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their importance in estimating economic impacts**

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‘Local’ producers’ production functions and their importance in estimating economic impacts

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Abstract

Understanding farm expenditure patterns is critical in assessing how local food systems impact community economic development. This article utilizes two unique data sets from samples of producers in New York State, along with U.S. Department of Agriculture Agricultural Resource Management Survey data to build expenditure profiles for local food system participants. The primary contribution of this article is to demonstrate with strong empirical evidence that local food system participants in New York State have different expenditure patterns than farmers who do not sell through local food markets. We show that farmers with local food sales have higher reliance on local labor and other variable expenses as primary inputs than farms without local food sales, and that local food producers spend a higher percentage of total expenditure in the local economy. Based on our results, we find that researchers who utilize aggregate agricultural sector data to determine the economic impact of local food system activity may under-estimate overall impact. We recommend that impact assessments utilize revised production functions that more accurately reflect inter-industry linkages of the local food sector.

Keywords: local food systems, economic impact assessment, production function

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Food marketed as locally-grown is now available throughout the U.S. Catalyzed by a myriad of actors, many local food outlets (e.g., farmers’ markets, food hubs, farm-to-school programs) are supported through public policies at the local, state, and/or federal levels, often under the auspices of strengthening community economic development. Despite the proliferation in availability of local food, the economic impacts of these activities remain unclear, largely due to data deficiencies.

To conduct economic impact analyses, one must have information about inter-industry linkages both within and among sectors of an economy; i.e., as a business or industrial sector buys from and sells goods and services to other sectors of the economy and to final users, the firm stimulates additional economic activity by other businesses and within other industrial sectors. This information is generally available only on an aggregate commodity sector scale, particularly for agriculture (e.g., IMPLAN data and software provided by Minnesota IMPLAN Group, INC – MIG), which limits the extent of tractable analyses of local food system activities. To this point, most current research quantifying the impact of local food systems utilize expenditure patterns for aggregated agricultural commodity sectors (e.g., Cantrell et al. 2006; Kane et al. 2010; Leung and Loke 2008; Conner et al. 2006; Swenson 2010, 2011; Timmons 2006; Henneberry et al. 2009; Otto and Varner 2005; Hughes et al. 2008; University of South Carolina 2010), thus assuming that the purchasing and sales patterns of local food producers are indifferent from those in aggregated commodity sectors.

In early 2013, the Union of Concerned Scientists and Michigan State University’s Center for Regional Food Systems convened a two-day meeting of economists and local food researchers to identify data needs and best practice methodologies in order to better understand

the impact of local food system activity. One of the gaps identified was a need to better understand the input expenditure patterns of farms that sell into local food markets and, in particular, what inputs farms require and where the inputs are purchased (Pirog and O'Hara 2013a, 2013b). This is not to suggest that the 2013 meeting was the first time that researchers have called for this type of information. Krinke (2002), for example, states that little is known about the labor and materials farmers use to supply their farms based on alternative farming systems. And Hughes et al. (2008) specifically called for more research on expenditure patterns of local food participants.

Understanding farm expenditure patterns is critical in assessing how local food systems impact community economic development. To the extent that local food system participants have different expenditure patterns than other types of agricultural producers, they will interact with the local economic sectors differently and produce varied impact results. While previous attention on input purchase patterns and their connection to economic impacts has concentrated on farm size and/or alternative farming practices, little attention has focused on differential purchasing practices by producers involved in local food channels, either through direct-to-consumer (D2C) or through intermediated markets. As consumer demand for locally-grown products continues to increase, accurately assessing the economic impacts of local food channel activity is becoming increasingly important, particularly when public funding is utilized to support these activities.

As a step towards better understanding the production profiles of local food system participants, this article utilizes two unique data sets from samples of producers in New York State (NYS), along with 2008-2011 U.S. Department of Agriculture (USDA) Agricultural Resource Management Survey (ARMS) data to build expenditure profiles for local food system

participants.¹ Building on an initial case study by Schmit et al. (2013), the primary contribution of this article is to demonstrate with strong empirical evidence that local food system participants in NYS have different expenditure patterns than farmers who do not sell through local food markets. We show that farmers with local food sales have higher reliance on local labor and ‘other variable expenses’ as primary inputs than farms without local food sales. Additionally, when field crop, fruit, and vegetable producers with local food sales are viewed alone, they have lower expenditures on fertilizer and chemicals—the largest expenditure item for farms without local food sales. Based on our results, we find that researchers who utilize aggregate agricultural sector data to determine the economic impact of local food system activity will likely underestimate overall impact. We recommend that impact assessments utilize revised production functions that more accurately reflect inter-industry linkages of the local food sector.

We begin the rest of this paper by reviewing the literature on farm input expenditure patterns and its relationship to community economic development. This is followed by a description of the data collected in the two case studies and utilized from the ARMS. Finally, the empirical results are discussed, along with their implications and directions for future research.

Literature summary

The importance of the relationship between farm input expenditures and community economic development is well documented. For rural areas with strong agricultural and less diversified economies, there is evidence that the mix of inputs purchased and the location of the purchases has key community impacts (e.g., Aldrich and Kusmin 1997; Lambert et al. 2009; Shaffer et al. 2004). As the structure of farming in many rural economies continues to shift—in large part due to improvements in transport and telecommunication technologies—much of the literature focuses on the negative impacts resulting from these changes (Tacoli 1998; Krinke 2002; Stabler

and Olfert 2009; McManus et al. 2012). McManus et al. (2012) refer to this phenomenon as the ‘uncoupling’ of farm enterprises and rural service centers. They conclude that as farms are freed from reliance on ‘the local’, small rural towns are likely to experience decline unless they have other attributes that will support local economies (i.e., amenity tourism).

Related literature emphasizes the impact of farm attributes (especially scale and farming practices) on input purchase decisions, though none looks specifically at the relationship between market channel and input purchases. Goldschmidt’s (1947) seminal study of two California communities generated the hypothesis that large-scale farming has detrimental community impacts while family-operated farms enhance community well-being—in part because family-operated (smaller-scale) farms more largely supported local businesses. Marousek (1979) surveyed small and large farmers in two towns in Idaho and found that small farms spend a higher percentage of their total expenditures locally (59 compared to 55 percent). Chism and Levins (1994) conducted a study of 30 crop and livestock farmers in Minnesota, finding that larger farms purchased a smaller percentage of their inputs from the local economy. Lawrence et al. (1997) reported from their survey of pork producers in Iowa that large-scale producers spend less money on inputs in the nearest community than small-scale producers. Tacoli (1998) writes that the multiplier effects of ‘prosperous’ agriculture often bypasses local small towns; and Krinke (2002) cites a farmer in Green Isle, MN as stating that “When dairy gets so big, they don’t deal with you; they buy direct and bypass the local economy” (9).

Additional research suggests that farming practices also play an important role in determining the location of input purchases. Brodt et al. (2006) and Milestad et al. (2010) claim that ‘sustainable’ farming practices tend to require more locally produced inputs, and to replace agrochemicals obtained in distant markets. However, Brodt et al. (2006) caution that preliminary

evidence suggests that increased local input purchases only result where local economies are prepared to meet the needs of alternative agricultural producers. Lockeretz (1989) compared five previously published studies examining the economics of high input conventional cropping systems with low input alternatives to assess the community economic impact. He reports that though lower input systems contribute less money per acre to the local economy (as they purchase less inputs), a greater portion of the value of expenditure is spent locally.

Community economic impacts resulting from the declining employment opportunities in agriculture on small rural towns is well understood (e.g., Heady and Sonka 1974; Marousek 1979). Significant technological advances and increases in productivity, farm employment and labor expenditures per dollar of gross output have declined precipitously throughout the United States. With declining levels of farm employment and labor expenditure, many rural communities are unable to support businesses that supply farm inputs and household items. As a result, many remaining farms and households can no longer purchase products in the nearest town, but travel to more densely populated locations (Aldrich and Kusmin 1997; Lambert et al. 2009; Shaffer et al. 2004).

Despite these negative community impacts, it is not clear that higher levels of farm employment are desirable. Irwin et al. (2010) note that federal farm support policies “have not typically sought to promote local job growth...and in fact may detract from rural growth given the need for productive farms to shed labor to remain competitive” (532). There are a limited number of studies that look specifically at differential labor input requirements for participation in local food system market channels. Biermacher et al. (2007) conducted a two-year study of growing and selling products for a farmers’ market in rural Oklahoma. They calculated that 55 percent of the total variable production expenses were associated with hired labor. In their

conclusion they note that though rural customers were willing to pay a premium price for farmers' market products, there were not enough customers to overcome production costs. They suggest that if family (unpaid) labor can be obtained, production costs can be reduced.

LeRoux et al. (2010) and Hardesty and Leff (2010) conducted research on market channel selection for local food system producers. Both studies demonstrate the high labor demands per unit of output associated with certain D2C sales outlets. They conclude that increased labor needs associated with some market channels offset price premiums, thus having a large impact on farm net income, and market channel selection. Similarly, King et al. (2010) found that producers receive a greater share of retail prices in local food supply chains than mainstream supply chains—partially due to the fact that producers assume additional supply chain functions such as processing, distribution, and marketing. However, these supply chain functions are costly and King et al. found that producers often do not include the costs of their own (unpaid) labor in their production budgets.

Methods

While some data exist on the value of D2C and intermediated sales within local food systems (e.g., Martinez et al. 2010; Low and Vogel 2011), there is widespread recognition that official tracking has not kept pace with the sector's growing importance (Tropp 2008). Most available data “does not describe how local food systems operate or how their operations and economics vary from place to place” (Hendrickson et al. 2013). To analyze the differential expenditure patterns of local food system producers, we use a case study approach, interviewing two sample groups of farmers during the summers of 2011 and 2012. We utilize USDA ARMS data for farms with local food sales to broaden our scope of analysis and assess the robustness of our case study results. Additionally, we use USDA ARMS data for farms who do not report local sales as

well as default IMPLAN agricultural sector data to compare sales patterns for farms with local food sales to those without.

Case study data

The first case study data (henceforth the ‘CD study’) was collected through interviews during the summer of 2011 from a random sample of farms within the Capital District (CD) region of NYS.² In this case study, we endeavored to better understand the purchasing patterns of small and mid-scale farms with D2C sales. A team of Cornell Cooperative Extension educators identified farmers in each county that marketed at least a portion of their farm products through D2C market outlets. The team identified 752 farms in total, a number consistent with data from the 2007 Census of Agriculture, which reported that there were 797 farms in the region with D2C sales in 2007 (USDA ERS 2007). In total, 130 farmers were randomly selected for interviews based on the county-level distribution of all farms in the region (USDA 2007).

A total of 97 interviews (75% response rate) contained complete information, 82 of which were small or mid-scale operations (under \$500,000 in gross sales). The interview protocol was designed based on our knowledge of how farmers report expenditures in an income (or profit and loss) statement for their business. Farmers were asked to provide their 2010 annual farm expenditures by item category and the proportion of each expenditure purchased locally (i.e., purchased within the 11-county region), as well as outside of the region but within NYS. Based on the farm’s commodity with the largest sales (numerous farms produced products in multiple categories), the distribution of farms by category was 15% fruit, 27% vegetables, 6% dairy, 23% meat and livestock, 12% greenhouse and nursery, and 17% other crops.

Interviews for the second case study (henceforth the ‘food hub study’) were conducted during the summer of 2012 with farmers who supplied product to Regional Access (RA), a food

hub located in Trumansburg, NY.³ The purpose of this case study was to understand the economic impact of food hubs, particularly on participating farmer vendors. We chose RA as our case study food hub because of their commitment to working directly with farmers (they currently source product from 96 farmers, as well as 65 specialty processors), their length of time in operation (they were established in 1989), the diversity of their customer base (they sell product to over 600 customers, including individual households, restaurants, institutions, distributors, buying clubs, retailers, manufacturers, and bakeries), and size of their operation (they are a mid-scale operation with over \$6 million in annual sales).

We conducted 30 interviews with RA's farmer vendors out of a population of 86 located in NYS (35% response rate). Farmers were asked to provide their 2011 annual farm expenditures by item category and the proportion of each expenditure purchased locally (i.e., purchased within NYS). Unlike the CD study, the expenditure categories were designed to correspond to the MIG sector categorization within the IMPLAN software. In addition, for the CD study we only included small and mid-scale local food system participants, while the food hub study utilized information from farms of all scales working with RA. In this study, 37% farms were classified as 'small' (\$1,000-\$249,999 in total gross sales), 43% farms were classified as 'large' (\$250,000-\$999,999 in total gross sales), and 20% were classified as 'very large' (\$1 million or more in total gross sales). Farmers were also asked to identify their primary commodity category; accordingly the distribution of farms by primary category was 37% meat and livestock, 30% fruit and vegetable, and 33% value added products (including cheese, butter, yogurt, honey, maple syrup, wine and juice).

ARMS data

The ARMS is the only nationally representative sample of farmers that estimates the costs of production. Starting in 2008, the ARMS added specific questions about sales to local food outlets. However, Low and Vogel (2011), the first researchers at the USDA ERS to publish local food data from ARMS, caution “the design and structure of the questions create[s] obstacles” (18). The ARMS utilizes a stratified sampling technique, which targets certain commodities (depending on the year), large farms, and farms in 15 core agricultural states (of which NYS is not one). Given that local food system participants are overwhelmingly small- and mid-scale farms (65% of local food farms in NYS report under \$500,000 in gross annual sales), they have a small overall sample size in ARMS, and larger associated weights.

We utilized custom-built USDA ERS software with a jackknife re-sampling process that employs additional weights from NASS for each sample to estimate the average expenditure components and their standard errors (Dubman 2000; USDA ERS 2012). Due to the small sample size of farms reporting local food sales in NYS, the data were aggregated over the available four years with local food questions (2008-2011). Following Low and Vogel (2011), we excluded cut Christmas trees, short rotation woody crops, nursery, greenhouse and floriculture from our definition of ‘local foods’, as well as point farms (those with under \$1,000 in total gross annual sales).⁴ We included any farm that reported a non-zero number for D2C or intermediated sales as a ‘local food’ producer. In total, ARMS reports 64 unique respondents with local food sales in NYS over the four years, representing 5,536 farms (as a point of comparison, the 2007 Census of Agriculture reports 5,210 farms in NYS with D2C sales). Of the 64 respondents, 22% define their primary commodity as field crops, 27% as vegetables, fruit,

and nuts, 43% as livestock, and 8% as dairy. Average farm sales for farms reporting local food sales is \$45,431 (141 acres), compared to \$125,874 (239 acres) for those without.

Nonlocal food system participant data

In order to analyze the differential expenditure patterns of producers in NYS with and without local food sales, we utilized ARMS data for farms that do not report local food sales, as well as default agricultural sector IMPLAN data. There are 429 farms that do not report local food sales in the ARMS for NYS from 2008-2011 (representing 27,575 households). According to the respondents, 27% define their primary commodity as field crops, 4% as vegetable, fruit, and nuts, and 69% as livestock and dairy.

The default IMPLAN data is based on 2011 data for NYS. We created an ‘agricultural production sector’ that includes the IMPLAN agricultural commodity sectors corresponding to the CD and food hub studies. Accordingly, our agricultural production sector in IMPLAN includes oilseed farming, grain farming, vegetable and melon farming, fruit farming, greenhouse, nursery and floriculture farming, all other crop farming, cattle ranching and farming, dairy cattle and milk production, poultry and egg production, and all other animal production. Though the default IMPLAN data includes both farms with and without local food sales, the farms without local food sales dominate the data due to their larger volume of total expenditure (Schmit et al. 2013).

Results

Utilizing the case study and ARMS data, expenditure profiles for local food system producers in NYS were calculated from each source. The results demonstrate some key points of convergence between the three local food producer data sets, as well as acute differences with NYS ARMS respondents without local food sales and the default IMPLAN data.

Expenditure patterns

Due to the varying designs of the interview protocols and the way that IMPLAN divides its sectors, we can only compare certain aggregated expenditure items from the food hub study and the default IMPLAN data to the CD study and ARMS data. Table 1 compares total expenditures for the small- and mid-scale farms with D2C sales in the CD study with the ARMS data for NYS broken into four groups—those with local food sales and those without, and divided by primary commodity (all and field crop, vegetable, fruit and nut producers).⁵

For all local food system participants, ‘labor’ and ‘other variable expense’ are the largest areas of expenditure.⁶ The CD farms spend on average 22% of total expenditure on labor, and 16% on other variable expenses. ARMS data show local food participants spend 18% of total expenditure on labor and 16% on other variable expenses. Closer analysis of ARMS data divided by primary commodity reveals that field crop, vegetable, fruit and nut producers spend 29% of total expenditure on labor. As 71% of CD respondents report fruit, vegetable, greenhouse, nursery or other crop as their primary production category, comparison with the ARMS producers reporting field crop, vegetable, fruit and nut as their primary production category is perhaps a more accurate comparison than utilizing the entire ARMS local food sample (with 41% of farms reporting livestock or livestock-related as their primary commodity).⁷ The data from the food hub study supports this finding; on average food hub farms spend 26% of total expenditure on labor (see table 2). Unfortunately, given the design of the food hub study interview protocol and the composition of the IMPLAN sectors, we are unable to break out an equivalent ‘other variable expense’ item for the food hub study or default IMPLAN data.

For NYS ARMS respondents without local food sales, livestock-related expenditure represents the highest portion of total expenditure (24%), followed by labor (14%) and other

variable expense (10%). Though we cannot break out livestock-related expenditure or other variable expense within the default IMPLAN data, we see similar average expenditure on labor (15%). ARMS respondents, both with and without local food sales, show much higher portions of total expenditure on livestock-related expenses than the CD respondents (14% for ARMS respondents without local food sales, 24% for ARMS respondents with local food sales, compared to 4% in the CD study); CD study respondents report a larger share of total purchases of seeds and plants (10%) compared to 3% for ARMS respondents without local food sales and 4% for ARMS respondents with local food sales. However, these differences may reflect the survey samples—the CD respondents having the smallest representation of livestock producers (23%).

ARMS field crop, vegetable, fruit and nut respondents without local food sales spend the largest proportion of expenditure on fertilizer and chemicals (21%). This stands in stark contrast to expenditures by our local food samples. ARMS field crop, vegetable, fruit and nut respondents with local food sales spend 10% of total expenditure on fertilizer and chemicals and CD farmers spend 8%. Unfortunately, we are unable to break out fertilizer and chemical expenses for the food hub study.

Pairwise means difference tests were conducted to compare variance in expenditure proportions between the farms with local food sales and farm without local food sales in the ARMS data, where the null hypothesis is $H_0 : \beta_1 = \beta_2$ (β_1 = no local food sales, β_2 = local food sales). Table 1 shows which of the categories are statistically different at significance levels of 1% and 5%. Though only three of the input expenditure items have statistically significant differences (custom work, other variable expense, and tax, land and property), this is particularly

influenced by the small sample size where the jackknife estimator can be problematic (Dubman 2000).

Location of input expenditure

In both the CD and food hub studies, surveyed farmers reported spending higher percentages of their total input expenditures ‘locally’ than is reported in the default IMPLAN data for the corresponding regions (11-county CD region and NYS, respectively). Table 2 shows that the RA food hub farms spent 82% of their total expenditures in NYS. By comparison, the default IMPLAN data, which includes all corresponding agricultural sectors, show 54% of expenditures taking place in NYS. The interview data from the CD study shows farms spending 64% of their total expenditures in the 11-county CD region, compared to 52% in the default IMPLAN data.⁸ If the definition for ‘local’ expenditure is extended to include all of NYS, the CD study farms spent 82% of their total input expenditure locally. Thus results from both case studies are very similar in terms of location of expenditure by local food participants when ‘local’ is defined as NYS.

The information on local expenditures is limited in the ARMS survey. The 2008-2011 ARMS surveys ask about the purchase location (miles traveled) of four input expenditure items: farm machinery and implements; fuel; fertilizer; and chemicals.⁹ Table 3 reports the average miles traveled for each item, differentiated by whether or not the farm reports sales to local food outlets. There are no major differences in the distance location of purchases based on whether the farm reports local food sales or not. As ARMS does not ask about expenditure items of key importance to local food producers, the usefulness of the ARMS data in terms of expenditure location is limited.

Discussion and Conclusion

The input expenditure pattern results from the two case studies, the ARMS, and default IMPLAN data elicit strong empirical evidence that local food system participants in NYS have different expenditure patterns than farmers who do not sell through local food markets. Across all data sets for local food system producers, we find that expenditures are greatest on labor and other variable expense. Consistent with King et al (2010), we expect that the greater reliance on labor and other variable expenses is likely due in part to the additional supply chain functions assumed by local food system participants. Though our case studies and ARMS data do not enable us to know exactly what is included in other variable expense, items like marketing and packaging materials are not accounted for in other categories. LeRoux et al. (2010) and Hardesty and Leff's (2010) research on marketing costs associated with D2C market channel requirements supports the fact that local food producers have substantially higher labor input requirements. Thus, as local food system participants are more likely to market and distribute their own items, the differences in the production budgets may be a reflection of these supply chain characteristics.

Greater reliance on labor, in particular, for local food system participants may be a double-edged sword. On one hand, previous research shows that the additional labor needs may have important community economic impacts, ensuring threshold-level farm business and household expenditure to support local businesses. On the other hand, there is some evidence to show that additional labor requirements may impede profitability (e.g., LeRoux et al. 2010; Hardesty and Leff 2010). This article does not attempt to make any judgment on the implications of our findings to these questions, other than to say that researchers interested in modeling economic impact of local food activity should utilize production functions that more accurately reflect inter-industry linkages of the local food sector.

Our results also show that field crop, vegetable, fruit and nut farms without local food sales have greater reliance on fertilizer and chemicals as a share of total expenditure. In attempt to better understand this finding, we looked the proportion of farms with certified organic acreage by whether or not they participated in local food sales channels. According to 2008-2011 ARMS data for the combined New England and Mid-Atlantic regions, 2.8% of farms with local food sales report certified organic acreage versus only 0.5% of farms without local food sales.¹⁰ This characteristic may, in part, be driving the differences in expenditures on fertilizers and chemicals between the two groups of farms. Furthermore, our results from the CD study show that 87% of total chemical and fertilizer purchases were made within the CD region, and that percentage increases to 91% if the region is expanded to include all of NYS. Thus our CD results do not support the conclusion that fertilizers and chemical purchases are inherently nonlocal (Brodt et al. 2006; Lockeretz 1989; Milestad et al. 2010).

Our two case studies also provide evidence that in comparison to the default agriculture sector data available in IMPLAN, local food participants purchase more of their inputs locally than do farms without local sales. Though ARMS data does not support this finding, its evidence in this regard is limited by the scope of the questions.

Future research

This article highlights the differential input expenditure patterns for local food producers in NYS compared to ARMS respondents without local food sales and default IMPLAN data. Our results provide evidence that warrant additional data collection in other states and regions to see how local food system participants interact within a local economy. More case studies are needed, as is a larger sample of respondents with local food sales in the ARMS.

Our case studies show additional local expenditure by local food system participants, as well as higher reliance on labor and other variable expense. The extent to which the differential expenditure patterns, particularly a greater reliance on labor and assuming additional supply chain functions, impacts farm profitability is a key area for future research.

As the Michigan State University and Union of Concerned Scientists' convened meeting found, more research is needed to determine best practice methodologies in order to better understand the impact of local food system activity. Determining expenditure profiles for local food system participants is only one of the requisite steps to conducting economic impact analyses. Taking the next step to incorporate differential expenditure patterns into modeling efforts remains a key area for future research. As we show local food producers spend a larger percentage of total expenditure in the local economy, this inherently has a direct economic impact, by increasing total local demand. However the multiplier impacts from inter-industry linkages remain unclear. Differential expenditure patterns impact inter-industry linkages, the extent and direction of the impacts are uncertain. Schmit et al. (2013) provide some of the first evidence that shows that these differential expenditure patterns do indeed lead to higher total output, value added, and labor income multipliers. More studies are needed to verify this result utilizing revised local food expenditure profiles.

References

- Aldrich, L., and L. Kusmin. 1997. "Rural Economic Development: What Makes Rural Communities Grow?" Ag. Information Bulletin No. 737. U.S. Department of Agriculture, Economic Research Service.
- Barham, J., D. Tropp, K. Enterline, J. Farbman, J. Fisk, and S. Kiraly. 2012. "Regional Food Hub Resource Guide." U.S. Department of Agriculture, Agricultural Marketing Service.
- Biermacher, J., S. Upson, D. Miller, and D. Pittman. 2007. "Economic Challenges of Small-Scale Vegetable Production and Retailing in Rural Communities: An Example from Rural Oklahoma." *Journal of Food Distribution Research* 38(3):1–13.
- Brodthorn, S., G. Feenstra, R. Kozloff, K. Klonsky, and L. Tourte. 2006. "Farmer-community Connections and the Future of Ecological Agriculture in California." *Agriculture and Human Values* 23(1):75–88.
- Cantrell, P., D. Conner, G. Erickcek, and M. Hamm. 2006. "Eat Fresh and Grow Jobs, Michigan." Michigan Land Use Institute and The C.S. Mott Group.
- Chism, J.W., and R.A. Levins. 1994. "Farm Spending and Local Selling: How Do They Match Up?" *Minnesota Agricultural Economist* 676. Minnesota Extension Service.
- Conner, D., W. Knudson, M. Hamm, and H.C. Peterson. 2006. "The Food System as an Economic Driver: Strategies and Results from Michigan". Michigan State University.
- Dubman, R.W. 2000. "Variance Estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Study Surveys". ERS Staff Paper AGES 00-01. U.S. Department of Agriculture, Economic Research Service.
- Goldschmidt, W. 1947. *As You Sow*. 1st ed. Glencoe, IL: Free Press.

- Hardesty, S.D., and P. Leff. 2010. "Determining Marketing Costs and Returns in Alternative Marketing Channels." *Renewable Agriculture and Food Systems* 25(1):24–34.
- Heady, E.O., and S.T. Sonka. 1974. "Farm Size, Rural Community Income, and Consumer Welfare." *American Journal of Agricultural Economics* 56(3):534–542.
- Hendrickson, M., T.G. Johnson, and R. Cantrell. 2013. "Input/Output Interviews." Local Food Linkages Project. Available at: <http://localfoodlinkages.wordpress.com/iointerviews/>
- Henneberry, S.R., B. Whitacre, and H.N. Agustini. 2009. "An Evaluation of the Economic Impacts of Oklahoma Farmers Markets." *Journal of Food Distribution Research* 40(3):64–78.
- Hughes, D.W., C. Brown, S. Miller, and T. McConnell. 2008. "Evaluating the Economic Impact of Farmers' Markets Using an Opportunity Cost Framework." *Journal of Agricultural and Applied Economics* 40(1):253–265.
- Irwin, E.G., A.M. Isserman, M. Kilkenny, and M.D. Partridge. 2010. "A Century of Research on Rural Development and Regional Issues." *American Journal of Agricultural Economics* 92(2): 522 –553.
- Kane, S., K. Wolfe, M. Jones, and J. McKissick. 2010. "The Local Food Impact: What If Georgians Ate Georgia Produce?" Center Report: CR-10-03. Center for Agribusiness and Economic Development, University of Georgia.
- King, R., M.S. Hand, G. DiGiacomo, K. Clancy, M.I. Gomez, S.D. Hardesty, L. Lev, and E.W. McLaughlin. 2010. "Comparing the Structure, Size, and Performance of Local and Mainstream Food Supply Chains." ERS-99. U.S. Department of Agriculture, Economic Research Service.

- Krinke, M. 2002. "Comparative Regional Economic Impacts from Agriculture: A Literature Review". Land Stewardship Project.
- Lambert, D.M., T.R. Wojan, and P. Sullivan. 2009. "Farm Business and Household Expenditure Patterns and Local Communities: Evidence from a National Farm Survey." *Review of Agricultural Economics* 31(3):604–626.
- Lawrence, J.D., D. Otto, and S. Meyer. 1997. "Purchasing Patterns of Hog Producers: Implications for Rural Agribusiness." *Journal of Agribusiness* 15(1):1-17.
- LeRoux, M.N., T.M. Schmit, M. Roth, and D.H. Streeter. 2010. "Evaluating Marketing Channel Options for Small-Scale Fruit and Vegetable Producers." *Renewable Agriculture and Food Systems* 25(1):16–23.
- Leung, P., and M. Loke. 2008. "Economic Impact of Increasing Hawai'i's Food Self-Sufficiency." University of Hawaii Cooperative Extension.
- Lockeretz, W. 1989. "Comparative Local Economic Benefits of Conventional and Alternative Cropping Systems." *American Journal of Alternative Agriculture* 4(2):75–83.
- Low, S.A, and S. Vogel. 2011. "Direct and Intermediated Marketing of Local Foods in the United States." ERR-128. United States Department of Agriculture, Economic Research Service.
- Marousek, G. 1979. "Farm Size and Rural Communities: Some Economic Relationships." *Southern Journal of Agricultural Economics* 11(2):57–62.
- Martinez, S., M. Hand, M. Da Pra, S. Pollack, K. Ralston, T. Smith, S. Vogel, S. Clark, L. Lohr, S. Low, and C. Newman. 2010. "Local Food Systems: Concepts, Impacts, and Issues." ERR-97. U.S. Department of Agriculture, Economic Research Service.

- McManus, P., J. Walmsley, N. Argent, S. Baum, L. Bourke, J. Martin, B. Pritchard, and T. Sorensen. 2012. "Rural Community and Rural Resilience: What Is Important to Farmers in Keeping Their Country Towns Alive?" *Journal of Rural Studies* 28(1):20–29.
- Milestad, R., J. Ahnstrom, and J. Bjorklund. 2010. "Essential Multiple Functions of Farms in Rural Communities and Landscapes." *Renewable Agriculture and Food Systems* 25(1):1–12.
- Otto, D., and T. Varner. 2005. "Consumers, Vendors, and the Economic Importance of Iowa Farmers' Markets: An Economic Impact Survey Analysis." Iowa State University.
- Pirog, R., and J.K. O'Hara. 2013a. "Economic Analysis of Local and Regional Food Systems Webinar." Available at: <http://foodsystems.msu.edu/events/econ-analysis-webinar>.
- . 2013b. "Economic Analysis of Local and Regional Food Systems." Michigan State University.
- Schmit, T.M., B.B.R. Jablonski, and Y. Mansury. 2013. "Impacts of Local Food System Activities by Small Direct-to-Consumer Producers in a Regional Economy: a Case Study from Upstate NY." Working Paper 13-16. Dyson School of Applied Economics and Management, Cornell University.
- Shaffer, R., S. Deller, and D. Marcouiller. 2004. *Community Economics: Linking Theory and Practice*. 2nd ed. Ames, Iowa: Blackwell Pub.
- Stabler, J.C., and R. Olfert. 2009. "One Hundred Years of Evolution in the Rural Economy." In *Perspectives of Saskatchewan*, edited by J.M. Porter and C. Avery, 125–147. Winnipeg: University of Manitoba Press.
- Swenson, D. 2010. "The Economic Impact of Fruit and Vegetable Production in Southwest Iowa Considering Local and Nearby Metropolitan Markets." Iowa State University.

- . 2011. “Measuring the Economic Impacts of Increasing Fresh Fruit and Vegetable Production in Iowa Considering Metropolitan Demand.” Leopold Center for Sustainable Agriculture, Iowa State University.
- Tacoli, Cecilia. 1998. “Rural-urban Interactions: a Guide to the Literature.” *Environment and Urbanization* 10(1):147–166.
- Timmons, D. 2006. “Measuring and Understanding Local Foods: The Case of Vermont.” The University of Vermont.
- Tropp, D. 2008. “The Growing Role of Local Food Markets: Discussion.” *American Journal of Agricultural Economics* 90(5): 1310–1311.
- U.S. Department of Agriculture (USDA). 2007. “State and County Profiles - New York.” 2007 Census Publications. Available at:
http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/New_York/index.asp.
- U.S. Department of Agriculture, Economic Research Service (USDA ERS). 2007. “Food Environment Atlas.” Available at: <http://www.ers.usda.gov/data-products/food-environment-atlas/download-the-data.aspx>.
- . 2012. “Documentation.” ARMS Farm Financial and Crop Production Practices. Available at: <http://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices/documentation.aspx>.
- University of South Carolina. 2010. “The Economic Impact of Agribusiness and the Return of the Certified South Carolina Grow Campaign.”

Table 1: Expenditures by Item, as Percentage of Total Expenses

Expenditure Item	CD Region		NYS USDA ARMS (2008-2011, average)			
	D2C small- and mid-scale farms	all farms	Local food sales, all outlets		No local food sales	
			all farms	field crop, vegetable, fruit, and nut farms	all farms	field crop, vegetable, fruit, and nut farms
All livestock-related	6%	18%	1%	29%	2%	
Seeds and plants	10%	3%	5%	4%	9%	
Fertilizer and chemicals	8%	7%	10%	8%	21%	
Labor	22%	18%	29%	14%	14%	
Fuel and oil	9%	7%	9%	7%	10%	
Repair and maintenance	8%	11%	11%	9%	10%	
Custom work	2%	2% *	2% *	4%	3%	
Utilities	6%	4%	3%	3%	3%	
Other variable expense	16%	16% **	18% **	10%	10%	
Taxes, land and property	7%	9% **	2% **	6%	10%	
Insurance premium	5%	3%	4%	3%	5%	
Rent and lease payments	2%	1%	2%	2%	3%	

Source: 2011 primary data collection by the authors and 2008-2011 USDA Agricultural Resource Management Survey

Note: Asterisk (*) denotes statistically significant difference of the means at the .01 level (**) at the .05 level.

Table 2: Regional Food Hub Case Study, Expenses and Distribution Across All Farms

Item	% of total expenditure ^a	% of expenditure local, by item ^b	% of expenditure local, by total expenditure
Ag commodities from other farms	16.3%	89.4%	14.6%
Ag services	9.6%	92.0%	8.8%
Utilities	4.4%	100.0%	4.4%
Repair and maintenance of farm buildings	2.6%	98.8%	2.6%
On farm processing	9.4%	40.6%	3.8%
Off farm processing	1.5%	74.9%	1.1%
Wholesalers	6.1%	53.6%	3.2%
Tractor/machinery repair	3.0%	93.3%	2.8%
Items purchased from retail stores	4.1%	79.9%	3.3%
Transportation	4.3%	78.5%	3.4%
Warehousing -rented	0.2%	100.0%	0.2%
Information services	0.7%	96.2%	0.7%
Insurance	1.6%	100.0%	1.6%
Rented/leased land	1.3%	100.0%	1.3%
Rented equipment	0.3%	100.0%	0.3%
Professional services	0.4%	97.8%	0.4%
Veterinary services	0.3%	100.0%	0.3%
Waste disposal	0.2%	100.0%	0.2%
Education/training programs	0.2%	86.8%	0.2%
Taxes	5.9%	100.0%	5.9%
Labor (not contracted)	26.3%	100.0%	26.3%
Other	1.3%	66.0%	0.8%
<i>Total Local Expenditure</i>			86.3%

Source: 2012 primary data collection by the authors

^a The sum of this column totals 100% and provides information on total average input expenditure by item.

^b This column shows the percentage of each row expenditure item made in the local economy.

Table 3: Average Miles traveled to purchase selected expenditure items, ARMS data, 2008-2011, New York, by type of farm.

Expenditure Item	Average miles by type of farm		
	Farms with no local food sales	Farms with local food sales ^a	All farms
Farm machinery and implements	19	24	20
Fuel	10	9	10
Fertilizer	10	14	11
Chemicals	22	25	22

Source: 2008-2011 USDA Agricultural Resource Management Survey

^a We define 'local food' based on a set of marketing channels: D2C (i.e., farmers' sales at roadside stands, farmers' markets, onfarm stores, and community-supported agriculture arrangements); and, intermediated marketing channels (i.e., farmers' sales to local retail, restaurant, and regional distribution outlets) (Low and Vogel 2011, 1).

¹ We follow USDA Economic Research Service (ERS) by defining ‘local food’ based on a set of marketing channels: D2C (i.e., farmers’ sales at roadside stands, farmers’ markets, onfarm stores, and community-supported agriculture arrangements); and, intermediated marketing channels (i.e., farmers’ sales to local retail, restaurant, and regional distribution outlets) (Low and Vogel 2011, 1).

² The Capital District region in NYS includes the counties of Albany, Columbia, Fulton, Greene, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren and Washington.

³ “A regional food hub is a business or organization that actively manages the aggregation, distribution, and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand” (Barham et al. 2012, 4).

⁴ Note that greenhouse and floriculture producers are included in the CD study, but not in the food hub study.

⁵ Note that the case study and ARMS data presented only include variable expense items (i.e., we did not ask about capital expenditure items in the case studies, or utilize non-variable expenditures available from the ARMS).

⁶ The ARMS defines ‘other variable expense’ as V32B (Hand tools, supplies, farm shop power equipment expense) + V36 (General business expense excluding insurance) - V35A (utilities).

⁷ When we create an expenditure profile for CD farms who report fruit, vegetable, or crop as their primary commodity, average expenditures are very similar. However, average percentage of total expenditure on labor increases to 24% and average expenditure on other variable expenses decreases to 15%.

⁸ Note that the percentage of total expenditure reported as ‘local’ is different than that recorded in the Schmit et al. (2013) article. In an attempt to make the CD study methodology more consistent with the food hub study (for the sake of comparison), we revised the sectors rendered exogenous. In Schmit et al. (2013) Enterprises (Corporations), Indirect Business Tax, Inventory Additions/Deletions, and Other Property Type Income are all treated as endogenous, whereas here we treat these expenditure items as nonlocal purchases.

⁹ The expenditure items are slightly different across the four years.

¹⁰ Even with the aggregated four years of ARMS data we could not use NYS alone to verify certified organic acreage as the number reporting was too small to disclose.

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