Emergence of a New Biofuels Market: A Computable General Equilibrium Analysis

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Preliminary and Incomplete – Not for Citation

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4-6, 2013

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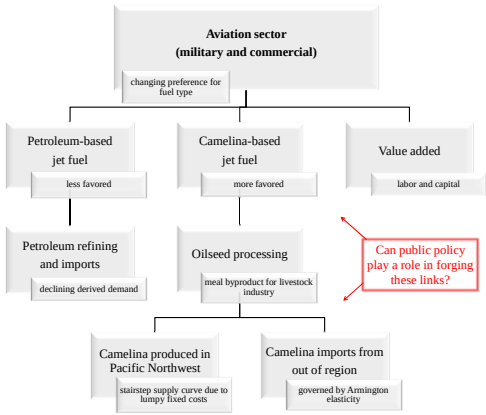
The issue

- The aviation sector (both military and commercial airlines) is making plans to offset petroleum-based jet fuel with jet fuel created from the oilseed camelina.
- A "demand pull" rather than "supply push" approach to biofuels
- Military is motivated in part by security concerns: Diversify fuel sources to include "home grown" camelina-based fuel
- Commercial airlines and airports (PDX, SEA) also interested in using U.S.-grown biofuels, perhaps for perceived environmental reasons (possible reduction in net greenhouse gas (GHG) emissions)
- What will the Pacific Northwest regional economy look like with a functioning camelina-based jet-fuel sector?
- What role, if any, is there for public policy in helping making the connections portrayed at right?



Regional CGE model

- The CGE model takes a relatively standard, neo-classical approach that accounts for all key sectors that may be affected, including interactions that these sectors have with each other.
- Producers of an activity such as aviation have constant elasticity of substitution technologies over value-added (labor and capital), and combine these with intermediate inputs using a Leontief functional form and cost minimization. Jet fuel is one of the intermediate inputs.
- The model treats Oregon, Washington, and Idaho as a single geographic unit and distinguishes trade between this region and the rest of the United States, and also trade between this region and the rest of the world.
- Model parameters are calibrated using baseline information on from IMPLAN (IMpacts for PLANning) data for the year 2011. The 509 sectors of the IMPLAN data are aggregated to 13 sectors displayed below.
- The model solution provides a set of prices that clears all commodity and factor markets and makes all the individual agent optimizations feasible and mutually consistent.

Counterfactual

- The model is written as a simultaneous system of non-linear equations in GAMS (General Algebraic Modeling System). The joint equilibrium value of endogenous variables is calculated using the PATH solver.
- The model is initially solved for baseline values of all endogenous variables to replicate the 2011 Social Accounting Matrix.
- The use of petroleum-based jet fuel by the aviation sector is replaced by an equal quantity of camelina-based jet fuel.
- This triggers increased demand for oilseed processing and oilseed farming. Some of this can come from outside the region.
- Oilseed meal is newly supplied to the livestock sector.

Old crop, new use

- Camelina grown for thousands of years in Europe and Central Asia
- Camelina oil yields very high quality jet fuel; camelina also yields a meal that could be a livestock feed source
- Can be used in Wheat-Fallow rotations in dry inland Pacific Northwest
- Camelina has low input requirements, can be grown in marginal soils, and has a natural competitiveness with weeds
- Japan Airlines and U.S. Navy have been flying planes fueled with camelina-based jet fuel

Map of study region

CGE model sectors

Number	Abbreviation	Name
1	OILSF	Oilseed farming
2	LVSTOCK	Livestock production
3	OILSDPROC	Oilseed processing and refining
4	OTHAGR	Other agriculture
5	REFINED	Petroleum refineries
6	CONST	Construction
7	UTIL	Utilities
8	TRAD	Wholesale and retail trade
9	MIN	Mining and quarrying
10	FOOD	Processed food
11	MAN	Manufacturing
12	TRANS	Transportation Services
13	OTHSERV	Other services and miscellaneous

Results

Counterfactual shock induces a $210 million increase in the aviation sector's use of biofuels. This in turn induces the following changes:

- Pacific Northwest oilseed production rises by 41.5%
- Pacific Northwest imports of oilseeds from outside the region rise by 44.5%
- Oilseed price rises by 1.05%
- Bio-based fuel production rises by 5.9%
- Transportation sector contracts very slightly (-0.006%) and uses less traditional petroleum-based fuel than before
- In addition to $210 million increased use of oilseeds, the oilseed processing industry also uses more oilseed processing (5.4%)

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