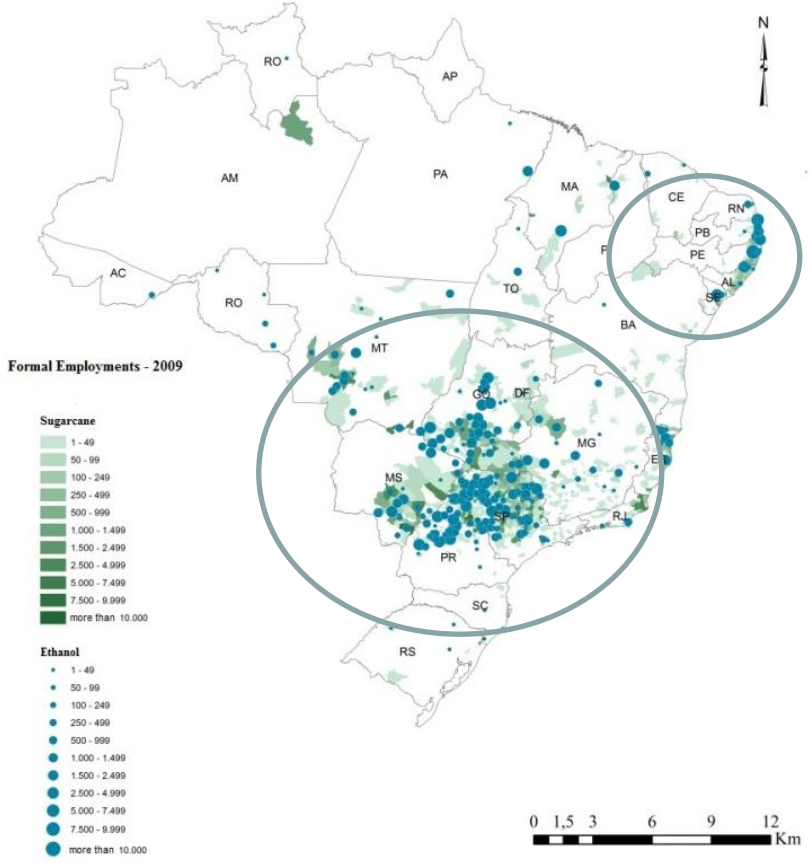
Source: RAIS (2009).

SPATIAL DISTRIBUTION OF EMPLOYMENT

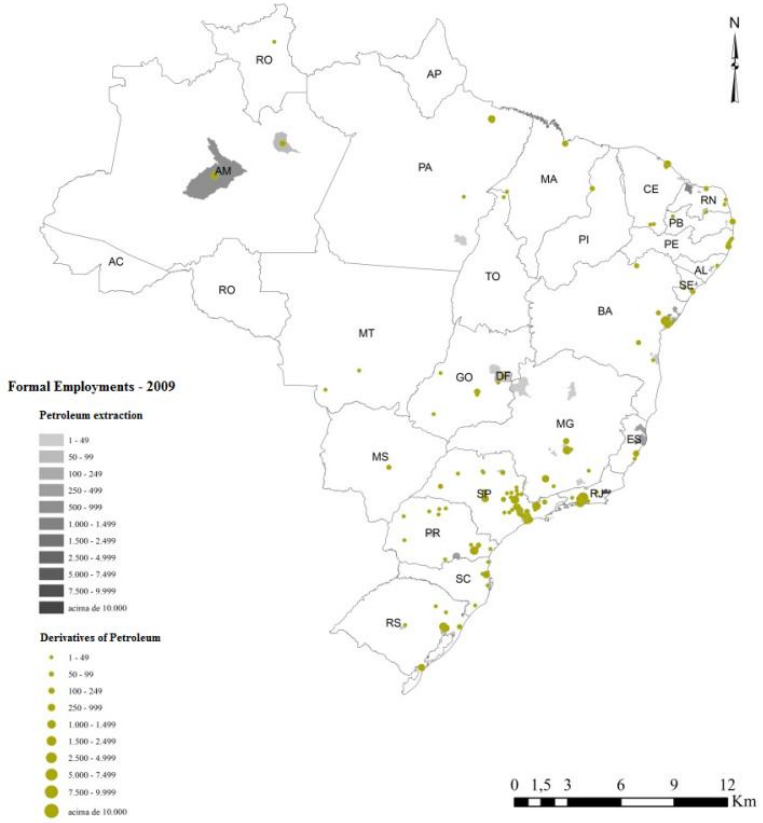
- **Located in 1042 cities**
-**Number of jobs:** 6 times greater than the number of workers employed in petroleum production

Petroleum extraction and oil by-products
- Located in 176 cities

Sugarcane and ethanol



Oil drilling and derivatives



Source: RAIS (2009).

IMPACT ANALYSIS

Impact on jobs of increasing demand for hydrous ethanol *(in R$ millions)*

Number of jobs created in 2004 by a 15% increase in hydrous ethanol demand, with an equivalent reduction in Type C gasoline consumption, considering direct, indirect and income effects.

Increases in hydrous ethanol consumption	15%			
Impact/ Shock	North-Northeast	South-Central	São Paulo	Brazil
Rest of Brazil	67,211	27,957	5,647	100,815
São Paulo	632	2,718	13,536	16,886
Brazil	67,843	30,674	19,184	117,701

Source: Research results.

Impact on wages of increasing demand for hydrous ethanol

Increase in aggregate monthly wages in 2004 resulting from a 15% increase in hydrous ethanol demand, with an equivalent reduction in Type C gasoline consumption, considering direct, indirect and income effects.

Increases in hydrous ethanol consumption	15%			
Impact/ Shock	North-Northeast	South-Central	São Paulo	Brazil
Rest of Brazil	97.08	77.93	-31.96	143.05
São Paulo	1.2	14.07	77.6	92.87
Brazil	98.27	92.01	45.63	235.91

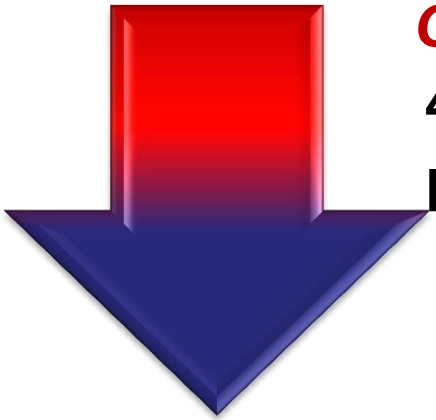
Source: Research results.

IMPACT ANALYSIS

Changing gasoline to ethanol, 15%

117,701 jobs

R$236 millions on earnings



Changing ethanol to gasoline, 0.8%

45,799.5 jobs and

R$120.2 millions on earnings

Key Points

- High employment generation in the two production linkages of ethanol.
  - Sugarcane to ethanol production and ethanol sector employs 456 thousands workers, more than four times the jobs on oil drilling and derivatives sector
- High capillarity and internalization of jobs: 1,095 municipalities by sugarcane and ethanol sector versus 208 municipalities in oil drilling and derivatives sector.
- Multiplier effect on economy: replacing gasoline with ethanol 15%, generating about 120 thousands additional jobs and almost R$ 240 million in total income.
- These results show that public policies to boost consumption of ethanol have a significant social and economic benefit when considering the location and number of jobs generated.

http:www.esalq.usp.br/gemt

Thanks for your attention

Feel free to contact

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