Agro-fuels and Rural Households income in Yucatan

Javier Becerril, Amarella Eastmond, Julio Sacramento & Sam Sweitz

NSF Research Coordination Network
Conference: 22-25 July 2014, Recife, Brazil

Outline

- Background
- Industry of Agro-Biofuels in Mexico
- Sources and Information
  - Research Area
  - Inhabitants Profile
- Impact Assessment (Propensity Score Matching)
- Findings

Background

"NSF-PIRE Collaboration: ***Sustainability Evaluation of Jatropha Oil Production in Yucatán***" **USAID's PEER program**

Social Science: Describe and evaluate the effect jatropha cultivation sites have had over surrounding communities
Dr. Amarella Eastmond, Dr. Sam Sweitz

Economics: Estimate the economic effect jatropha cultivation companies have had over surrounding communities
Dr. Javier Becerril

Process Engineering: Evaluate the overall sustainability of various design options of a jatropha-based biofuel industry (production pathways)
Dr. Julio Sacramento

Background

"NSF-PIRE Collaboration: ***Sustainability Evaluation of Jatropha Oil Production in Yucatán***" **USAID's PEER program**

Social Science: Describe and evaluate the effect jatropha cultivation sites have had over surrounding communities
Dr. Amarella Eastmond, Dr. Sam Sweitz

Economics: Estimate the economic effect jatropha cultivation companies have had over surrounding communities
Dr. Javier Becerril

Process Engineering: Evaluate the overall sustainability of various design options of a jatropha-based biofuel industry (production pathways)
Dr. Julio Sacramento

Background

According to *Janda, Kristoufek and Zilberman* (2012).

- **First** generation biofuels: food-crops, rich in sugar, starch, or vegetable oil.
- **Second** generation: residual non-food parts of current crops, or novel non-food dedicated crops (jatropha!)
- **Third** generation: GMO mainly.
- **Fourth** generation?

Energy Economics 34 (2012) 1922–1930

Contents lists available at SciVerse ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneco

Biofuels and economic development: A computable general equilibrium analysis for Tanzania

Channing Arndt [a], Karl Pauw [b], James Thurlow [c,*]

[a] Department of Economics, University of Copenhagen, Denmark
[b] International Food Policy Research Institute, Washington, DC, USA
[c] United Nations University, World Institute for Development Economics Research, Katajanokanlaituri 6 B, FI-00160 Helsinki, Finland

ARTICLE INFO

Article history:
Received 22 December 2009
Received in revised form 23 July 2012
Accepted 26 July 2012
Available online 11 August 2012

JEL classification:
D58
O13
Q42

Keywords:
Biofuels
Growth
Poverty
CGE model
Tanzania

ABSTRACT

Biofuels could offer new economic opportunities for low-income countries. We use a recursive dynamic computable general equilibrium model of Tanzania to evaluate different biofuels production options and estimate their impacts on growth and poverty. Our results indicate that maximizing the poverty-reducing effects of biofuels production in countries like Tanzania will require engaging and improving the productivity of smallholder farmers. Evidence shows that cassava-based ethanol production is more profitable than other feedstock options. Cassava also generates more "pro-poor" growth than sugarcane-based systems. However, if smallholder yields can be improved rather than expanding cultivated land, then both sugarcane and cassava out-grower schemes generate similar pro-poor outcomes. We conclude that, in so far as the public investments needed to establish a biofuels industry are consistent with other development needs, then producing biofuels will enhance economic development in countries like Tanzania.

According to *Arndt, Pauw and Thurlow* (2009).
Biofuels could offer new economic opportunities for low-income countries.
The findings suggest: economic growth and poverty alleviation in Tanzania.
Require engaging and improving the productivity of smallholder farmers.

Biofuels and employment effects: Implications for socio-economic development in Thailand

Thapat Silalertruksa [a,b], *Shabbir H. Gheewala* [a,b,*], *Katja Hünecke* [c], *Uwe R. Fritsche* [c]

[a] *Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi, 126 Prachauthit Road, Bangkok, Thailand*
[b] *Center for Energy Technology and Environment, Ministry of Education, Thailand*
[c] *Öko-Institut, Energy & Climate Division, Darmstadt, Germany*

ARTICLE INFO

Article history:
Received 16 August 2011
Received in revised form
17 May 2012
Accepted 28 July 2012
Available online 30 August 2012

Keywords:
Biofuels
Socio-economic
Input–output analysis
Employment
Thailand

ABSTRACT

The study assesses the impacts of the biofuels production to the socio-economic development in Thailand. The four kinds of biofuels considered in the analyses are ethanol from cassava, molasses and sugarcane ethanol as well as palm biodiesel. The key elements of socio-economic development including employment generation, economic effects on GDP and trade balance are investigated based on a combination of process and input–output analysis. The results show that producing ethanol and biodiesel require about 17–20 and 10 times more workers than gasoline and diesel as per energy content, respectively. Direct employment in agriculture contributes to more than 90% of total employment. Nevertheless, there are the significant differences in the characteristics of employment in the agriculture and biofuel processing sectors. The overall impacts of ethanol production in Thailand in year 2022 are the employment generation of around 238,700–382,400 person-years, 150 M$ additional GDP, imported goods worth 1583 M$ but 2547 M$ of imports would be saved if compared to petroleum fuels. The other socio-economic aspects such as agricultural improvement and rural development due to biofuels policy in Thailand and some policy measures that need to be urgently promoted are also discussed in the study.

The findings from *Silalertruksa, Gheewala, Hunnecke and Fristche* (2012)
Key elements: jobs creation, economic effect GDP, trade balance, etc.
Findings: Producing Ethanol requires 17-20 times more workers than Gasoline and Diesel.
Direct employment in agriculture contributes to more than 90% of total employment.

Agro-Fuels Industry in Mexico

- The “Plan Nacional de Desarrollo 2007-2012”, a proposal from the Federal Government established:
  - “…mediante la promoción y producción de bioetanol (se) dinamizarán las economías rurales y generará empleo al favorecer la puesta en marcha de un nuevo sector en el ámbito agrícola.”
  - February 2008: Ley de Promoción y Desarrollo de Bioenergéticos (LPDB).

Agro-Fuels Industry in Mexico

- National Energy Strategy 2013 – 2027.
  - Policy 4: Energy transition
  - “México deberá lograr el correcto balance entre mantener al país económicamente competitivo, tecnológicamente innovador y diversificado, mejoramiento calidad ambiental, y cumplimiento de los compromisos ambientales globales, presente y futuros” p. 48.
  - The strategy for long term starting 2013:
    - Natural Gas resources available
    - Renewable energy sources: environmental benefits
    - Rethinking nuclear energy: security present and future

Agro-Fuels Industry in Mexico

- Mexico has a portfolio of different sources:
  - Eolic, Solar, Geothermic, Biomass, and Hydraulic

- Specific Action:
  - To thrust the development of a competitive market, without affecting food security, as long as it be a viable alternative in environmental (as per a Life Cycle Assessment), economical, and social terms. (p. 53)

Agro-Fuels Industry in Yucatan

- **KuoSol** group
- **LODEMO** group
- **The Global Clean Energy**

  – Jatropha (*curcas*)

Sources & Information

- Data & Information from the research project: "NSF & PIRE ***Sustainability Evaluation of Jatropha Oil Production in Yucatán***" Financed by **USAID**
- **907** inhabitants (interviewed)
- **192** Households (surveyed)
- Three municipalities: **Tizimin$^{\varphi}$, Muna$^{\varphi}$, Santa Elena***

$^{\varphi}$Treatment *Control

Study area

Study area, characteristics

Municipality	Village	Maya-speaking population
Santa Elena	San Simón	93%
Muna	San José	40%
	Dzonot Carretero	77%
Tizimin	Tixcancal	82%
	Sucopo	67%

Inhabitants and Household Profiles

Description	Work for AF Industry	NO-Work for AF Industry	/ *t* /Value
Annual Income (Salary)	$37,950.0	$12,408.13	**6.00**
1 = Male	0.88	0.49	**3.78**
Age in years	34.58	40.23	**1.76**
Formal Education	6.45	5.80	0.76
n = 564 inhabitants over 18 years old.			

Mayan Household
and
Home-garden (Solar)

Inhabitants and Household Profiles

Description	Work for AF Industry	NO-Work for AF Industry	/ *t* / Value
Family Size (number of members)	4.33	4.62	0.58
Solar (Home garden) 1 = True	0.90	0.78	1.39
Milpa (farm with three crops: maize, Beans & Squash)	0.36	0.37	0.11
Parcela (farm with permanent trees)	0.27	0.16	1.24
Total crops (Solar + Milpa + Parcela)	5.27	4.68	1.21
Farm land endowment (in hectares)	12.02	24.92	**1.76**
Subsidy “Procampo” (cash transfer) 1 = True	0.41	0.25	1.62
“Seguro Popular” program (Public Social Security)	0.91	0.66	**2.41**
Income from Public Policy Programs	$5,834.55	$7,175.40	0.74
Owns motorcycle	0.55	0.29	**2.39**
Owns television	1	0.86	**1.85**
Owns sewing machine	0	0.05	**2.83**
n = 192 Households			

Impact Assessment

- How impact assessment the economic benefit to work at Agro-Fuels Industry?
- If we have:

  Y^1 = income if works in the Agro-Fuel Industry

  Y^0 = income if doesn't work in the Agro-Fuel Industry
- The economic benefit is the difference:

$$\Delta_i = Y^1 - Y^0$$

- But, only know for each farmer: Y^1 or Y^0 that means, $\boldsymbol{\Delta_i}$ **unknow**.
- To solve this prolem we applied the *Propensity Score Matching* quasi-experiment scenario.

Impact Assessment

The main idea behind the *Propensity Score Matching*:

As similar as possible

Work for Agro-Fuel Industry
"Treatment Group"

No-Work for Agro-Fuel Industry
"Control Group"

Impact Assessment: Economic Impact

"Matching" algorithm	Dependent Variable	ATT	Number of treatments	Number of controls
"*Nearest Neighbor Matching*"	Per-Capita Income Salary Annual	$**14,123.08 (1.75**)	13	231
n = 564 inhabitants over 18 years old.				

Findings

- Positive Effects on annual per-capita income $**14,123.08** rate: US $1 dollar = MX $13.5 peso
- Considerable economic flow in salaries
- + Loss of Biodiversity (number of crops)
- + Attention to Own Farm Production (Solar, Milpa, and Parcela).
- - No evidence of Capital (productive) Investment evidence.
- - Investment on unproductive assets(Motorcycles and TVs)

Thank you very much!

Questions and comments to:
javier.becerril@uady.mx

Presented by:
julio.sacramento@uady.mx