AN EXAMINATION OF THE RELATIONSHIP BETWEEN BIODIESEL AND SOYBEAN OIL PRICES USING AN ASSET PRICING MODEL

Miguel Carriquiry, Instituto de Economía, Universidad de la República, Uruguay, mcarriquiry@iecon.ccee.edu.uy

Selected Poster prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, Boston, Massachusetts, July 31-August 2

Copyright 2016 by Carriquiry, Elobeid, and Goodrich. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.
AN EXAMINATION OF THE RELATIONSHIP BETWEEN BIODIESEL AND SOYBEAN OIL PRICES USING AN ASSET PRICING MODEL

Miguel Carrquiry
Instituto de Economía, Facultad de Ciencias Económicas, UdelaR

Introduction

- Feedstock (vegetable oils) costs usually account for between 80% and 90% of the total costs of production.
- Given the installed capacity to convert soybean oil into biodiesel, margins to biodiesel productions should not open beyond certain quantities that allow plants to earn a normal profit.
- Large literature analyzing the relationship between the prices of energy and commodities, mostly on crude oil or gasoline and corn. Much less attention paid to the relation between biodiesel prices and their feedstock

Figure 1. Daily prices of biodiesel and soybean oil

Stylized facts and hypothesis

- Biodiesel production raised rapidly in recent years
- Soybean oil, is the main feedstock for biodiesel production in the U.S.
- Y’s price should be related to the price of biodiesel

Figure 1. Recent evolution of biodiesel production levels in the U.S.

Asset pricing model

- Empirical models of asset pricing attempt to extract information about latent state variables and structural parameters from observed prices.
- These models can involve high dimension latent state variables, can be conveniently estimated using Bayesian methods
- As the variables that modulate the valuation of soybean oil as a major input for biodiesel production are not observable, we will utilize and estimate a model commonly used in the asset pricing literature, when latent variables are involved.
- These methods treat the parameters of the models as random variables, having a distribution, which depends on observed state variables X and dependent variables Y.

\[
\begin{align*}
y_{t+1} &= \mu_y + \sigma_y \epsilon^y_{t+1} \\
\mu_{t+1} &= E_y + \beta (\mu_t - E_y) + \gamma Z_{t+1} + \sigma_{\mu} \epsilon^\mu_{t+1}
\end{align*}
\]

With \( \epsilon^y_{t+1} \) and \( \epsilon^\mu_{t+1} \sim N(0,1) \) and \( \text{corr}(\epsilon^y_{t+1}, \epsilon^\mu_{t+1}) = \rho \)

MCMC Methods used to estimate the model parameters \( \mu = \{\mu^y_{t+1}\} \) and \( \Theta = \{E_y, \beta, \sigma_y, \sigma_{\mu}, \rho, \gamma\} \)

Simulation study

To assess the ability of the used methods to estimate the parameters of the model, a simulations study is conducted

Table 2. True versus simulated parameters

Application to real data: Results

Daily observations for the pair of biodiesel and soybean oil prices for the period June 2007 to December 2012 were collected and used to estimate the model, yielding the following results

The parameter \( \gamma \) is likely positive \( P(\gamma > 0) > 0.95 \) but small, indicating the price of soybean oil has a small direct impact on the price of biodiesel

The price of biodiesel seems to be more strongly driven in the short run by factors affecting the path of the latent variables than by the price of soybean oil (as reflected by \( \beta \))

Final remarks

This work utilized a discrete time return model of finance to analyze whether prices changes of soybean oil, the main feedstock for biodiesel production in the US affect the prices of biodiesel

Model parameters were estimated using MCMC methods, which were first shown to be able to identify the both the model parameters and the latent variables involved.

Results from this study indicate the price of soybean oil does not have a strong direct impact on the price of biodiesel in the short run, or in a daily basis.

This study analyzed only whether the price of soybean oil drove the price of biodiesel (at a daily frequency). In particular, it did not use lower frequency to analyze equilibrium relationship, and it did not attempt to analyze whether the price of biodiesel affected that of soybean oil.