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Investigating Impacts of Fuel Costs on Retail Prices for Local and Non-local Milk Products

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Recent high oil prices may have effectively lessened existing price gaps between locally produced goods and competing non-local markets, therefore making it more affordable for people to purchase local goods.

Also in this issue

Each item in the typical American meal or snack has traveled an average of 1,500 miles. If every person in the United States ate just one meal per week containing only foods grown locally, U.S. oil consumption would decrease by over 1.1 million barrels of oil per week.

While eating local is proposed as an easy and relatively cost-effective way to reduce our impact on the environment, in a recent *ARE Update* article Sexton (Vol. 13, No. 2) shed some more light on this discussion by outlining health and environmental welfare implications of restructuring food towards "local" production, looking at a variety of crops and products in the United States. Sexton highlights that not all crops (and fresh products) would be available locally—thus decreasing consumer choices and welfare. Also, Sexton contends that switching to local farms may be inefficient, as it would eliminate economies from large-scale production and comparative advantages that emerge when regions specialize in producing foods to which they are relatively best suited and then engage in trade with other regions.

Our focus is to investigate whether increasing oil prices may be transferring demand to locally produced goods by reducing price gaps between local and non-local products because local goods are transported shorter distances. Increases in costs of inputs needed to produce a food product, including the costs to transport the product from production or processing location to the retail store, should over time "pass-through" to affect the retail price paid by consumers.

Although this is the first paper to investigate different price pass-through rates for local and non-local foods, numerous studies have examined the impact of energy prices on overall food prices, but with no distinction made between local and non-local goods. These studies stress the importance of assessing the amount of energy used to produce a product in determining its impact on the product's price, and in our paper we investigate discrepancies in pass-through of input prices into retail prices by distinguishing local and non-local milk products in the analysis.

Data and Empirical Strategy

We use an Information Resources Incorporated (IRI) panel scanner data set of weekly prices for numerous milk products produced by several vendors sold at several retail stores in 51 different cities located in 32 states (Table 1). Milk was chosen because both local and non-local versions are available in many states and stores, and since milk items have barcodes, prices are easy to track over time. It is also available in many sizes, brands, and types (organic, non-fat, chocolate, etc.). This allows us to include a large variety of items for each store and increases our sample size. The prices span five consecutive

Table 1. Summary of Store Locations for the Scanner Dataset		
Region	State	Cities/Regions
East Coast	GA	Atlanta
	MA	Boston, New England, Pittsfield
	NY	Buffalo/Rochester, New York City, Syracuse
	NC	Charlotte, Raleigh/ Durham
	PA	Harrisburg/Scranton, Philadelphia
	CT	Hartford
	RI	Rhode Island
	VA	Richmond/ Norfolk, Roanoke
	SC	South Carolina
	D.C.	Washington D.C.
Gulf Coast	AL	Birmingham
	TX	Dallas, Houston
	MS	Mississippi
	LA	New Orleans
	NM	West Texas/ New Mexico
Midwest	IL	Chicago, Peoria/ Springfield
	OH	Cleveland, Toledo
	IA	Des Moines
	MI	Detroit, Grand Rapids
	WI	Eau Claire, Milwaukee, Green Bay
	IN	Indianapolis
	MO	Kansas City, St. Louis
	TN	Knoxville
	MN	Minneapolis/St. Paul
	OK	Oklahoma City, Tulsa
	NE	Omaha
Rocky Mtn	UT	Salt Lake City
West Coast	CA	Los Angeles, San Diego, San Francisco, Sacramento
	AZ	Phoenix
	OR	Portland
	WA	Seattle/Tacoma, Spokane

years, beginning on January 1, 2001 and ending on December 31, 2005. In addition, we use weekly gasoline prices from the Energy Information Administration for the corresponding period, where prices are categorized by region, grade, and type of gasoline. A composite of U.S. No. 2 diesel prices for all sellers is also included because it is assumed that milk products from both local and non-local vendors are shipped to stores in large vehicles that require diesel. Finally, the price per barrel of oil is included as a proxy for future gasoline prices.

We wish to estimate variations in price caused by changes in input costs, and to differentiate changes in costs for locally produced versus non-locally produced products. We also controlled statistically for unobserved variables that vary across states but not over time, and variables that vary over time but not across states—what economists call time and location fixed effects.

Results

Four empirical specifications were estimated in order to measure the differences in input-price pass-through between local and non-local milk products. Results are presented in Table 2. Results that are statistically significant are denoted with an asterisk. The estimates in the first column display only the effect of time and location, explaining variations in milk prices. This allows us to see the extent to which changes in milk prices are the result of regional and seasonal variations, such as temperature and various other weather conditions which are not included in the overall price model. Location and time explain 7.1% of the variation in milk prices— this is shown in Table 2 by the "R^2 statistic" reported at the bottom of the table.

The results shown in column 2 also include time and location fixed effects, but add product characteristics in an effort to discover how much of the variation in milk prices can be attributed to differing characteristics among the products. Here we see that product characteristics, such as size in fluid ounces, local product indicator (LOCAL) and product/brand-fixed effects, explain an additional 24.7% of the variation in prices relative to the specification in column 1.

The third specification (column 3) adds variables for current and lagged fuel costs. As noted, we include three different measures of fuel costs: Diesel Price, Gas Price, and Barrel Price. To allow for delayed pass-through of cost changes, we also include the diesel price lagged one, two, and three weeks—denoted as Diesel 1, Diesel 2,

Table 2. Results of Price Regressions, Dependent Variable: Price of Milk Product i at Time t				
	Coefficient			
	1	2	3	4
Fluid oz.		0.014*		0.0140*
LOCAL		0.0094*	0.7701*	0.6646*
Diesel Price			0.0764*	0.0374*
Gas Price			0.0193*	0.0426*
Barrel Price			0.0007*	0.0006*
LOCAL Diesel			0.0133	0.1079*
LOCAL Gas			-0.006	-0.0328*
LOCAL Barrel			-0.0064*	-0.0079*
Diesel 1			0.1077*	0.0869*
Diesel 2			0.1080*	0.0871*
Diesel 3			0.1080*	0.0874*
LOCAL Diesel 1			-0.1188*	-0.1039*
LOCAL Diesel 2			-0.1238*	-0.1075*
LOCAL Diesel 3			-0.1205*	-0.1053*
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Product Fixed Effects	No	Yes	No	Yes
R Squared	0.071	0.318	0.08	0.323

Number of observations for each sample: 16,103,465
** Significant at the 1% level*

and Diesel 3 in Table 2. Then, to ascertain whether there is a different effect on pass-through for locally produced milk products, we interact the variable denoting a local product (LOCAL) with each of the six variables measuring fuel costs. We also include as an explanatory variable an indicator for a local product with the variable LOCAL. These interaction variables are denoted as LOCAL Diesel, LOCAL Gas, LOCAL Barrel, LOCAL Diesel 1, LOCAL Diesel 2, and LOCAL Diesel 3 in Table 2.

In column 3 of Table 2, we add gas prices and LOCAL variable indicators to the specification listed in column 1 of the same table. This model shows the role of fuel prices in explaining variations in products' prices, in addition to the differences explained by differences in space and time. After subtracting the explanatory power provided by the location and time variables, we see by comparing the R^2 statistics that gas and oil prices explain only a small fraction of the variation in milk prices—about .07%.

The final column 4 of Table 2 combines the previous three specifications. Here, we are able to ascertain the full impact of gas/oil prices on local goods. All parameters are statistically significant in this specification. Note first that locally produced milk products are more expensive, other factors constant by about $0.66. All six of the fuel cost variables are positive, meaning that higher fuel costs pass through to cause higher retail prices. However, in five of the six instances the interaction of the LOCAL variable with the fuel-cost variables has a negative coefficient. This result means that locally produced milk products experienced less of a price increase due to higher fuel costs than non-local products, no doubt due to the fact that local products are transported a shorter distance than non-local products. In most cases the coefficient on the interaction variables involving LOCAL are of a similar magnitude to the corresponding coefficient on the fuel-cost variable, meaning that there is little impact of higher fuel costs on prices of locally produced milk. For example, the coefficient for Diesel 1 (diesel price, lagged one week) is 0.1077, and the coefficient for LOCAL Diesel 1 is -0.1188.

Conclusion

Our main finding is that there is a substantial and negative difference in the way increases in oil prices affect the price of local and non-local milk products. This means that increased oil prices lead to larger price increases for non-local goods than they do for local milk products. Concerns about the health and environmental costs of transporting food have lead to an increased awareness and abundance of local food products. The monetary costs of transporting food reached new heights in 2008 when oil prices spiked to record highs. The price of a barrel of oil in May 2007 went from $65 dollars to an all time high of $147. During this same time, the average price of a gallon of gasoline rose to $4.11.

Given our empirical findings, the extremely high oil prices may have reduced or eliminated price gaps between the two types of goods, making it more affordable for people to purchase locally produced goods. What remains to be studied is whether the changes in relative prices have caused consumers to eat more locally grown food and, more importantly, whether eating local has empirically measurable health and environmental impacts, as discussed in Sexton (2009).

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For additional information, the authors recommend:

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