Applied Energy 86 (2009) S37–S46

Contents lists available at ScienceDirect

Applied Energy

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

Biofuels and the Greater Mekong Subregion: Assessing the impact on prices, production and trade

Jun Yang [a], Jikun Huang [a,*], Huanguang Qiu [a], Scott Rozelle [b], Mercy A. Sombilla [c]

[a] Center for Chinese Agricultural Policy, Chinese Academy of Sciences and Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Beijing 100101, (the) People's Republic of China
[b] Freeman Spogli Institute of International Studies, Stanford University, East Encina Hall, Stanford, CA 94305, USA
[c] Southeast Asian Regional Center for Graduate Study and Research in Agriculture, College, Laguna 4031, Philippines

ARTICLE INFO

Article history:
Received 15 January 2009
Received in revised form 16 April 2009
Accepted 16 April 2009
Available online 26 May 2009

This article is sponsored by the Asian Development Bank as part of the Supplement "Biofuels in Asia".

Keywords:
Biofuel
GMS
Impacts
Agriculture

ABSTRACT

Similar to many other countries, all nations in the Greater Mekong Subregion (GMS) have planned or are planning to develop strong national biofuel programs. The overall goal of this paper is to better understand the impacts of global and regional biofuels on agriculture and the rest of the economy, with a specific focus on the GMS. Based on a modified multi-country, multi-sector computable general equilibrium model, this study reveals that global biofuel development will significantly increase agricultural prices and production and change trade in agricultural commodities in the GMS and the rest of the world. While biofuel in the GMS will have little impacts on global prices, it will have significant effects on domestic agricultural production, land use, trade, and food security. The results also show that the extent of impacts from biofuel is highly dependent on international oil prices and the degree of substitution between biofuel and gasoline. The findings of this study have important policy implications for the GMS countries and the rest of the world.

1. Introduction

Global biofuel production has been growing rapidly. While motivations for the expansion of biofuels are complex and multidimensional, the most important is to improve national energy security. With the demand for fossil fuels growing and supplies relatively limited, governments in many energy-short countries are searching for any and all means to increase the amount of energy their nations can produce [12,21]. Governments are also interested in biofuels because they may offer a way that will enable them to increase energy consumption without adding to the amount of CO2 in the atmosphere. Some governments also see biofuels as a means to support the politically powerful—or politically sensitive—farm sector (depending on the country).

While there is potential that biofuel could spur rural development, there are concerns regarding its implications on food security and poverty. Biofuels might facilitate agricultural and rural development by fostering greater investment in agriculture and creating jobs in feedstock production, biofuel manufacture, and the transport and distribution of feedstock and products [30,13]. But concerns about its potential effects on food security and poverty are rising [12,19,24]. If world food prices or demand for crops used as biofuel feedstocks experience significant increases, then the age-old concerns of governments and development practitioners regarding food security and poverty may re-emerge as real issues for the first time in decades.

Similar to many other countries, all nations in the Greater Mekong Subregion (GMS)[1] have planned or are planning to develop strong national biofuel programs. The degree of biofuel development greatly differs across countries, but recently every country has proposed a large biofuel development plan [25]. However, the ability to develop and sustain the rapid expansion of biofuel production has been hindered by the lack of information and understanding of the economics of its market. As observed in the GMS [5], and in other areas as well, no country has thus far been able to launch a domestic biofuels industry without the active support of government beyond its normal regulatory role.

Biofuel development in the GMS must therefore take into account the full spectrum of market and societal values, such as forgone food and other agricultural output, impacts on environmental services, and overall improvements in the well-being of the rural poor. A proper economic analysis is necessary to weigh the upfront

[1] The GMS covers five countries (Cambodia, Lao PDR, Myanmar, Thailand, and Viet Nam) and two provinces (Yunnan and Guangxi provinces) of (the) People's Republic of China. In this study, we limit our study to the five countries and exclude the two provinces of (the) PRC.

* Corresponding author. Tel.: +86 10 64889833; fax: +86 10 64856533.
E-mail address: jkhuang.ccap@igsnrr.ac.cn (J. Huang).

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doi:10.1016/j.apenergy.2009.04.031

social costs and benefits of biofuels and to decide when, where, and how to embark on a biofuel program. Economic analysis also may be a valuable tool in reshaping planned or existing programs to maximize their efficiency and their net benefits to society.

This study is one of the first steps in attempting to better understand the impacts of the global and regional biofuels on agriculture and the rest of the economy, with a specific focus on the GMS. More specifically, the analysis aims to provide answers to the following questions: how will the rise in demand for biofuels affect food prices, agricultural production, and trade in the GMS and the rest of the world? What are the implications on national food security and land use? Answers to these questions could help shape policy recommendations necessary to ensure the development of economically and socially sound biofuels programs in the countries in the region.

The paper is organized as follows. Section 1 is the introduction. Section 2 provides an overview of global biofuel development as well as new initiatives on biofuel programs in the GMS. Section 3 discusses the methodology and scenarios developed for assessing the effects of biofuel development. The impacts of alternative biofuel development scenarios on world food production and prices, national production, and international trade are presented in Section 4. The last section concludes this study.

2. Emerging biofuel development

2.1. Overview of biofuel production in major countries

Global biofuel production has risen rapidly since the early 2000s (Table 1). Although some countries, like the United States (USA) and Brazil, started their biofuel development programs in the mid-1970s when oil prices reached its highest on record, the expansion of biofuel development programs has accelerated only after 2000. Since 2000, growth of global biofuel production has been stimulated by high levels of government support in many countries, as well as by surges in oil prices until late 2008. Global production of biofuels in 2007 amounted to 53.2 million tons—consisting of 44.2 million tons of bioethanol and 9 million tons of biodiesel (Table 1)—equal to nearly 2% of total global transport fuel consumption in energy terms. The USA and Brazil together accounted for almost three-fourths of the global biofuel supply in 2007. In both countries, ethanol accounts for almost all of total biofuel output, though biodiesel production in the US has also increased substantially in the last 2 years.

In the USA, production of bioethanol, which is derived mainly from maize, has surged in recent years as a result of rising world oil prices, tax incentives, and mandates for ethanol as a gasoline-blending component. The total bioethanol production in the US reached 21.3 million tons in 2007 (Table 1), accounting for 48.2% of the global bioethanol output. The demand for maize as feedstock for ethanol has been rising rapidly, with about one-third of the 2007 maize yields in the US used to produce bioethanol. Also, in 2007, biodiesel production in the US was estimated at about 2.1 million tons (Table 1), using 20% of its total soybean output [22]. The Energy Independence and Security Act passed in 2007 has targeted US biofuel production to reach 7.5 billion gallons in 2012, 30 billion gallons in 2020, and 36 billion gallons in 2022. Maize-based bioethanol and cellulosic bioethanol will be the major biofuels in the future. For example, the Act prescribed that of the total 36 billion gallon biofuel production in 2020, 15 billion gallons will be produced from maize (or 50% of total biofuel production), 10.5 billion gallons will be based on cellulosic technologies (about 34% of total biofuel production), 3.5 billion gallons from other energy crops such as sweet sorghum and sugarcane, and 1 billion gallons of biodiesel.

Brazil was the world's largest producer of biofuels until 2006, and became the second largest producer thereafter. Although it was overtaken by the US as the top biofuel producer in 2006, the volume of its production and growth in the future still has significant impacts in the world food market, particularly on sugar. In Brazil, production of bioethanol, based entirely on sugarcane, peaked in the 1980s, and then declined as international oil prices fell; however, production has increased rapidly since the beginning of the century (Table 1). Falling production costs, higher oil prices and the introduction of vehicles that allow switching between ethanol and conventional gasoline have led to this renewed surge in output. Bioethanol production in Brazil in 2007 reached 16.5 million tons (Table 1), accounting for 37.2% of the world's total bioethanol production. The government has targeted bioethanol production for 9.5 billion gallons in 2012 (or 31 million tons), and 11.5 billion gallons in 2016 (or 37.7 million tons). The government also enacted a law establishing biodiesel targets of: 2% by the end of 2007 (800 million liters per year), 5% by 2013 (2 billion liters per year), and 20% by 2020 (12 billion liters per year).

Production of biofuels in the European Union (EU) is also growing rapidly. The bulk of production in the EU is biodiesel. The EU's biodiesel production in 2007 reached 5.7 million tons, accounting for more than 74% of the world's biodiesel output (Table 1). The major feedstock used in the EU is rapeseed. Germany is the leading producer of biodiesel with 3.8 million tons produced during 2007 (or equivalent to 41% of world market share), and followed by the US (20%), France (11%), Italy (7%), and other countries [21]. Recently, the EU set a new target for biofuel production by 2020. A new Directive on Bioenergy, published as a Commission Proposal in early 2008, includes an increased and mandatory target to replace 10% of transport fuels with biofuels by 2020 [21]. The proposal makes a clear reference to second-generation biofuels, which are to represent an important portion of this target share.

Currently, many countries follow the practice of setting indicative targets for biofuel development with strong policy support. To promote biofuel development and ensure the targets being set can be achieved, various support policies have been adopted or considered in major countries. The measures affect various stages in the

Table 1
Biofuel production in major countries during 1996–2007 (million tons).

	1996	2000	2001	2002	2003	2004	2005	2006	2007
Ethanol: world	16.2	15.0	16.2	18.8	23.7	26.5	35.3	39.8	44.2
USA	3.6	5.3	5.8	7.0	9.2	11.1	12.8	15.9	21.3
EU27	n/a	0.2	0.2	0.4	0.4	0.5	0.8	1.5	1.6
Brazil	12.5	9.2	10.0	10.9	12.8	13.1	13.9	14.7	16.5
(the) PRC	–	–	–	0.0	0.1	0.2	0.8	1.3	1.4
Diesel: world	0.5	0.8	1.0	1.3	1.6	2.0	3.4	6.6	9.0
USA	n/a	n/a	n/a	n/a	n/a	0.1	0.2	0.8	2.1
EU27	n/a	n/a	0.9	1.1	1.4	1.9	3.2	4.9	5.7

Sources: world data are from US Renewable Fuels Association [29], Earth Policy Institute [10], and BIODIESEL 2020 [3]; USA data are from US Renewable Fuels Association [29] and BIODIESEL 2020 [3]; European Union (EU) data are from beyond petroleum [2] and European Biodiesel Board [11]; Brazil data are from Renewable Fuels Associations [23]. n/a: data not available. –: nearly zero.