Can Increasing Fuel Costs Make Locally Produced Food More Competitive?
Chuck Grigsby, Dr. Chad Hellwinckel, Dr. Dayton Lambert, Dr. Edward Yu, Department of Agricultural & Resource Economics, University of Tennessee

Background
Fresh produce in the United States often travels thousands of miles in diesel operated semi-trucks before arriving to market. Under a high fuel cost scenario, the current low cost, efficient supply chain could become a high cost organizational structure for US food distribution. Rising transportation costs of food sourced from distant locations may provide competitive opportunities for small- and mid-sized local producers if transportation costs are a smaller portion of their total costs. Farmers selling fresh produce in east Tennessee and Florida. A comparative analysis of conventional and local transportation energy consumption serves as an indicator of whether local farmers’ locational advantage in accessing nearby markets could open competitive opportunities over the conventional food supply chain in a high fuel cost scenario.

Methods
Transportation fuel use efficiency is measured as the total transportation fuel use (gallons) per one hundred pounds (cwt.) of produce delivered to market (g/cwt).
- To estimate local farmers’ transportation fuel use efficiency:
  - A survey of farmers selling fruits and vegetables in direct-to-consumer local markets in east Tennessee is conducted.
  - 29 farmers are interviewed on their travel route to market, vehicle characteristics, truckload weight, size of operation, and marketing strategies.
  - To estimate the transportation fuel use efficiency for the conventional food supply chain:
    - 3 Scenarios: Shipping points from Palm Beach County, FL, Hidalgo County, TX., and San Joaquin Valley, CA.
    - Terminal market location in all scenarios is Knoxville, TN.

- Fruits and vegetables are shipped in 48-53 foot, diesel operated semi-trucks hauling approximately 40,000 pounds of produce per trip at 5.7 MPG.
- Transportation fuel use efficiency depends on:
  - Travel distance to market
  - Truckload weight
  - Vehicle fuel economy (MPG)
  - Delivery logistics.
  - Truckload weight affected by:
    - Acres planted in fruits and vegetables, farming practices, vehicle size, alternative marketing channels per week.
  - Vehicle fuel economy is estimated by:
    - Farmer model, year and fuel type, and drivetrain.

Research Objectives
- Obtain information on energy use of transporting locally grown products for sale in nearby markets in east Tennessee.
- Compare the transportation energy use of local producers with the transportation energy uses of producers of similar crops using conventional, long-distance sourcing practices.
- Determine optimal production and distribution scales for local farmers to achieve a per-unit supply chain efficiency that is competitive with conventional agricultural food networks.

Conceptual Framework
Comparative Advantage in Production vs Locational Advantage in Transportation
Webber Location-Production Model

Energy Use Comparison
Transportation Fuel Use Efficiency

Food Miles to Fuel Use

Larger Farms, Larger Trucks, Larger Loads

Scenario 1

Sensitivity Analysis
Travel Distance Thresholds: Maintaining a Locational Advantage
Using the truckload regression coefficients and average miles per gallon (MPG) estimates of farmers’ vehicles, a sensitivity analysis is conducted to observe how variations in truckload and vehicle fuel economy affect local farmer travel distance thresholds - the maximum travel distance to market before the local farmer loses his/her locational advantage over conventionally transported food in terms of fuel use per unit of produce shipped.

Conclusions

If local farmers hope to compete with the conventional food supply chain in a high fuel cost scenario, they must at least capitalize in the area of transportation for which they potentially have a locational advantage. Yet when evaluating local farmer transportation fuel use, many surveyed farms have higher per unit transportation energy consumption than conventionally sourced food from CA, TX, or FL. One strategy local farmers could use to improve their transportation fuel use efficiency is to increase their production and distribution scales. Results from the sensitivity analysis show that as farms increase their acreage in production and vehicle size, the number of farms inside the competitive transportation zones increases. Calculations of travel distance thresholds and competitive zones of local food distribution may be useful to local farmers, regional governments, and others interested in building resilient local food economies.

Above: The farm’s production and distribution scale is small, the travel distance to market must be low in order for the farmer to compete with conventionally transported produce.

Above: Scaled-up farmers can market their products up to 86 miles from market.

OLS Results

• An additional acre planted in fruits and vegetables for a surveyed non-organic farm adds, on average, 129 lbs. more weight to truckloads.
• A farmer using a box truck carries 575 lbs. more produce to market than a farmer using a pick-up truck, controlling for all other variables.

Scenario 2

Comparative Advantage in Distribution

Comparative Advantage in Production

Comparative Advantage in Transportation

Scenario 3

Transportation Fuel Use Efficiency

The Impact of Scale

• There is growing interest in scaling up local food production and distribution so that it has similar transportation efficiencies to the conventional food supply chain.
• Most cited way to improve efficiencies is by increasing truckload weights.
• An exploratory, ordinary least squares (OLS) regression model tests hypotheses on how local farmer production and distribution scales affect truckload weights transported to market.

Sensitivity Analysis
Travel Distance Thresholds:

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