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Washington biofuel feedstock crop supply under output price and quantity uncertainty

Qiujie Zheng [a,1], C. Richard Shumway [b,*]

[a] University of Alaska Anchorage, Department of Economics, 3211 Providence Drive, Anchorage, AK 99508, USA
[b] Washington State University, School of Economic Sciences, P.O. Box 646210, Pullman, WA 99164-6210, USA

HIGHLIGHTS

- Within-state feedstock crop supplies insufficient for Washington biofuel industry.
- Potential Washington corn and sugar beet supplies very responsive to price changes.
- Feedstock supplies more responsive to higher expected profit than lower risk.
- R&D for conversion of waste cellulosic feedstocks is potentially important policy.

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ABSTRACT

Subsidized development of an in-state biofuels industry has received some political support in the state of Washington, USA. Utilizing in-state feedstock supplies could be an efficient way to stimulate biofuel industries and the local economy. In this paper we estimate supply under output price and quantity uncertainty for major biofuel feedstock crops in Washington. Farmers are expected to be risk averse and maximize the utility of profit and uncertainty. We estimate very large Washington price elasticities for corn and sugar beets but a small price elasticity for a third potential feedstock, canola. Even with the large price elasticities for two potential feedstocks, their current and historical production levels in the state are so low that unrealistically large incentives would likely be needed to obtain sufficient feedstock supply for a Washington biofuel industry. Based on our examination of state and regional data, we find low likelihood that a Washington biofuels industry will develop in the near future primarily using within-state biofuel feedstock crops.

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0. Introduction

Biofuels have become major components of transportation fuels in many parts of the world. They also provide local economic benefits such as additional markets for farm crops and additional jobs in rural communities. Broader benefits include potential mitigation of greenhouse gas emissions (under certain scenarios) as well as improvements in energy security by decreasing dependence on foreign sources of fuels (Yoder et al., 2010).

Biofuel production and use are in their infancy but are again experiencing a period of rapid growth. New markets are being created to help foster biofuel growth across the United States and many other countries. Explicit national goals, mandates, and incentives are increasingly being used by many countries to stimulate replacement of petroleum-based fuels (particularly imported oil) with biofuel and other renewable fuels (e.g., Bell et al., 2011; Swinbank et al., 2011). In the U.S., national biofuel policies have been enacted specifically to stimulate fuel blenders' demand for domestic biofuel. They include tax credits, import tariffs, the Renewable Fuel Standard, and the Renewable Identification Numbers market. They combine to increase biofuel demand and decrease or eliminate the gap between market values of biofuel and the price needed to stimulate investment. In turn they increase feedstock demand and raise feedstock price.

Individual states have also joined the effort to develop renewable sources of transportation energy. The state of Washington is just one example. The major use of biofuels in Washington focuses on ethanol as an additive to regular gasoline to improve performance with respect to air pollution. In April 2007, the Washington State Legislature passed bill E2SHB 1303 that addresses the local energy market. Although there was considerable political interest in increasing the use of biofuels in the transportation energy markets, the state did not establish biofuel

* Corresponding author. Tel.: +1 509 335 1007; fax: +1 509 335 1173.
E-mail addresses: qiujiezheng@gmail.com (Q. Zheng), shumway@wsu.edu (C.R. Shumway).
[1] Tel.: +1 614 329 8754.

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mandates and has not yet provided explicit incentives. Rather, the bill contained research and planning initiatives, one of which was a directive to analyze the availability and types of biofuel feedstock sources that could contribute to biofuel production in the state (Yoder et al., 2010).

The biofuel processing industry in Washington is very small. The slow development of local biofuel facilities is partially due to the high production cost of feedstocks. Because of the lack of local feedstock supplies, the Washington biofuel industry does not currently have a comparative advantage in the production of biofuel and is not competitive with the Midwest region (Yoder et al., 2010). It accounts for only a small percentage of total fuel consumption in the state (The Seattle Times, 2009).

In the biofuel feedstock market, feedstocks are typically partitioned into food and feed crops that are used for ethanol (e.g., corn and sugar beets) and biodiesel (e.g., soybeans and canola), and cellulosic feedstocks (e.g., corn stover, grain straw, switchgrass, and forest waste). Corn ethanol is the major biofuel currently produced in the United States. In Washington, corn is primarily grown under irrigation in the Columbia Basin. Because of competition for land and water resources by high-value crops, it is relatively expensive to grow corn in Washington compared to the Midwest. With corn prices having risen nearly four times as much as the average price of other agricultural commodities during the last half of the recent decade, it is not surprising that Washington corn production in 2010 was 63 percent higher than in 2006. Nevertheless, as noted in Fig. 1, it contributes a trivial part of national production (0.2 percent). In addition, only 1600 acres (648 ha) of sugar beets, another potential ethanol feedstock, were planted in Washington in 2008 (USDA, 2008). Much larger acreages of sugar beets were grown in Washington prior to 1978, but little has been produced since processing facilities were closed due to low sugar prices and high energy costs. As noted in Fig. 2, Washington has only produced an average of 0.25 percent of U.S. sugar beets in recent years.

While much grain (primarily wheat) is grown in the state, there is very little oilseed production. Some canola, mustard, safflower, and soybeans are grown. Canola has the highest oil yield of the various oilseed crops and has been grown in limited quantities for several decades in Washington. Mustard and safflower have lower oil yields than canola. Soybeans can be grown in the warmer southern portion of the Columbia Basin but only under irrigation. Camelina, sunflower and peanuts are under cropping trials in the State. Localized agronomic research focusing on planting and harvesting techniques, nutrient and soil management, and weed and pest control for these oil crops are just beginning (Washington State Biofuels Advisory Committee Report, 2007).

Another potential biofuel feedstock is cellulosic biomass, i.e., inedible plant material grown in meadows, forests, and fields. The use of cellulosic feedstock could mitigate the food versus fuel problem. While there is an abundance of cellulosic material in Washington that has potential as feedstocks in biomass-based fuels, the technology is not yet adequate for economic conversion of such feedstocks (Yoder et al., 2010). Because of the inadequacy of current technology to convert cellulose to fuel, we do not examine cellulosic feedstock supplies in this manuscript.

With so much apparent interest in the development of a biofuels industry in the state, it is important to assess the potential for growth of in-state feedstock supplies. While much research has focused on the responsiveness of crop supplies to changes in prices, no analysis of biofuel feedstock supply response in Washington has been conducted. The generally increasing demand for biofuel production is expected to drive feedstock prices higher which could play an important role in farmers' planting decisions and thus increase biofuel feedstock supply. Because of the volatile nature of farm commodity yields and prices, the analysis of biofuel feedstock supplies must take crop output price and quantity uncertainty into account.

In this manuscript we examine the supply of several potentially important biofuel feedstock crops produced by Washington farmers. Growers are presumed to maximize a linear mean-variance specification of the utility of their profit while considering both output price and quantity uncertainty. Because of limited data, the supply of one potential biofuel feedstock crop (canola) is examined for producers who seek to maximize expected profit assuming risk neutrality. The specific objectives of this study are to (a) estimate supply equations and elasticities for major biofuel feedstock crops in Washington and (b) use the results to draw important decision-making implications to guide Washington policy makers concerning incentives that could facilitate development of a biofuel industry in the state.

1. Method of analysis

The crops grown in Washington that appear to have the greatest potential as biofuel feedstocks are corn, sugar beets and

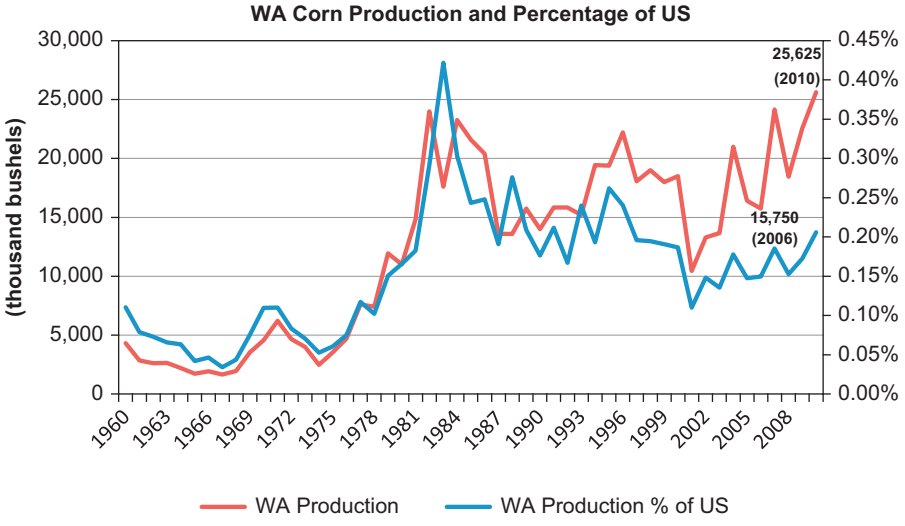

Fig. 1. WA corn production and percentage of US production.

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