Will Higher Shipping Costs Drive the U.S. to Source More Localized Produce?

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Abstract
The recent wide fluctuations in diesel fuel costs and subsequent trucking costs has raised speculation within the produce industry of potential structural shifts in the location of production. Recent increases in demand for local produce seem to further support speculation toward this end. A component pricing model is used to actually examine the impact of fuel prices on farm gate and retail produce prices for strawberries, lettuce, and potatoes. The study finds that distribution costs, while significantly increasing in absolute value, have surprisingly little contribution to changes in retail prices even in markets distant to the primary production regions. These results suggest that factors other than lower distribution costs for local produce will ultimately need to drive the supply for these products.

Background

During the middle of 2008, fuel prices were seen soaring to record levels and climbing at rates that were leading to projections that were widely varying. While fuel prices were impacting many sectors of the economy, a major component particularly affected was distribution. The marketing bill for agricultural products in general, and produce in particular, includes many elements. Distribution has generally been regarded as one of those important elements. The concentration of the production of fruits and vegetables has been substantially transferring to the southwestern U.S. and the deep South over the past three decades (Dimitri et al, 2003, Kaufman et al, 2000). Although moderated by a recently weakening dollar, import sources for most produce items have also been increasing. Many local fruit and vegetable production areas in the U.S. have been in steady decline.

The recent surge in fuel prices, together with an increased consumer interest generally in having local sources of food, seemed to be bringing together a sentiment that these factors would be working together to re-establish the viability of more localized production. Produce trade magazines regularly featured concerns about the rising fuel costs impacting the various levels of the produce value chain.[1] Trucking costs, indeed, tracked very closely with the climbing diesel rates. The USDA-AMS reported trucking

[1] One article in The Packer by David Mitchell in September 2008 noted "High Energy Costs Reduce Profits", quoting shippers stating their fuel bill was up 48% from a year ago, and all petroleum-based inputs were seeing steep price increases. Another article by Ashley Menaugh in the same publication a few months earlier, "Diesel costs cut into production", reflected much of the on-going sentiment by growers and shippers throughout the supply chain that input costs were going up. A new industry practice of implementing a fuel surcharge, back-billing growers after higher shipping costs than projected were incurred.

rates from Southern California to New York at $8,300 in June 2008, up 26% from the previous June (USDA-AMS, 2009).[2]

The interest in local food supplies is grounded in several value points. Factors cited by some researching consumers in this area of demand have included support for the local economy, reduced food miles, food security, and opportunity for improved quality.[3] While scale economies, climate, and other clustering factors have driven production to concentrate geographically during the past 30 years, growing interest in local supplies has offered a counter. Supermarkets and restaurants alike have moved to accommodate these trends. But aside from the demand side factors, local produce supplies have generally not been cost competitive and thus have given up much of their production market share to distant regions.

The question that has emerged with the concurrent fuel cost and consumer demand trends is whether or not substantially higher shipping costs will meaningfully impact local produce sources from a retail food cost standpoint.

Methodology and data

This paper looks at the relationship between fuel and shipping costs and produce prices both at the farm gate and at various regional urban market centers. We seek to estimate the contribution of fuel and trucking costs to various produce items in an effort to understand the magnitude of the cost impacts. There are many types of fresh produce, each with their own value chain characteristics. We selected strawberries, lettuce, and potatoes to represent a diversity of value per pound and perishability.

We draw on data provided by the Western Growers Association for retail prices in Los Angeles, Chicago, Atlanta, and New York and also for farm gate prices to their predominantly western grower members. Several variations of weekly trucking rates were initially employed in the analysis. While there is a strong correlation between diesel and trucking rates, a weekly series for truck rates from specific growing regions to specific markets proved a daunting data collection task. We simplified our measure of distribution cost to be simply the weekly number 2 diesel rate for either the U.S. (in the case of potatoes which are more widely produced) or in California (for strawberries and lettuce) provided by the U.S. Department of Energy[4].

Farm Gate Price Impacts

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[2] A special thanks to Camia Lane with AMS for providing extended weekly truck rate data beyond the 2002-2008 Fruit and Vegetable Truck Rate Report.

[3] See, for example, a report from the Hartman Group, 'What Buying Local Means to Consumers', a webinar transcript with Kate Peringer from May 2008. http://www.foodinstitute.com/buyinglocal.cfm

[4] All diesel fuel prices were obtained from the U.S. DOE, Energy Information Administration, Official Energy Statistics from the U.S. Government http://www.eia.doe.gov/. Diesel retail prices: U.S. No 2 Diesel Retail by All Sellers (Cents per Gallon); California No 2 Diesel Retail Sales by All Sellers (Cents per Gallon).

The first analysis looks at the relationship between shipping and fuel costs and farm gate prices. The model estimated is a simple OLS regression using weekly price data from 2002-2008.

$$Farmprice_{x,t} = \alpha_0 + \alpha 1\ farmprice_{x,t-1} + \alpha_2\ diesel_{t-1,r} + \varepsilon_x$$

For commodity x, weekly period t, and corresponding diesel rate, r.

Normal tests for autocorrelation were conducted.

The results of these regressions are presented in Table 1.

Table 1. Farm Gate Price Impacts

Commodity	Constant	FarmPrice(-1)	Diesel(-1)	R^2
Strawberries	0.488*** (0.124)	0.829*** (0.030)	0.00019 (0.00038)	0.69
Lettuce	0.061*** (0.018)	0.832*** (0.029)	0.00008 (0.00006)	0.71
Potatoes	0.089** (0.039)	0.880*** (0.025)	0.00014 (0.00016)	0.78

Note: Strawberries and lettuce use California diesel rates, potatoes uses the U.S. rate.

Retail Price Impacts

The second analysis looks at the relationship of fuel prices on each of the produce items in each of the four urban markets; New York, Chicago, Atlanta, and Los Angeles. The basic hypothesis was that more distant markets would be more significantly impacted by rising fuel costs associated with distribution.

The different commodities were chosen to represent produce items with different shipping characteristics. Strawberries are high in value per unit weight and also highly perishable. The actual shipment activity is a relatively smaller part of the marketing function as compared to a less perishable product like potatoes. Presumably, the smaller the contribution of shipping to the overall product value, the less of a relative impact changes in shipping costs will have.

This component pricing model is also set up as a simple OLS time series utilizing weekly data from 2002-2008. In this case, we include a lagged retail price and a lagged farm gate price along with the appropriate diesel price to measure the marginal impact on the current retail price. This allows us to capture other variations in production related events that may affect the farm and subsequently the retail price other than diesel rates/transportation. The model follows:

$$Retailprice_{x,m,t} = \beta_0 + \beta_1\ Retailprice_{x,m,t-1} + \beta_2\ farmprice_{x,t-1} + \beta_3\ diesel_{t-1,r} + \varepsilon_x$$

For commodity x, in market m, weekly period t, and corresponding diesel rate, r.

The results of these regressions are presented in Table 2.

Table 2. Estimating Retail Produce Prices in Various U.S. Markets

	New York	**Chicago**	**Atlanta**	**Los Angeles**
Strawberries				
Constant	-0.011	0.742***	0.462***	0.498***
RetailPrice(-1)$_k$	0.640***	0.481***	0.755***	0.605***
FarmPrice(-1)	0.156***	0.246***	0.099***	0.221***
Diesel(-1)	0.00019	0.00031	-0.00018	0.00038
R^2	0.67	0.53	0.73	0.66
Lettuce				
Constant	0.252***	0.291***	0.411***	0.085***
RetailPrice(-1)$_k$	0.532***	0.680***	0.587***	0.742***
FarmPrice(-1)	0.590***	0.276***	0.103***	0.337***
Diesel(-1)	0.00087***	0.00063***	0.00035***	0.00046***
R^2	0.65	0.72	0.51	0.81
Potatoes				
Constant	1.447***	2.142***	1.629***	0.911***
RetailPrice(-1)$_k$	0.417***	0.255***	0.465***	0.585***
FarmPrice(-1)	0.574***	0.335***	0.283***	0.137***
Diesel(-1)	0.0029***	0.0012***	0.0013***	0.0014***
R^2	0.47	0.31	0.43	0.53

Note: Strawberries and lettuce use California diesel rates, potatoes uses the U.S. rate.

Discussion of Results

There appeared to be no statistically significant impact of the single period lagged diesel rate on the current farm gate prices. This was a somewhat surprising result, given the perception of growers who stated the rising fuel costs were significantly impacting their business. The rising diesel prices, indeed, were not being reflected in the prices received. The short term run up on a key input price for farmers that are basically price takers allowed for little short term production adjustment. This held true for each of the three commodities examined here.[5]

The regressions looking at retail prices and diesel revealed some interesting results. The lagged weekly retail price was not surprisingly significant and the lagged farm gate price also was significant at the .01 level for each of the commodities. The impact of diesel prices, however, seemed to vary by commodity. The coefficients estimated for diesel

[5] It has been interesting to note that, despite the steady increases in California diesel rates since 2002, the planted acres to strawberries has continued to expand. Planting intentions for 2009 are not available at the time of this paper following the wide fluctuation in fuel prices over the past 6 months, but certainly the subsequent lower petroleum-based input prices to growers are likely to encourage this expansion trend further.

were not statistically significant in any geographic market for strawberries, but they were highly significant for both lettuce and potatoes in every market.

We drew on our estimated regressions to look at the marginal contributions of diesel rates for each commodity in each market. The mid-April 2008 values for each of the key variables are presented in Table 3.[6] Simply looking at the percent marketing margins, the percentage value added to lettuce is highest and distance from production seems to be significantly reflected in the retail price. It seems less so with potatoes and strawberries.

Table 3. Mid-April 2008 Values for Key Variables

	Retail New York	Retail Chicago	Retail Atlanta	Retail LosAngeles	Farm Gate Price
Strawberries ($/pound)	2.74	2.99	2.74	2.87	1.15
Lettuce ($/pound)	1.62	1.73	1.33	1.21	0.19
Potatoes ($/10 lb. bag)	3.99	3.97	4.81	3.86	1.25
U.S. Diesel Price (cents/gal) California Diesel Price (cents/gal)	399.5 411.8				

The most recent points of the time series for each variable were used to estimate the diesel impact from the coefficients in Table 2 for each commodity in each market. The marginal contribution for diesel is estimated per unit and in percentage terms. These are summarized in Table 4.

As suspected, a high value per unit commodity like strawberries has relatively little contribution to the retail price from distribution costs, and there seemed to be little connection between the distribution cost estimated by city and the distance from southern California, the predominant production region. Shipping costs as a percent or retail price was markedly higher for lettuce and potatoes. A product like lettuce is highly perishable and requires rapid refrigerated delivery. But unlike strawberries, it has a relatively low retail value per pound and a much greater fraction of the marketing bill is connected to the value of shipping. Potatoes have approximately the same percent contribution from distribution as lettuce, but actually much less on a per pound basis (note units in 10# bags). At peak diesel prices, most markets were experiencing about 5 cents per pound

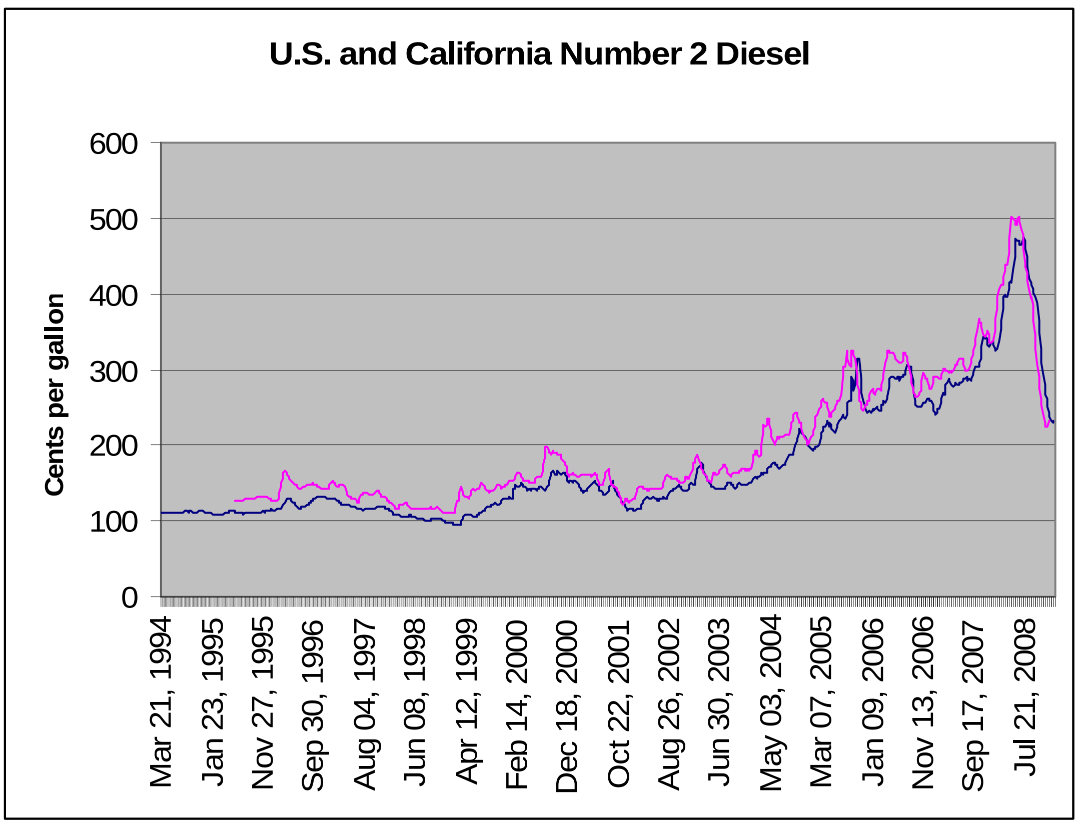
[6] Our regression results were based on data through mid-April 2008. Diesel prices peaked mid-July 2008 at $4.67 per gallon before dropping by more than half in 6 months to $2.31 in January 2009.

cost from distribution[7]. Lettuce distribution costs were 26-36 cents in the more distant markets of New York and Chicago.

Table 4. Estimated Marginal Contribution of Peak Diesel Rates on Retail Price

Market	$ per unit	Percent of retail price	$ per unit	Percent of retail price	$ per unit	Percent of retail price
	Strawberries		**Lettuce**		**Potatoes**	
New York	0.08	2.8	0.36	22.1	1.16	29.0
Chicago	0.13	4.2	0.26	15.0	0.48	12.1
Atlanta	-0.07	n/a	0.14	10.8	0.52	10.8
Los Angeles	0.16	5.4	0.19	15.6	0.56	14.5

Note: Marginal contribution based on diesel rates observed during mid-April 2008. Produce units are per pound for strawberries and lettuce and per 10 pound bag for potatoes.



Source: U.S. Department of Energy

[7] We were unable to get truck rates for non-refrigerated trucks, which are less expensive. Using a cost accounting model to estimate shipping costs to each market, one would expect to have a considerably lower cost to spread. Most trucks ship produce in 40,000 pound units and have to be very careful about what products are mixed in a load. It should be noted, as well, that the various urban markets each have closer sources from which they can source potatoes in contrast to most of the strawberries or lettuce.

Implications for Local Produce

Higher distribution costs seem to impact the final retail price of different produce items differently. It's probably fair to point to higher fuel costs as a major contributor to the various reports of 6-8% annual food price inflation identified late in 2008. Yet it is important to capture a sense of the magnitude for the price differences, even for items like lettuce and potatoes where diesel had a positive and significant relationship. The estimates of the marginal contribution to retail price are stated in total terms, that it, the total impact of fuel prices. These measures were taken near the peak of the recent fuel crisis when there was considerable anxiety about the rate of price increases. Fuel prices actually came down to the nominal levels of over five years ago in the last six months. While understanding the limits of projecting too far out of sample, even large increases in fuel prices seem to lead to fairly small changes in the retail price for the produce items here considered. We're essentially seeing a fairly minimal response to the retail price from fairly large swings in the fuel cost.

In sum, while there may be many factors commending consumer interest in local produce, it seems unlikely that relatively higher costs associated with transporting produce in from distant production regions will be realized as one of them. Not all produce items were considered here. Certainly items like lettuces that are highly perishable and have relatively low price may realize meaningful cost advantages during periods of high distribution costs. But even bulky, lower-value, less perishable items like potatoes have surprisingly little total cost tied up in delivering them to distant domestic markets.

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