FOOD SYSTEMS AND REGIONAL ECONOMIC DEVELOPMENT: EVALUATING POLICIES AND METHODS

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

Rebecca B.R. Jablonski

August 2014

FOOD SYSTEMS AND REGIONAL ECONOMIC DEVELOPMENT:

EVALUATING POLICIES AND METHODS

Rebecca B.R. Jablonski, Ph. D.

Cornell University 2014

In search of new opportunities to support U.S. rural economies, many researchers, practitioners, and policymakers promote policies that strengthen re-localized food systems. Since 2009, the U.S. Department of Agriculture has funded more than 2,600 local and regional food systems projects. Yet there have been few data-driven economic impact assessments of these initiatives, in part due to data deficiencies precluding comprehensive analysis. Through a series of three papers, this dissertation contributes to the question: What are the regional economic impacts of policies supporting re-localized food systems? The first paper develops an enhanced understanding of how local food system participants interact with other businesses and industries in a local economy. The primary contribution of this paper is to show that local food system participants in New York State have different expenditure patterns than farmers who do not sell through these markets. Through higher local expenditures (per unit of output), and greater reliance on local labor, it is likely that researchers who utilize aggregate agricultural sector data to determine the economic impact of local food system activity under-estimate overall impact. The second paper develops an empirically-driven methodology to estimate the regional and farm-level economic

impacts produced by policies promoting an increasingly popular regional food system initiative: food hubs, i.e., local food aggregation and distribution businesses. This is the first research to empirically derive net and gross regional economic impacts from food hub development, demonstrating that food hubs have higher associated output multipliers than comparable industry sectors, but that growth in final demand for food hub products results in offset purchases from other sectors. The third paper builds upon the second paper by examining the extent to which food hubs actually increase the overall availability of locally-grown food, enhance farm entry into markets, and impact farm viability. This paper offers some of the first empirical evidence that food hubs increase consumer access to locally-grown and processed foods, improve farm access to regional markets, and support farm business expansion.

BIOGRAPHICAL SKETCH

Rebecca B.R. Jablonski is a Doctoral Fellow at the U.S. Department of Agriculture's National Institute of Food and Agriculture. Her research and extension efforts focus on evaluating rural economic development initiatives and policies, with an emphasis on identifying strategies to improve agribusiness performance enhance regional food systems. Rebecca received her B.A. in History with concentrations in American Indian and Africana Studies from Cornell University in 2003, and an M.S. from the University of London's School of Oriental and African Studies (SOAS) in Development Studies in 2007.

With gratitude to my mentors: Susan Christopherson, Todd Schmit, and Paul O'Mara

ACKNOWLEDGMENTS

Preparation for this dissertation goes back to 2007 when Madison County's Agricultural Economic Development Program hired me as the County's first Agricultural Economic Development Specialist. Paul O'Mara, Eve Ann Shwartz, Bee Tolman, and Kate Fisher played important roles in shaping my understanding of the relationship between food systems and regional economic development. Each of them also demonstrates the difference that an individual can make in a community.

Thanks to my committee: Susan Christopherson, Todd Schmit, David Brown, and Miguel Gómez. This research benefited immensely from Susan's energy (she always says yes – be it another grant application, article, presentation in D.C., or general life advice – and manages to get everything done!) and commitment to engaged research. Other than Mann library, I have spent more hours in Todd Schmit's office than anywhere else on campus – what I am most sad to leave behind about Cornell are those hours in his office, and Todd's daily mentorship. This dissertation is greatly improved by Todd's attention to detail, his ability to order complex issues, and his continued good humor while spending the time to get things right. David's insight and network of colleagues made me re-think my conceptions and assumptions of 'rural', rural policy formation, and boundaries. Miguel worked with me through my first publication, and demonstrated how to gracefully balance large and diverse projects, extension, students, and family.

Cornell is an incredible institution and I am even more appreciative of it now than when I arrived. The Department of City and Regional Planning is a supportive

home and I am grateful to be part of its network of faculty and students. My graduate experience benefited from the opportunities to co-develop the Department's first course on Food Systems Planning, select speakers for various lecture series, and participate in the student-led ProSeminar. A special thank you to: Kieran Donaghy, John Forester, Yuri Mansury, Mike Manville, Stephan Schmidt, Michael Tomlan, Mildred Warner, Lesli Hoey, Javier Perez Burgos, Andy Rumbach, George Homsy, Ashima Krishna, Lauren Hansen, Courtney Knapp, Peter Wissoker, Silvano de la Llata, Amanda Micklow, Scarlett Zuo, and Molly Riordan. Additionally, I am grateful to colleagues across campus with whom I have collaborated and from whom I have sought advice: David Kay, Rod Howe, Heidi Mouillesseaux-Kunzman, Anu Rangarajan, Jennifer Wilkins, Jeff Piestrak, Brian Henehan, Andy Novakovic, Amanda Flaim, and Monika Roth.

I am fortunate to have a growing network of colleagues and collaborators at the U.S. Department of Agriculture, whose national perspective and deep knowledge of data contributed in important ways to this dissertation and my development as a researcher. Many thanks to Stephen Vogel, Bob Dubman, Sarah Low, John Pender, Jim Barham, and Debbie Tropp.

I also want to thank the farmers, distributors, processors, retailers, households, and others who were interviewed/surveyed as part of this research, as well as the many extension educators, policymakers, and practitioners whose ideas and actions inform my own.

Funding for this dissertation was provided by: the National Institute for Food and Agriculture, USDA, Competitive Grant No. 2012-67011-19957; the Agricultural

Marketing Service, USDA, Cooperative Agreement No. 12-25-A-5568; and, the Northeast Sustainable Agriculture Research and Education Program, Grant No. GNE11-021. The sponsors played no role in the study design, collection, analysis, interpretation of data, or the writing of this dissertation.

Last and most of all, I would like to thank my family (by birth, by marriage, and by friendship). I especially want to thank my mom – many times throughout the last four years I thought of the countless nights she stayed up to help me revise papers (even through college), and how that process prepared me for the type of collaborations in which I am now involved. Thank you to Lila for reminding me to play. And the biggest thank you to my partner in life, Kevin, whose ceaseless intellectual journey shapes and improves mine, and without whose edits, comments, and support I would not have finished this dissertation.

TABLE OF CONTENTS

BIOGRAPHICAL SKETCH ..... **V**

ACKNOWLEDGMENTS ..... **VII**

INTRODUCTION **1**

DEFINING 'RURAL' 4

LOCAL AND REGIONAL FOOD SYSTEMS: OPPORTUNITIES FOR REGIONAL DEVELOPMENT 6

PAPER 1: DIFFERENTIATING 'LOCAL' PRODUCERS' EXPENDITURE PROFILES TO EVALUATE IMPACTS OF POLICIES SUPPORTING LOCAL FOOD SYSTEMS 10

PAPER 2: ASSESSING THE ECONOMIC IMPACTS OF FOOD HUBS TO REGIONAL ECONOMIES, INCLUDING OPPORTUNITY COST 14

PAPER 3: INCREASING ACCESS TO 'LOCAL FOOD': EVALUATING THE FARM-LEVEL IMPACTS OF FOOD HUB DEVELOPMENT 17

REFERENCES 19

PAPER 1 DIFFERENTIATING 'LOCAL' PRODUCERS' EXPENDITURE PROFILES TO EVALUATE IMPACTS OF POLICIES SUPPORTING LOCAL FOOD SYSTEMS **30**

LITERATURE SUMMARY 33

METHODS 36

Case study data *37*

ARMS data *39*

Nonlocal food system participant data *40*

RESULTS 41

Expenditure patterns *41*

Location of input expenditure *44*

DISCUSSION AND CONCLUSION 45

FUTURE RESEARCH 47

REFERENCES 49

TABLE 1. EXPENDITURES BY ITEM, AS PERCENTAGE OF TOTAL EXPENSES 56

TABLE 2. REGIONAL FOOD HUB CASE STUDY, EXPENSES AND DISTRIBUTION ACROSS ALL FARMS 57

TABLE 3. AVERAGE MILES TRAVELED TO PURCHASE SELECTED EXPENDITURE ITEMS, ARMS DATA, 2008-2011, NEW YORK, BY TYPE OF FARM 58

TABLE 4. KEY FARM FINANCIAL MEASURES, ARMS DATA, 2008-2011, NEW YORK, BY TYPE OF FARM 59

PAPER 2 ASSESSING THE ECONOMIC IMPACTS OF FOOD HUBS TO REGIONAL ECONOMIES: INCLUDING OPPORTUNITY COST **60**

INTRODUCTION 60

LOCAL FOOD ECONOMIC IMPACT ASSESSMENTS 65

EMPIRICAL FRAMEWORK 67

Defining farms that sell to food hubs *69*

Impact analysis and considering opportunity cost *70*

CASE STUDY APPLICATION 72

Case study food hub *72*

Deriving food hub expenditure pattern *73*

Food hub farms *74*

Deriving food hub farms' expenditure pattern *75*

IMPLAN model construction *75*
Customer surveys *79*
Impact analysis *80*
RESULTS 81
Model 1: multiplier and distributional impacts *81*
Model 2: multiplier and distributional impacts *82*
Food Hub customer survey results *83*
DISCUSSION AND CONCLUSIONS 85
FUTURE RESEARCH 87
REFERENCES 90
APPENDIX 1: REGIONAL ACCESS SECTOR AGGREGATION SCHEME 99
FIGURE 1. RA EXPENDITURES AS PERCENTAGE OF TOTAL, LOCAL AND NONLOCAL 100
TABLE 1. FOOD HUB FARM AVERAGE EXPENDITURES BY IMPLAN SECTOR AND % LOCAL 101
TABLE 2. FOOD HUB FARM SALES, AVERAGE AND PERCENT LOCAL 102
TABLE 3. SUMMARY OF EXPENDITURE PATTERNS PER DOLLAR OF OUTPUT FOR THE DEFAULT AGRICULTURAL SECTOR (FOOD SOLD-FARM) AND THE FOOD HUB FARM SECTOR 103
TABLE 4. MODEL 1 OUTPUT RESULTS OF A MILLION DOLLAR INCREASE IN FOOD HUB FINAL DEMAND 104
FIGURE 2. INDIRECT AND INDUCED EFFECTS PER $1,000,000 INCREASE IN FINAL DEMAND (TOP IMPACTED INDUSTRY SECTORS), MODEL 1 INCLUDING OPPORTUNITY COST 105
TABLE 5. MODEL 2 IMPACT RESULTS 106
FIGURE 3. INDIRECT AND INDUCED EFFECTS PER $1,000,000 INCREASE IN FINAL DEMAND (TOP IMPACTED INDUSTRY SECTORS), MODEL 2 INCLUDING OPPORTUNITY COST 107

PAPER 3 INCREASING ACCESS TO 'LOCAL' FOOD: EVALUATING THE FARM LEVEL IMPACTS OF FOOD HUB DEVELOPMENT 108
LITERATURE REVIEW 110
METHODOLOGY: CASE STUDY 113
RESULTS 116
Impact on the availability of local food: consumer access *116*
Impact on the availability of local food: farm and nonfarm vendor access to markets *117*
Impact on farm viability *118*
DISCUSSION AND DIRECTIONS FOR FUTURE RESEARCH 120
REFERENCES 122
FIGURE 1. PERCENT OF VENDORS BY LEVEL OF FACILITATED SALES WITH REGIONAL ACCESS 129

CONCLUSION AND FUTURE RESEARCH 130
EVALUATING FARM-LEVEL IMPACTS 130
RURAL-URBAN DISTRIBUTION OF IMPACTS 132
EVALUATING OPPORTUNITY COST 134
EVALUATING THE IMPACT ON RURAL WEALTH CREATION AND PROSPERITY 135
DATA NEEDS 137
REFERENCES 139

INTRODUCTION

Among researchers, there is broad consensus that rural development policies in the United States (U.S.) have not met the needs of rural people and communities (Stauber 2001, 33) and that "policies to improve the disappointing economic performance of rural regions are, by and large, not working" (Porter et al. 2004, 3). Quigley (2002), for example, provides a detailed analysis of economic trends in rural and urban areas from 1970-2000 and finds a drop in total rural personal income, rural per capita incomes at about 70% of urban incomes, and increasing disparities in wages and salaries between rural and metropolitan regions. The period between 2010 and 2012 represents the first recorded period of nonmetro population loss in U.S. history, highlighting a growing demographic challenge facing much of rural America. At the community level, this may reduce the demand for jobs, diminish the quality of the workforce, and raise the per capita cost of providing services (Kusmin 2013, 6).[1]

Part of the challenge is that the U.S. has never had a systematic approach to rural development policy (Long 1987). There is no Department of Rural Development. The Rural Development Agency is one of 34 Agencies and Offices housed under the U.S. Department of Agriculture (USDA) (USDA 2013a). The fact that agriculture supersedes rural in the layers of federal bureaucracy may be indicative of a piecemeal approach to rural development.

The 'farm bill' (an omnibus bill passed approximately every five years), is the

[1] Though there are important differences between metro and urban, as well as nonmetro and rural, for the purpose of this introduction they will be treated as interchangeable.

primary policy tool of the U.S. government to support agricultural and rural development. The first farm bill, called the Agricultural Adjustment Act (AAA), was passed as part of Franklin D. Roosevelt's New Deal in 1933 as an emergency response to post-World War I economic distress in agriculture. When the AAA passed, 21.5 percent of the U.S. workforce worked in agriculture, and the agricultural gross domestic product (GDP) was 7.7% of total GDP (Dimitri et al. 2005). The 1933 and 1938 AAA, and 1948, 1949, 1954, 1956, 1965, and 1970 Agricultural Acts created and maintained agricultural commodity support mechanisms, supported by a "so-called iron triangle of farm bloc interest groups (originally the Farm Bureau, later other farm and commodity groups as well), the USDA, and congressional agricultural committees" (Lehrer 2010, 60). The result was tremendous increases in productivity—improved crop varieties through plant breeding and increased use of chemicals, fertilizers, pesticides, and sophisticated machinery (e.g., Dimitri et al. 2005; Lehrer 2010).

By 1970 the U.S. employed labor force working in agriculture declined to four percent as consolidation and growth in farm size increased. Additionally the relative share of agricultural GDP to total GDP declined to 2.3% (Dimitri et al. 2005). Simultaneously, a host of nonfarm interest groups—ranging from environmentalists to consumers to anti-hunger groups—gained access to the farm bill policy process. An urban-rural alliance among legislators developed whereby urban legislators would vote for the farm bill if rural legislators would support the Food Stamp Act (a national feeding program) (Lehrer 2010). However, a schism developed among rural America's farm bill interests; rural development interest groups, distinct from

agricultural commodity interest groups, began to emerge (the Center for Rural Affairs, for example, was started in 1973) (Center for Rural Affairs 2012). These rural development groups argued that the productivity of industrial agriculture was accompanied by serious side effects for rural America, including changes in rural employment, structure, and economic development incentives. Growth in farm size and consolidation, for example, meant that former small farmers began migrating out of rural communities in search of employment. Many rural communities were left without threshold levels of inhabitants to sustain local businesses (Lehrer 2010).[2]

Despite these structural changes in rural America, the powerful commodity agricultural interest groups (including agribusiness corporations such as Cargill and Tyson, general farm organizations such as the American Farm Bureau Federation, and commodity groups such as the National Corn Growers Association) maintained their position that funding for rural America was better spent supporting commodity agriculture (Lehrer 2010; Sheingate 2001). A sufficiently influential champion for rural development policy never emerged (Sheingate 2001). Consequently, rural development programs continue to be squeezed. The Agricultural Act of 2014 (the 2014 farm bill) provides the most recent example of the inferiority of rural development programs with 80% of projected outlays from the bill expected to fund nutrition programs, 6% conservation programs, 5% commodity programs, and the remaining 1% to everything else–including trade, credit, rural development, research and extension, forestry, energy, horticulture, and miscellaneous programs (USDA ERS

[2] There are many studies that demonstrate the critical mass (both in terms of population and business interdependence) below which business establishments are not sustainable (e.g., Irwin et al. 2010; Shonkwiler and Harris 1996; Wensley and Stabler 1998).

2014). The limited resources devoted to rural development, and inability for policymakers to fully distinguish its needs from commodity agriculture, may provide explanation for the failure of U.S. rural development policy.

Defining 'rural'

Another frequently cited reason for the failure of U.S. rural development policy is policymakers' definitional choices for 'rural' (e.g., Brown and Schafft 2011; Dabson 2007; Dabson et al. 2012; Isserman 2005; Shortall and Warner 2012). Brown and Schafft (2011) write that rural has always been defined using a location or 'place' approach, which "suffers from a number of inadequacies" (7). First, this approach assumes a clear delineation between urban and rural places. Second, and related to the first, while the 'urban' definition is often carefully calculated, the 'rural' becomes everything else. Shortall and Warner (2012) concur that "nonmetropolitan/rural areas are [defined as] those that are not metropolitan urban areas" (8). Thus, implicitly, the heterogeneity of rural regions is largely ignored (Drabenstott 2001).

These rural definitional choices have very important policy impacts. First, they affect how data are collected and viewed. The U.S. Bureau of the Census provides a poignant example. The Bureau uses population size and density thresholds to carefully delineate what is urban (metro), and then defines what remains as rural (nonmetro) (Dabson 2007; Dabson et al. 2012; Shortall and Warner 2012). Careful analysis of the 2000 Census, however, using the metro/non-metro distinction, results in more than half of all rural residents living in metro counties (Dabson 2007). The specific needs of these constituents may therefore be masked by the county's metro designation.

Second, the definition of rural establishes the rules regarding which localities

can benefit from USDA's Rural Development programs. Most Rural Development programs include maximum population thresholds, above which municipalities are not eligible to participate (USDA 2013c). As part of the Food, Conservation, and Energy Act of 2008 (The 2008 Farm Bill), the Secretary of Agriculture was required to report to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate on the Department's various definitions of the term 'rural', the definitional effects, and recommendations for improvement. The report acknowledges that within the Office of Rural Development there are "arbitrary barriers…perpetuating community isolation and less cost-effective economic and community development practices…[For example,] if a regional sewer project encounters a municipality of greater than 10,000 population…that community cannot be part of the Rural Development financing application no matter how much sense it might make to project engineers geographically and no matter what the impact of including the larger community might have had on end user rates as fixed costs get spread over a larger number of end uses" (USDA 2013c, 10).

The definitionally established delineation between urban and rural boundaries also has the effect of supporting policy aimed solely at rural or urban areas, rather than toward broader regions encompassing both rural and urban. This may be important as researchers acknowledge the high degree of connectedness and interdependence between urban and rural America (e.g., Irwin et al. 2010). Lichter and Brown (2011) highlight the "new rural-urban interface" marked by "rapid changes now taking place in rural America and the blurring of rural-urban spatial and social boundaries" (566), as well as the "new scholarly dialogue…along the rural-urban divide" (585). Kubisch

et al. (2008) underscore the influence that rural and urban places have on each other. And Dabson (2007) writes that "leading thinkers on strategies to achieve greater rural prosperity emphasize the value of strengthening productive ties between rural and urban places" (1).

Local and regional food systems: opportunities for regional development

Though historically there have been few federal programs to create and enhance strategic linkages between rural and urban areas, increased interest in and support for local and regional food systems are starting to bridge that gap. The USDA (2013c) report provides evidence of changes–particularly in regards to an expanded rural definition with respect to local and regional food systems.[3,4] In making this change, policymakers and agency staff explicitly acknowledge the "role of more populous areas in providing market opportunities for goods and services provided by rural people" (USDA 2013c, 10). Both the 2002 and 2008 Farm Bills expanded access for local and regional food enterprises to loans and loan guarantees under the Business and Industry (B&I) program, to establish and facilitate the growth of local and regional food markets (as well as to support increased access to 'local' food in 'food deserts – i.e., underserved communities). The 2008 Farm Bill reserved at least five percent of B&I funding each year for this purpose, and defined eligible businesses as those selling product within 400 miles of the farm, or within the same state (USDA

[3] There are also other programs that have been recently excluded from traditional rural definitions. Perhaps most notably is the Rural Energy for America Program, which was amended in the 2008 Farm Bill to allow agricultural producers to be eligible for funds, irrespective of where their operations are located. For more detailed analysis of the other exceptions, see: USDA (2013c).

[4] The 2008 farm bill contains few program provisions that directly support local and regional food systems. However, many existing federal programs benefiting U.S. agricultural producers may also provide support and assistance for local food systems (Johnson et al. 2013).

2013c).

This shift in Farm Bill policy reflects the recommendation of many researchers and practitioners advocating for a move to regionalized policies to support rural development, as well as the desire of many health, consumer, and environmental interest groups to strengthen alternative local and regional food systems (e.g., Dabson 2007; Dabson et al. 2012; Feenstra et al. 2003; Gillespie et al. 2007; Jensen 2010; Kubisch et al. 2008; Marsden et al. 2000; Porter et al. 2004).

The term 'local food systems' has prevailed in the U.S. since the 1990s, marked by increased interest in sustainable agricultural production and alternative food markets (Dimitri et al. 2005; Hinrichs and Charles 2012). And though, other than with respect to the B&I program, the term does not have a legal definition, it most frequently references geographic proximity between producers and consumers, and, secondarily, social, environmental, or supply chain characteristics (Johnson et al. 2013; Hand and Martinez 2010; Martinez et al. 2010).

By almost any measure the demand for locally and regionally grown products has increased. Tropp et. al. (2008) found that "the value of direct-to-consumer food sales in the United States grew 37 percent between 1997 and 2002—from $592 million to $812 million" (Tropp et al. 2008, p.7). Farms that market their products direct-to-consumer (through farmers' markets, Community Supported Agriculture, farm stands, U-pick operations, etc.) are often thought of as synonymous with local food systems (e.g., Ostrom 2006). However, as Hinrichs and Charles (2012) point out, "the 'systems' of local food systems entail more involved and potentially complicated overlays of economic activities, institutions and networks" (157). Low and Vogel

(2011), reiterate this sentiment, finding that most local food involves intermediary businesses (e.g., aggregators, distributors, wholesalers) to get the product from farm-to-market; when they include local food system participants with intermediated sales in their estimates of total sales, they find a number four times higher than estimates based on direct-to-consumer sales alone--$4.8 billion in 2008. Acknowledging the myriad of actors involved in sustaining this economic activity is important in determining the size of the sectors, and understanding its potential as a strategy for rural development.

Since 2009 when the USDA and President Obama created the Know Your Farmer, Know Your Food (KYF) initiative, an inter-agency task force to "help connect producers with new opportunities in local and regional marketing—and to better inform Americans about the business of agriculture and opportunities to connect with farmers and ranchers" over 2,600 projects nationwide have been supported, mostly through farm bill appropriations (USDA 2013b).[5] For example, federal funding has supported almost 450 projects nationally that expand farmers' markets, over 860 projects to increase the production of fruits and vegetables for sale at local markets, and more than 4,000 microloans to small-scale producers interested in local marketing opportunities. According to the Secretary of Agriculture, Tom Vilsack, these initiatives support enhanced rural economic development and farm viability, and thus

[5] The KYF initiative has been met with some resistance, particularly on the part of commodity agriculture interest groups. Former ranking member of the Senate Agriculture, Nutrition and Forestry Committee, Senator Roberts (R-Kansas, a longtime supporter of commodity agricultural interests), for example, raised questions about the efficacy of the Know Your Farmer, Know Your Food initiative. "But policy makers must ask with such dramatic private sector growth would taxpayer dollars be better invested elsewhere, like research, pest and disease management that help the entire industry, rather than one particular farmers' market" (Little 2012). Despite the development of the KYF initiative, it has no money or staff, but rather provides a framework under which USDA agency staff can interact.

developing local and regional food systems has become one of the Department's priorities (USDA 2013b).

Despite the increased interest from the USDA to support these initiatives, there have been very few empirically-driven analyses of the efficacy of local and regional food systems as a strategy to support regional economic development.[6] Further, there is not an agreed upon methodology for how these type of assessments should be conducted. Accordingly there is a widespread call from policymakers and researchers to spur this effort (e.g., Clancy 2010; Jenson 2010; King et al. 2010; O'Hara and Pirog 2013; Schmit et al., 2013; The National Research Committee on Twenty-First Century Systems Agriculture, National Research Council 2010).

One major barrier to conducting economic impact assessments of local and regional food system initiatives is the lack of requisite data for complete evaluation. Tropp (2008), for example, writes that "official tracking of direct farm sales has not kept pace with the sector's growing importance in the U.S. food system" (1310). Matteson and Hunt (2012) similarly note that "agricultural data collection efforts usually focus on farm production issues, not…marketing practices" (10).

Through a series of three papers, this dissertation contributes to the question: What are the regional economic impacts of policies supporting re-localized food systems? The first paper develops an enhanced understanding of how local food system participants interact with other businesses and industries in a local economy, which is important for economic impact assessments. The second paper provides an

[6] There are many non-economic impact studies of local food systems. For more information about the other categories of food system assessments, see: Freedgood et al., 2011.

empirically-driven methodology to estimate the regional and farm-level economic impacts produced by policies promoting an increasingly popular regional food system initiative: food hubs, i.e., local food aggregation and distribution businesses. The third paper builds upon the second paper by examining the extent to which food hubs increase the overall availability of locally-grown food, enhance farm entry into markets, and impact farm viability. Together these papers make important methodological and empirical contributions to evaluating the regional economic impacts of policies supporting re-localized food systems, and thus to considering the role local food systems can play in rural economic development.

Paper 1: Differentiating 'local' producers' expenditure profiles to evaluate impacts of policies supporting local food systems

The economic impact of an industry depends on the size of the industry, number of and payment to employees, and its linkages to other industries within a local economy. Each industry requires inputs in order to produce its outputs. The act of purchasing these inputs creates linkages with other industries. Purchases can be made locally, or they can be made from the rest of the world. When they are made locally, these inter-industry purchases can be measured to show the strength of linkages within a locality. When non-local purchases are made, the money leaks out of the local economy. The stronger the local inter-industry linkages, the larger the local economic impact (Ribeiro and Warner 2004).

Most economic impacts from re-localized food systems occur from import substitution (Swenson 2009).[7] As consumers (e.g., households, restaurants, schools,

[7]Cooke and Watson (2011) demonstrate empirically that import substitution is at least as an effective economic development strategy as enhancing regional exports. They find that import substitution and

grocery stores, hospitals) shift their purchasing preferences and patterns towards locally-grown and processed products, they are strengthening the inter-industry linkages within their local economy. This increase in local purchases usually comes at the expense of other purchases. As local purchases increase, consumers will likely decrease their nonlocal purchases. Consumers are thus substituting imports with local purchases, theoretically resulting in a positive local economic impact.

To conduct economic impact assessments, therefore, one must have information about inter-industry linkages both within and among sectors of an economy. This information can then be used to assess the impact of a policy (exogenous shock) on all inter-linked industries within an economy (i.e., a policy that expands the amount of locally-grown products purchased by a school). A Social Accounting Matrix (SAM) model is an accounting system that links the economic transactions within an economy among production sector, labor and other factors of production, and government and other institutions (Miller and Blair 2009). Most previous local food assessments utilize SAM models with data and software generated by the IMPLAN Group, LLC. to analyze the local economic impact resulting from import substitution (e.g., Cantrell et al. 2006; Conner et al. 2008; Haynes 2010; Henneberry et al. 2009; Hughes et al. 2008; Kane et al. 2010; Leung and Loke 2008; Otto and Varner 2005; Swenson 2010, 2011; Timmons 2006).

One of the main challenges, however, with this body of work is that the data available on inter-industry linkages are generally available only at the aggregate

---

enhancing regional exports have the same direct impact (assuming the same comparative advantages), but import substitution increases the indirect effects through additional endogenous purchases, which then increase the output and income multipliers.

commodity sector scale, 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, thus assuming that the purchasing and sales patterns of local food producers are indifferent from those in aggregated commodity sectors. By default, the entire economy is represented by 440 sectors within IMPLAN data. Each IMPLAN sector is represented by a single, static production function (the type and quantity of inputs required to produce one unit of output). The production function for each sector reflects average purchase and sales patterns across all firms in the sector, without the requisite information to be able to disaggregate them by any specific characteristic (i.e., scale of operation, or marketing channel) (Lazarus et al. 2002; Liu and Warner 2009).[8] As IMPLAN sector data represents all inter-industry linkages, the expenditure and sales patterns are more reflective of those firms that contribute a higher proportion of total output in the sector (typically the larger firms) (Lazarus et al. 2002; Schmit et al. 2013).

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 specific gaps identified was a need to better understand the input expenditure patterns of farms that sell into local food markets and, in particular, what

[8] For an in-depth discussion of how production functions are constructed within IMPLAN, see Lazarus et al. (2002).

inputs farms require and where the inputs are purchased (Pirog and O'Hara 2013; O'Hara and Pirog 2013). Understanding farm expenditure patterns is critical in assessing how local food systems impact local 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. Given that local food system participants tend to be smaller in scale, and represent a small overall portion of agricultural sector transactions (Low and Vogel, 2011), the estimates of the impacts from increased local food sales based on existing IMPLAN data may be misleading if local food system participants have different patterns of input expenditures (e.g., different production functions) and/or they purchase a different proportion of their inputs from local sources.

The first paper of this dissertation provides data-driven results to enhance understanding of the production profiles (or inter-industry linkages) of local food system participants. Utilizing two unique data sets from samples of producers in New York State (NYS), along with 2008-2011 USDA Agricultural Resource Management Survey (ARMS) data, this paper constructs expenditure profiles for local food system participants in NYS. 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. This paper shows 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. Accordingly, researchers who utilize aggregate agricultural sector data to determine the economic impact of policies supporting local food system activity will likely under-estimate overall impact.

Paper 2: Assessing the economic impacts of food hubs to regional economies, including opportunity cost

Building on the production function data collected in the first paper, the second paper applies these differential expenditure patterns to an examination of the regional economic impacts that result from policies supporting a local food initiative. The paper uses an illustrative local food initiative, a food hub, as an example. Following the USDA's working definition, a 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). The USDA supports food hubs in an effort to: 1) increase market access for local growers, particularly those that are small and mid-scale; and 2) strengthen regional food systems (USDA AMS 2014). Food hubs are receiving increasing levels of financial and professional development support from the USDA, state governments, and private foundations. For example, the USDA's KYF task force has a Regional Food Hub Subcommittee. In 2011, the Subcommittee prepared a list of 15 USDA agency programs that already provide funding to support food hubs, including: Rural Development; Agricultural Marketing Service; the National Institute of Food and

Agriculture; Farm Service; Natural Resources Conservation Services; and Risk Management (USDA KYF 2011). Some state governments have also utilized public funds to support food hub development. In February 2013, the New York State Governor announced $3.6 million in state funding to support four new food hubs (Cuomo 2013). Despite this substantial and growing interest in food hubs, as well as a burgeoning literature, there have been no data-driven economic impact assessments completed to date, nor is there an agreed upon methodology about how an economic impact assessment should be conducted (O'Hara and Pirog 2013).

The primary objective of this paper is to promote the utilization of a best-practice methodology to evaluate the economic impact of food hubs to regional economies and the participating farms they support. By collecting detailed expenditure and sales information from food hubs, as well as participating farms, a SAM analysis-by-parts approach is used to estimate the multiplier effects of a change in final demand for food hub products. The framework developed is applied to a case study analysis of a food hub located in NYS.

Using Regional Access, LLC (a food hub located in Trumansburg, NY) as a case study, this paper demonstrates that the estimated multiplier effects on the farm sector are 7% lower when using the agricultural sector data that is not differentiated by local food system participant production function information. And, overall, the total output multiplier is biased downward. If the farms in this case study are shown to be typical elsewhere, the impact of food hubs utilizing default IMPLAN agricultural sector data will likely underestimate the true magnitude of the local economic impact. Of more fundamental importance to the rural economy, however, is the ability of food

hubs to strengthen the interlinked network of business-to-business and business-to-customer sales within the region. Thus results showing that local food system participants spend more money per unit of output on employee compensation, other agricultural sectors, and support activities for agriculture and forestry, may be particularly important for rural economies.

In addition to the importance of understanding local food system participants differential expenditure patterns mentioned above, the other key difficulty in previous local food economic impact assessments is what O'Hara and Pirog (2013) refer to as an 'interpretation' challenge. Specifically, "stipulating how the 'opportunity cost'…is defined" (4). As they rightly point out, measuring opportunity cost is not straightforward, and requires information about the extent to which increased consumer purchases of locally-grown food offsets other types of purchases, changes market prices and/or supply chain characteristics, or impacts land use. There are only a handful of local food economic impact assessments that explicitly acknowledge the need to consider opportunity cost (Conner et al. 2008; Hughes et al. 2008; Gunter and Thilmany 2012; Tuck et al. 2010; Swenson 2010). However, each of these studies makes assumptions about the sectors in which there are decreased purchases (or changes in land use) as a result of increases in local food consumption–in other words, none collects the data necessary to more fully understand the opportunity costs of increased local purchases.

Accordingly, the secondary objective of this paper is to better understand the extent to which food hubs increase the overall demand for and consumption of local food products. By collecting detailed customer information on purchasing patterns

from food hubs, a better understanding of the important factors affecting the growth and scalability of food hubs as business enterprises can be attained, along with estimating the opportunity costs associated with increases in food hub product purchases (i.e., offsets via decreases in purchases in other sectors).

Results from the Regional Access case study estimate that a policy that generates an additional $1 direct effect increase in final demand for food hub products also results in a $0.11 direct effect offset in purchases from other sectors occur (mainly the wholesale trade sector). When including this corresponding negative direct effect in the SAM model, the gross output multiplier is reduced by over 11%, demonstrating the importance of including opportunity costs in future assessments.

Paper 3: Increasing access to 'local food': evaluating the farm-level impacts of food hub development

The third paper builds upon the second paper, continuing to examine the impact of food hub development. One of the major motivations for supporting food hub initiatives is to increase consumer access to local foods, and farm access to markets, thereby increasing farm profitability. Given that most local food moves through intermediated channels (Low and Vogel 2011), the USDA has determined that unmet demand is due to the fact that accessing appropriately scaled markets is difficult for small- and mid-sized farms as supply chains become more vertically-integrated and consolidated. Large-scale supermarket retail and wholesale operations demand large volumes, low prices, and consistent quantities and qualities that must meet increasingly strict safety standards. The procurement systems in such markets are often vertically and horizontally integrated, global in scale, and aim to maximize

efficiency (King et al. 2010; Richards and Pofahl 2010; Sexton 2010; Tropp et al. 2008).

However, to date there has been little empirically-driven research that examines if food hubs increase the overall availability of local foods. The primary objective and contribution of this paper is to better understand the extent to which food hubs increase consumer access to locally-grown and processed products, enhance farm-entrée to markets, and support farm viability. As in paper 2, a case study approach is employed, given the significant data needs to conduct this type of analysis. The case study includes surveys with over 300 food hub customers, and in-depth interviews with 30 farms and 15 processors that sell food products to a food hub. This paper offers some of the first empirical evidence that food hubs increase consumer access to locally-grown and processed foods, improve farm access to regional markets, and support farm business expansion.

References

Barham, J., D. Tropp, K. Enterline, J. Fisk, and S. Kiraly. 2012. Regional Food Hub Resource Guide. U.S. Department of Agriculture, Agricultural Marketing Service. Available at: http://dx.doi.org/10.9752/MS046.04-2012 [Accessed March 12, 2014].

Brown, D.L., and K.A. Schafft. 2011. *Rural People and Communities in the 21st Century: Resilience and Transformation*. Cambridge: Polity Press.

Cantrell, P., D. Conner, G. Erickcek, and M. Hamm. 2006. Eat Fresh and Grow Jobs, Michigan. E. Lansing, MI: Michigan Land Use Institute and The C.S. Mott Group.

Center for Rural Affairs. 2012. About the Center for Rural Affairs. Available at: http://www.cfra.org/about [Accessed March 12, 2014].

Clancy, K. 2010. A Priority Research Agenda for Agriculture of the Middle. Available at: http://www.agofthemiddle.org/archives/2010/05/a_priority_rese.html [Accessed March 12, 2014].

Conner, D., W. Knudson, M. Hamm, and H.C. Peterson. The Food System as an Economic Driver: Strategies and Applications for Michigan. *Journal of Hunger & Environmental Nutrition*. 3(4):371-383.

Cooke, S., and P. Watson. 2011. A Comparison of Regional Export Enhancement and Import Substitution Economic Development Strategies. *The Journal of Regional Analysis & Policy*. 41(1):1–15.

Cuomo, A. 2013. Governor Cuomo Announces $3.6 Million in CFA Funding for Food

Distribution Hubs. Available at: http://www.governor.ny.gov/press/cuomo-announces-3-6-million-cfa [Accessed March 1, 2013].

Dabson, B., J. Jensen, A. Okagaki, A. Blair, and M. Carroll. 2012. Case Studies of Wealth Creation and Rural-Urban Linkages. Columbia, MO: RUPRI Rural Futures Lab.

Dabson, B. 2007. Rural-Urban Interdependence: Why Metropolitan and Rural America Need Each Other. The Blueprint for American Prosperity Metropolitan Policy Program. The Brookings Institution.

Dimitri, C., A. Effland, and N. Conklin. 2005. The 20th Century Transformation of U.S. Agriculture and Farm Policy. Economic Information Bulletin 3. U.S. Department of Agriculture, Economic Research Service.

Drabenstott, M. 2001. New Policies for a New Rural America. *International Regional Science Review.* 24(1):3–15.

Feenstra, G.W., C.C. Lewis, C.C. Hinrichs, G.W. Gillespie, and D. Hilchey. 2003. Entrepreneurial Outcomes and Enterprise Size in US Retail Farmers' Markets. *American Journal of Alternative Agriculture*. 18(1):46–55.

Freedgood, J., M. Pierce-Quinonez, and K.A. Meter. 2011. Emerging Assessment Tools to Inform Food Systems Planning. *Journal of Agriculture, Food Systems, and Community Development*. 2(1):1-22.

Gillespie, G.W., D. Hilchey, C.C. Hinrichs, and G.W. Feenstra. 2007. Farmers' Markets as Keystones in Rebuilding Local and Regional Food Systems. In

C.C. Hinrichs and T.A. Lyson, eds. *Remaking the North American Food System: Strategies for Sustainability*. Lincoln, NE: University of Nebraska Press, 65–83.

Gunter, A., and D. Thilmany. 2012. Economic Implications of Farm to School for a Rural Colorado Community. *Rural Connections: a publication of the Western Rural Development Center.* 6(2):13–16.

Hand, M.S., and S. Martinez. 2010. Just What Does Local Mean? *Choices: The Magazine of Food, Farm & Resource Issues*. 25(1).

Haynes, M. 2010. Farm-to-School in Central Minnesota - Applied Economic Analysis. Minneapolis, MN: Center for Urban and Regional Affairs, University of Minnesota. Available at: http://www.cura.umn.edu/publications/catalog/cap-144 [Accessed December 4, 2012].

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.

Hinrichs, C.C., and L. Charles. 2012. Local Food Systems and Networks in the US and UK. In M. Shucksmith, D.L. Brown, S. Shortall, J. Vergunst, and M.E. Warner, eds. *Rural Transformations and Rural Policies in the US and UK.* Routledge Studies in Development and Society. New York: Routledge, 156–176.

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.

Isserman, A.M. 2005. In the National Interest: Defining Rural and Urban Correctly in Research and Public Policy. *International Regional Science Review*. 28(4):465-499.

Jensen, J.M. 2010. Local and Regional Food Systems for Rural Futures. Columbia, MO: RUPRI Rural Futures Lab.

Johnson, R., R.A. Aussenberg, and T. Cowan. 2013. The Role of Local Food Systems in U.S. Farm Policy. Congressional Research Service Report 7-5700. Available at: http://www.fas.org/sgp/crs/misc/R42155.pdf [Accessed March 12, 2014].

Kane, S., K. Wolfe, M. Jones, and J. McKissick. 2010. The Local Food Impact: What if Georgians Ate Georgia Produce. CR-10-03. The University of Georgia, Center for Agribusiness and Economic Development.

King, R., M.S. Hand, G. DiGiacomo, K. Clancy, M.I. Gómez, S.D. Hardesty, L. Lev, and E.W. McLaughlin. 2010. Comparing the Structure, Size, and Performance of Local and Mainstream Food Supply Chains. ERR-99. U.S. Department of Agriculture, Economic Research Service.

Kubisch, A.C., J. Topolsky, J. Gray, P. Pennekamp, and M. Gutierrez. 2008. Our Shared Fate: Bridging the Rural-Urban Divide Creates New Opportunities for

Prosperity and Equity. Washington, D.C.: The Aspen Institute. Available at: http://www.aspeninstitute.org/sites/default/files/content/upload/SharedFate-Final_10-20.pdf [Accessed December 21, 2012].

Kusmin, L. 2013. Rural America at a Glance, 2013 Edition. EB-24. U.S. Department of Agriculture, Economic Research Service. Available at: http://www.ers.usda.gov/publications/eb-economic-brief/eb24.aspx#.UyCwuhBV8_e [Accessed March 12, 2014].

Lazarus, W., D. Platas, and G. Morse. IMPLAN's Weakest Link: Production Functions or Regional Purchase Coefficients. *The Journal of Regional Analysis & Policy*. 32(1):33-49.

Lehrer, N. 2010. *U.S. Farm Bills and Policy Reforms: Ideological Conflicts Over World Trade, Renewable Energy, and Sustainable Agriculture.* Amherst, NY: Cambia Press.

Leung, P., and M. Loke. 2008. Economic Impact of Increasing Hawai'i's Food Self-Sufficiency. EI-16. Manoa, HI: University of Hawai'i Cooperative Extension.

Lichter, D.T., and D.L. Brown. 2011. Rural America in an Urban Society: Changing Spatial and Social Boundaries. *Annual Review of Sociology*. 37(1):565–592.

Little, S. 2012. Senator Roberts: USDA Report Shows Misuse of Taxpayer Dollars. United States Senate Committee on Agriculture Nutrition and Forestry. Available at: http://www.ag.senate.gov/newsroom/press/release/senator-roberts-usda-report-shows-misuse-of-taxpayer-dollars [Accessed March 12, 2014].

Liu, Z., and M. Warner. 2009. Understanding Geographic Differences in Child Care Multiplers: Unpacking IMPLAN's Modeling Methodology. *The Journal of Regional Analysis & Policy*. 39(1):71-85.

Long, R.W. 1987. Rural Development Policy: Rationale and Reality. *Publius: The Journal of Federalism.* 17(4):15–31.

Low, S.A., and S. Vogel. 2011. Direct and Intermediated Marketing of Local Foods in the United States. ERR-128. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service. Available at: http://www.ers.usda.gov/Publications/ERR128/ [Accessed November 8, 2011].

Marsden, T., J. Banks, and G. Bristow. 2000. Food Supply Chain Approaches: Exploring their Role in Rural Development. *Sociologia Ruralis.* 40(4):424-428.

Martinez, S., M. Hand, M. DaPra, 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. Available at: http://www.ers.usda.gov/publications/err97 [Accessed February 8, 2011].

Matteson, G., and A.R. Hunt. 2012. The Emergence of Retail Agriculture: Its Outlook, Capital Needs, and Role in Supporting Young, Beginning, and Small Farmers. Report to the Farm Credit Council. Available at: http://fccouncil.com/wp-content/uploads/2012/09/Emergence_of_Retail_Ag_2012_Revisions_for_web.pdf [Accessed September 3, 2013].

Miller, R.E., and P.D. Blair. 2009. *Input-Output Analysis: Foundations and Extensions*. New York: Cambridge University Press.

O'Hara, J., and R. Pirog. 2013. Economic Impacts of Local Food Systems: Future Research Priorities. *Journal of Agriculture, Food Systems, and Community Development*. 3(4):35-42.

Ostrom, M. 2006. Everyday Meanings of "Local Foods": Views from Home and Field. *Community Development.* 37(1):65-78.

Otto, D., and T. Varner. 2005. Consumers, Vendors, and the Economic Importance of Iowa Farmers' Markets: An Economic Impact Survey Analysis. Ames, IO: Iowa State University.

Pirog, R., and J. O'Hara. 2013. Economic Analysis of Local and Regional Food Systems: Taking Stock and Looking Ahead. E. Lansing, MI: Michigan State University Center for Regional Food Systems.

Porter, M., K. Miller, and R. Bryden. 2004. Competitiveness in Rural U.S. Regions: Learning and Research Agenda. Harvard Business School, Institute for Strategy and Competitiveness.

Quigley, J.M. 2002. Rural Policy and the New Regional Economics: Implications for Rural America. Available at: http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED473470 [Accessed February 21, 2011].

Richards, T. J., and G. Pofahl. 2010. Pricing Power by Supermarket Retailers: A Ghost in the Machine? *Choices: The Magazine of Food, Farm & Resource Issues* 25:1–12.

Ribeiro, R., and M. Warner. 2004. Measuring the Regional Importance of Early Care and Education: The Cornell Methodology Guide. Ithaca, NY: Cornell University. Available at: http://economicdevelopmentandchildcare.org/documents/methodology_guide/MethodologyGuide_Section5.htm [Accessed September 6, 2012].

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. Ithaca, NY: Dyson School of Applied Economics and Management, Cornell University.

Sexton, R.J. 2010. Grocery Retailers' Dominant Role in Evolving World Food Markets. *Choices: The Magazine of Food, Farm & Resource Issues* 25:1–13.

Sheingate, A. 2001. *The Ride of the Agricultural Welfare State*. Princeton, NJ: Princeton University Press.

Shonkwiler, J. S., and T.R. Harris. 1996. Rural Retail Business Thresholds and Interdependencies. *Journal of Regional Science.* 36(4):617-630.

Shortall, S. and M.E. Warner. 2012. Rural Transformations: Conceptual and Policy Issues. In M. Shucksmith, D.L. Brown, S. Shortall, J. Vergunst, and M.E. Warner, eds. *Rural Transformations and Rural Policies in the US and UK.* Routledge Studies in Development and Society. New York: Routledge, 3–17.

Stauber, K., 2001. Why Invest in Rural America—And How? A Critical Public Policy Question for the 21st Century. *Economic Review.* Second Quarter:33–63.

Swenson, D. 2011. Exploring Small-Scale Meat Processing Expansion in Iowa. Ames, IA: Iowa State University, Leopold Center for Sustainable Agriculture. Available at: http://www.iowameatprocessors.org/LeopoldExpan.pdf [Accessed March 12, 2014].

Swenson, D. 2009. Investigating the Potential Economic Impacts of Local Foods for Southeast Iowa. Ames, IA: Iowa State University, Leopold Center for Sustainable Agriculture. Available at: http://www.leopold.iastate.edu/research/marketing_files/seiowa.html [Accessed February 22, 2011].

Swenson, D. 2010 The Economic Impact of Fruit and Vegetable Production in Southwest Iowa Considering Local and Nearby Metropolitan Markets. Ames, IA: Iowa State University, Leopold Center for Sustainable Agriculture. Available at: http://www.leopold.iastate.edu/research/marketing_files/swiowa.html [Accessed September 6, 2011].

The National Research Committee on Twenty-First Century Systems Agriculture, Natural Research Council. 2010. *Toward Sustainable Agricultural Systems in the 21st Century*. Washington, D.C.: The National Academies Press.

Timmons, D. 2006. Measuring and Understanding Local Foods: the Case of Vermont. M.S. Thesis. Burlington, VT: University of Vermont.

Tropp, D. 2008. The Growing Role of Local Food Markets: Discussion. *American Journal of Agricultural Economics.* 90(5):1310–1311.

Tropp, D., E. Ragland, and J. Barham. 2008. Supply Chain Basics: The Dynamics of Change in the U.S. Food Marketing Environment. Agriculture Handbook 728-3, U.S. Department of Agriculture, Agricultural Marketing Service.

Tuck, B., M. Haynes, R. King, and R. Pesch. 2010. The Economic Impact of Farm-to-School Lunch Programs: A Central Minnesota Example. Economic Impact Analysis: An Extension Community Economics Program. St. Paul, MN: University of Minnesota.

U.S. Department of Agriculture (USDA). 2013a. USDA Agencies and Offices. Available at: http://www.usda.gov/wps/portal/usda/usdahome?navid=AGENCIES_OFFICES_C [Accessed March 12, 2014].

———. 2013b. FACT SHEET: Strengthening New Market Opportunities in Local and Regional Food Systems. Newsroom. Available at: http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/11/0219.xml&contentidonly=true [Accessed March 12, 2014].

———. 2013c. Report of the Definition of "Rural". Office of the Secretary. Available at: http://www.rurdev.usda.gov/Reports/RDRuralDefinitionReportFeb2013.pdf [Accessed March 12, 2014].

U.S. Department of Agriculture, Agricultural Marketing Service (USDA AMS). 2014. Food Hubs: Building Stronger Infrastructure for Small and Mid-Size

Producers. Available at: http://www.ams.usda.gov/AMSv1.0/foodhubs [Accessed March 12, 2014].

U.S. Department of Agriculture, Economic Research Service (USDA ERS). 2014. Agricultural Act of 2014: Highlights and Implications. Available at: http://www.ers.usda.gov/farm-bill-resources.aspx#.UyD4Fs6YFj5 [Accessed March 12, 2014].

U.S. Department of Agriculture, Know Your Farmer Know Your Food (USDA KYF) 2011. Potential USDA Programs to Support Food Hub Development. Available at: http://www.ngfn.org/resources/ngfn-database/knowledge/Regional%20Food%20Hub%20Resources%20from%20USDA%20v1.pdf [Accessed March 12, 2014].

Wensley, M.R.D., and J.C. Stabler. 1998. Demand-Threshold Estimation for Business Activities in Rural Saskatchewan. *Journal of Regional Science.* 38(1):155–177.

PAPER 1

DIFFERENTIATING 'LOCAL' PRODUCERS' EXPENDITURE PROFILES TO EVALUATE IMPACTS OF POLICIES SUPPORTING LOCAL FOOD SYSTEMS

Food marketed as locally-grown is now available throughout the United States. 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 of these policies (the U.S. Department of Agriculture reports funding over 2,600 local food projects between 2009-2013, USDA 2013), the resulting economic impacts remain unclear, largely due to data deficiencies precluding comprehensive analysis.

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 the IMPLAN Group LLC), 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), thereby 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 agricultural economists to identify data needs and best practice methodologies to assess the economic 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 evaluating how policies supporting 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 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.[9] 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 policies supporting local food system activity will likely 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.

[9] 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).

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 (e.g., 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 involve 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 have resulted in farm employment and labor expenditures per dollar of gross output declining precipitously throughout the United States; accordingly, 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.[10] 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 remarkably 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 annual 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, and outside of NYS. Based on the farm's commodity with the largest sales (numerous farms

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

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.[11] 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 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

[11] "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).

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).[12] 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 farms). 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 are based on 2011 data for NYS. We created an 'agricultural production sector' that includes the IMPLAN agricultural commodity

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

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).[13]

[13] Note that the case study and ARMS data presented only include variable expense items (i.e., we did

For all local food system participants, 'labor' and 'other variable expense' are the largest areas of expenditure.[14] 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).[15] 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.

[Tables 1 and 2 here]

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

---

not ask about capital expenditure items in the case studies, or utilize non-variable expenditures available from the ARMS).

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

[15] 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%.

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 $H_0 : ß_1 = ß_2$ ($ß_1$ = no local food sales, $ß_2$ = 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.[16] 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.[17] Table 3 reports the average miles traveled for each item, differentiated by

[16] 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.

[17] The expenditure items are slightly different across the four years.

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, for example supporting 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). Additionally, we can use the same NYS ARMS data set to look at key farm financial measures (table 4). On average, farms that did not report local food sales were more likely to have a positive net income (55.1%, compared to 39.8% for those with local food sales). This relationship holds if we exclude dairy and livestock operations; on average, 58.6% of field crop, vegetable, fruit, and nut farms without local sales reported positive net farm incomes, compared to 43.4% of those with local food sales. Likewise, farms with local food sales had a higher average operating expense ratio (92.3 for all farms, 81.8 for field crop, vegetable, fruit, and nut farms) compared to farms without local food sales (81.6 for all farms, 74.3 for field crop, vegetable, fruit, and nut farms). The median operating profit margin (100 * (net farm income + interest expense) / gross farm income, excluding the imputed cost of operator labor) was negative for farms with local food sales (-12.4 all farms, -16.6 field crop, vegetable, fruit, and nut, farms), but positive for farms without local food sales (11.0 all farms, 22.9 field crop, vegetable, fruit, and nut, farms). Though we cannot say for certain whether the local food system participants' additional labor expenditure is correlated with the financial measures, the results demonstrate the need for future research that examines potential tradeoffs between higher local and/or labor expenditures per unit of output and profitability.

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.[18] 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

[18] 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.

within a local economy, so that policies promoting local food system activity can be accurately evaluated.

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, and will have important implications for the direction of future policy.

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 that assess the impact of policies support local food system initiatives 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. Understanding how these differential expenditure profiles reverberate throughout the economy remains the key next step in understanding the economic impacts that result from policies supporting strengthened local food systems.

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.

Brodt, 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, C. 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). 2013. FACT SHEET: Strengthening New Market Opportunities in Local and Regional Food Systems. Newsroom. Available at: http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/11/0219.xml&contentidonly=true.

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

	CD Region (2011)	NYS USDA ARMS (2008-2011, average)			
		Local food sales, all outlets		No local food sales	
	D2C small- and mid-scale farms	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, between farm with local food sales and those without.

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%
Total Local Expenditure			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

	Average miles by type of farm		
Expenditure Item	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).

Table 4. Key farm financial measures, ARMS data, 2008-2011, New York, by type of farm

	Local food sales, outlets		No local food sales	
	all farms	field crop, vegetable, fruit, and nut farms	all farms	field crop, vegetable, fruit, and nut farms
% of farms with positive net farm income	39.8	43.3	55.1	58.6
Average operating expense ratio	92.3	81.8	81.6	74.3
Median operating profit margin [a]	-12.4	-16.6	11.0	22.9

Source: 2008-2011 USDA Agricultural Resource Management Survey

[a] Median operating profit margin is calculated as 100 * (net farm income + interest expense) / gross farm income, where the imputed cost of unpaid operator labor is treated as an overhead expense.

PAPER 2

ASSESSING THE ECONOMIC IMPACTS OF FOOD HUBS TO REGIONAL ECONOMIES: INCLUDING OPPORTUNITY COST

Introduction

As policymakers, researchers, and practitioners seek new opportunities to support rural communities and agri-businesses, interest in re-localized food systems continues to grow (Clancy 2010; Jensen, 2010; King et al. 2010; Martinez et al. 2010; O'Hara and Pirog 2013; The National Research Committee 2010). The role of small- and medium-scale producers in developing local and regional food systems has also attracted renewed attention, as their importance in supplying these alternative food markets gains recognition (Low and Vogel 2011). Despite local food systems' purported potential to increase farm sales and support rural economic development, the U.S. Department of Agriculture (USDA) acknowledges the "lack of distribution systems for moving local foods into mainstream markets" as a barrier to 'scaling up' local foods and meeting consumer demand (Martinez et al. 2010, iv).

Accessing markets that provide return on investment is difficult for small- and mid-sized farms as supply chains become more vertically-integrated and consolidated. Large-scale supermarket retail and wholesale operations demand large volumes, low prices, and consistent quantities and qualities that meet increasingly strict safety

standards. The procurement systems in such markets are often vertically and horizontally integrated, global in scale, and aim to maximize efficiency (King et al. 2010; Richards and Pofahl 2010; Sexton 2010; Tropp et al. 2008).

In order to facilitate market access for small- and mid-scale farms, public agencies and private foundations are increasingly financing and promoting 'food hub' development. Following the USDA's working definition, a 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).

For example, the USDA and the Wallace Center at Winrock International have partnered with the National Good Food Network, the Farm Credit Council, and other organizations to launch the Food Hub Collaboration, which "works to ensure the success of existing and emerging food hubs in the US by building capacity through connection, outreach, research, technical assistance and partnership" (NGFN 2010). In addition, the USDA's Know Your Farmer, Know Your Food task force has a Regional Food Hub Subcommittee. In 2011, the Subcommittee prepared a list of 15 USDA agency programs that already provide funding to support food hubs, including: Rural Development; Agricultural Marketing Service; the National Institute of Food and Agriculture; Farm Service; Natural Resources Conservation Services; and Risk Management (USDA KYF 2011). Some state governments have also utilized public funds to support food hub development. In February 2013, the New York State Governor announced $3.6 million in state funding to support four new food hubs

(Cuomo 2013).

Despite this substantial and growing interest in food hubs, as well as a burgeoning literature (e.g., Abatekassa and Peterson 2011; Barham 2011; Barham et al. 2011; Clancy and Ruhf 2010; Conner et al. 2011; Day-Farnsworth and Morales 2011; Diamond and Barham 2011; Feenstra et al. 2011; Hardesty et al. forthcoming; Jablonski et al. 2011; Matson et al. 2011; Rozyne 2009; Schmidt et al. 2011; Slama et al. 2010; Stevenson and Pirog 2008), there have been no comprehensive, data-driven economic impact assessments completed to date. Additionally, there is not an agreed upon methodology about how an economic impact assessment of food hubs should be conducted (O'Hara and Pirog 2013).

Economic impact assessments model and measure the economic activity associated with the chain effects of linked purchases. An (exogenous) final demand driven change for food hub goods and services results in changed production levels of other industry sectors throughout the entire economy. Of key importance is the extent to which food hubs serve to increase overall demand for and consumption of locally-grown agricultural products, versus diverting some regional farm sales from existing local markets to another, as well as the percentage of the sales price retained by the farm through food hub sales compared to other market outlets. This is due to the fact that policymaker's primary interest in food hubs emanates from their potential to support economic development, which one must measure by estimating the total impacts, including who or what benefits and loses. In other words, it is not clear whether increases in final demand for food hub goods and services divert sales from other industry sectors (like wholesale trade), thus resulting in a 'beggar thy neighbor'

phenomenon taking place (Boys and Hughes 2013; Thilmany et al. 2005), or serve to increase farm profitability. Thus, taking into account where businesses would have purchased products had the food hub not existed (the opportunity cost) is important. Attention to this type of impact assessment can help to better inform public and private programs that support food hub initiatives.

Efforts to assess the impacts of local food system activities are often complicated by a lack of data necessary for complete evaluation. Frequently, these efforts suffer from insufficient data to identify the major inter-industry sales and purchase linkages of local food system participants. Data problems are exacerbated as data is not collected about a food hub industry sector per se, and thus food hub inter-industry linkages must be identified within existing industry sectors in the economy.

The primary objective of this paper is to promote the utilization of a best-practice methodology to evaluate the economic contributions of food hubs to their local economies and the participating farms they support. This is accomplished by developing a data-driven empirical framework applicable to a variety of food hub structures. Included in this framework is a discussion of the data requirements and a recommended methodology for collecting such data. As the USDA distinguishes a food hub from other traditional food aggregators or distributors in part based on the fact that they purchase products "primarily from local and regional producers," the differential expenditure patterns can be modeled to determine the relative effects on the regional economy, including the impact on local agricultural sectors.

The framework developed is applied to a case study analysis of a food hub located in New York State. There are significant limitations to generalizing the results

of an individual case study to other food hubs. However, in contexts where food hubs exhibit similar attributes to our case study (i.e., performs similar types of business functions, serves the same number of farms or physical market), one may be able to utilize the adjusted expenditure patterns in constructing a similar analysis. However, where food hubs are more dissimilar in terms of their activities and purchasing and sales patterns, following the complete data collection procedure proposed is advised.

The secondary objective of this paper is to better understand the extent to which food hubs increase the overall demand for and consumption of local food products. We collect additional information on the nature of purchases of food hub output, and we analyze the extent to which these purchases represent increased demand for local goods and services, or if they instead represent substitutes of purchases from one local source for another (e.g., from a conventional wholesale distribution company to a food hub). The information collected from purchasers of food hub goods and services allows us to ascertain the direct value of food hub purchases, offsets in purchases from other sectors, and the potential in our case study for growing overall local food product demand.

We begin with a brief description of economic impact analysis to frame the paper's objectives, along with a discussion of previous literature analyzing the impacts of local food system infrastructure. Next we provide an analytical framework for our analysis and a detailed empirical methodology, including two alternative modeling approaches. A discussion of the case study application follows, including the interpretation of and policy implications from the particular results and a set of recommendations for replicating the methodology in alternative settings. We conclude

with priorities for future research.

Local food economic impact assessments

Most local food economic impact assessments utilize social accounting matrix (SAM) models with data and software generated by the IMPLAN Group LLC (IMPLAN).[19] Among these assessments, there are a handful that measure the impacts of specific marketing channels, such as farmers' markets (e.g., Henneberry et al. 2009; Hughes et al. 2008; Myles and Hood 2010; Otto and Varner 2005; Sadler et al. 2013) or farm-to-school programs (Gunter and Thilmany 2012; Tuck et al. 2010), as well as key pieces of infrastructure such as meat processing facilities (Swenson 2011).

Throughout most of these studies, there are two main challenges that reflect the difficulty in meeting the significant data requirements to conduct rigorous economic impact assessments. The first is what O'Hara and Pirog (2013) refer to as an 'interpretation' challenge. Specifically, "stipulating how the 'opportunity cost'…is defined" (4). As they rightly point out, measuring opportunity cost is not straight-forward, and requires information about the extent to which increased consumer purchases of locally-grown food offsets other types of purchases, changes market prices and/or supply chain characteristics, or impacts land use. There are only a handful of local food economic impact assessments that explicitly acknowledge the need to consider opportunity cost (Conner et al. 2008; Hughes et al. 2008; Gunter and Thilmany 2012; Tuck et al. 2010; Swenson 2010). However, each of these studies makes assumptions about the sectors in which there are decreased purchases (or

[19] A SAM is an accounting system that links the economic transactions within an economy among production sectors, labor and other factors of production, and government and other institutions (Miller and Blair 2009).

changes in land use) as a result of increases in local food consumption–in other words, none collects the data necessary to more fully understand the opportunity costs of increased local purchases.

The second challenge is that almost all of these studies reflect the implicit assumption that local food system participants have the same patterns of expenditure as the aggregate agricultural sector data available in IMPLAN. By default, the entire economy is represented by 440 sectors within IMPLAN. Each IMPLAN sector is represented by a single, static production function. The production functions for each sector reflect average purchase and sales patterns across all firms in the sector, without the requisite information to be able to disaggregate them by any specific characteristic (i.e., scale of operation, or marketing channel) (Lazarus et al. 2002b; Liu and Warner 2009).[20] As IMPLAN sector data represents all inter-industry linkages, the expenditure and sales patterns are more reflective of those firms that contribute a higher proportion of total output in the sector (typically the larger firms) (Lazarus et al. 2002a). Given that local food system participants tend to be smaller in scale, and represent a small overall portion of agricultural sector transactions (Low and Vogel 2011), the estimates of the impacts from increased local food sales based on existing IMPLAN data may be misleading if local food system participants have different patterns of input expenditures (e.g., different production functions) and/or they purchase a different proportion of their inputs from local sources. As one of the distinctive definitional attributes of food hubs are their tendency to purchase more regional inputs, this would

[20] For an in-depth discussion of how production functions are constructed within IMPLAN, see Lazarus et al. (2002b).

be expected to be the case by definition, though to an unknown extent.

There are a limited number of local food system impact assessment studies that disaggregate key sectors and augment the IMPLAN database with primary data collection on expenditure patterns. Gunter and Thilmany (2012) utilize a combination of survey data and National Agricultural Statistics Service data to create a customized farm-to-school farm sector within IMPLAN, reflecting the differential production function of farm-to-school producer participants. Schmit et al. (2013) collect detailed expenditure and sales data from farms in Upstate New York and show that small- and mid-scale farms participating in direct-to-consumer (D2C) markets have different spending patterns than depicted in the default agricultural sector data in IMPLAN. They conclude that local food economic impact assessments utilizing default IMPLAN agricultural sectors to estimate economy-wide impacts will typically underestimate the true magnitude. Swenson's (2011) study is the only of its kind to provide evidence that it is not just farms participating in local food market outlets that are not well represented by default IMPLAN sectors. His research on the small-scale meat processing sector in Iowa demonstrates differences in expenditure patterns based on the scale of operation, implying that utilizing default IMPLAN sector data to describe infrastructure required by local food systems (likely smaller in scale than what is reflected in default IMPLAN data), may not reflect true impacts.

Empirical framework

To conduct an impact assessment of food hubs using an input-output analytic framework like IMPLAN, we must define the industry sectors of interest and their linkages with other industries. This is not straightforward as a separate *food hub sector*

and its transactions with other industries do not exist within traditional data sources (including IMPLAN). The implication for an impact assessment is that additional information must be collected to develop a food hub sector and to describe the nature of all of its transactions.

Formally, we do not create a single aggregated food hub sector for the analysis. Instead, we model the food hub sector through the allocation of food hub expenditures (associated with revenues resulting from final demand for its output) to food hub input suppliers (including regional farms), food hub employees, and food hub owners; this is an analytically equivalent alternative known as 'analysis-by-parts'.[21] Conceptually, the allocated expenditures listed represent the first round of indirect inter-industry purchases and payments to value added made by the food hub, each of which triggers additional indirect and induced effects.

Defining the scope of a food hub within IMPLAN therefore requires detailed data on the food hub's annual outlays, including (*i*) purchases by the food hub from each industry sector, along with the proportions of those expenditures that are purchased within the defined local economy, (*ii*) payments to the value added components, and (*iii*) other institutional purchases (e.g., payments to households or government purchases).

In addition, one should consider whether the default IMPLAN production functions associated with the sectors the food hub purchases from adequately represent the production technologies (input combinations) of firms with whom the food hub

[21] See IMPLAN's 'Case Study: Analysis-By-Parts' for more information: http://implan.com/v4/index.php?option=com_multicategories&view=article&id=730:case-study-analysis-by-parts&Itemid=71

interacts. If not, additional information will be required from firms representing these upstream sectors. This is perhaps most acute for the farm production sectors that supply food products to the food hub; i.e., are farms that sell to food hubs adequately represented using the default farm average data contained within IMPLAN? In order to assess this question, to see if there are substantial differences, we construct two alternative impact assessment models–one that incorporates additional data collected from farms selling to the food hub and one that does not.

Expenditure categories from the food hub data must be mapped to appropriate industry, value added, and institutional sectors within IMPLAN. We start defining industries by utilizing the two-digit NAICS aggregation scheme provided within IMPLAN, but leave sectors of particular interest or importance to food hubs disaggregated. Importantly, in addition to the industries included in the 2-digit NAICS aggregation scheme, we create a separate aggregated 'food sold-farm' sector that only includes those sectors from which the food hub purchases food products.[22] Similarly, we separate from the 2-digit NAICS scheme processed food and beverage products that food hubs purchase from nonfarm manufacturers for resale. We then consolidate them into a new 'food sold-nonfarm' sector.

Defining farms that sell to food hubs

Understanding how farms that sell product to food hubs (henceforth 'food hub farms') interact with other sectors of the economy is important in improving the precision of

[22] We define the 'food sold-farm sector' to include 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.

an impact assessment. While the same can be said of any input supplying sector, since purchases from farms generally represent a relatively large share of total food hub expenses, and we are particularly interested in how food hub farms are impacted by food hubs given the role this may play in rural economic development, it is important to consider the inter-industry linkages for farm suppliers.

Furthermore, for most of the businesses from which food hubs purchase inputs, it is both sufficient and consistent with standard practice to assume that the individual business' expenditure patterns reflect that of the entire industry sector. For example, a food hub is unlikely to purchase insurance from a specialty food hub insurance provider. As such, assuming that the food hub's insurance company has a similar production function to that of the region's 'insurance' sector within IMPLAN should be sufficient. By contrast there is growing evidence that farms participating in local food system outlets are oftentimes (but not exclusively) smaller in scale, and/or have different patterns of expenditures and labor requirements per unit of output than is reflected in IMPLAN's default agricultural sectors (Schmit et al. 2013).

Defining a separate food hub farm sector distinct from the total farm sector requires outlays data analogous to what is required from the food hub described above; i.e., the value and location of payments by the food hub farm to each industry sector and value added component.

Impact analysis and considering opportunity cost

Once our SAM model is customized to reflect food hub expenditure patterns according to the framework explained above, we can perform the impact analysis. We consider a scenario in which an exogenous shock increases the final demand for food

hub products and services. Given the absence of a discrete food hub sector, the increase in final demand is fully allocated according to the food hub's expenditure pattern. While the initial increase in final demand is the value of the direct effect, only a portion of expenditures to satisfy that increase occur locally, and thus only the expenditures that occur with local firms are included in the impact analysis (as first-round indirect effects).

In addition to a positive hypothetical shock assumed due to an increase in demand for food hub products, we need to consider resulting negative impacts due to decreased spending in other sectors. We hypothesize that food hub purchases are not strictly additional, new purchases from local suppliers (i.e., they are likely to offset to some extent local purchases from existing wholesale distributors). At the same time, however, it is likely that consumers increase their overall purchases of local products due to the more specialized food hub marketing efforts and the resulting availability of food hub products and services. Customers should have increased awareness of and access to a basket of goods that is differentiated from that available from other types of distributors (i.e., they have more options to purchase local goods).

In order to test this hypothesis and more fully reflect the impact that increased demand for food hub products has on other sectors, we require the following information from food hub customers: (*i)* the percentage of food hub customers who would have purchased product from other sectors had the food hub outputs not been available; and (*ii*) of the customers who purchased less product from other sectors, the amount of reduced purchases that are a result of purchases from food hubs.

Case study application

Given the heterogeneous structure of food hub operations and the detailed data needs required for an impact assessment, we utilize a case study approach. This is a preliminary case study and is not indented to provide definitive evidence of the economic impact of food hubs, but rather to: 1) test the framework developed herein; and 2) provide an initial case study with which future research can be compared.

Case study food hub

Regional Access, LLC (RA) was chosen for our case study because they fit within the USDA's regional food hub definition as an aggregation and distribution business that is committed to supporting local farmers and preserve source-identification. In addition, RA's length of time in operation, the diversity of its customer base, and its operation size make it an interesting business to examine. RA was established in 1989. In 2011, it had over $6 million in sales, and employed 32 full-time jobs. Utilizing 9 vehicles and a 25,000 square foot warehouse, RA aggregates and delivers products primarily throughout NYS. RA has over 3,400 product listings, including beverages, breads, cereals, flour, meats, produce, prepared foods, grains, and fruits and vegetables. RA purchases products directly from 96 farm vendors, 65 specialty processors (nonfarm vendors), as well larger-scale foodservice distributors. The product is sold to over 600 customers, including: individual households, restaurants, institutions, other distributors, fraternities and sororities, buying clubs, retailers, manufacturers, and bakeries. RA also provides freight services to a range of businesses.

New York State (NYS) was chosen as our local region of analysis. Though we recognize that the defining choice of local is a fraught one, RA works primarily with

farms and customers across NYS; accordingly, the term 'local' will refer to NYS throughout the case study application.

Deriving food hub expenditure pattern

RA provided a detailed 2011 profit and loss statement, along with estimates of the percentages expenditures in each category that were local. Based on the data they provided and follow up discussions with RA personnel, the hub's expenditure categories were mapped to IMPLAN sector, value added, and other components. For ease of exposition, the detailed sector aggregation and mapping scheme is included in Appendix 1.

After accounting for the value of all hub outlays, relative expenditures by category are computed and disaggregated by their local versus nonlocal components. RA's six largest expenditure items are shown in Figure 1. The two largest expenditure items are food sold-nonfarm (44%) and food sold-farm (18%). Together, food sold-nonfarm and food sold-farm expenditures represent what is commonly referred to as cost of goods sold (COGS). Interestingly, the COGS for RA is very similar to the average COGS reported by Fischer et al. (2013) from their national food hub survey (61%). The Farm Credit Council and Farm Credit East's Food Hub Benchmarking Study (2013) reported average COGS of 68%. By comparison, the Food Marketing Institute (2008) reports average COGS for food distributors at 71%.

The third largest expenditure item was employee compensation (16%). Similarly, the Farm Credit Council and Farm Credit East's (2013) Food Hub Benchmarking Study reported average labor costs as a percent of sales to be 17%. The Food Marketing Institute (2008) reports total payroll and employee benefits at 15% of

total expenditures.

[Figure 1 here]

The extent to which these purchases are local is also important to consider. Figure 1 depicts RA's expenditures as percentage of total, divided into local and nonlocal. For RA, 54% of all expenditures are local. RA's largest local expenditures as a percentage of total expenditures are food sold-farm (16%), employee compensation (16%), food sold-nonfarm (7%), finance and insurance (4%), proprietor income (3%), and automotive equipment rental and leasing (3%). As a point of comparison, Fischer et al. (2013) also asked food hubs about the percentage of their expenditures that were local. Though they do not provide an average for all expenditures, they found "no expenditure averaged less than 50% spent in-state" (pp.34) with 85% of food and/or product purchases taking place within the state of the food hub's operation.

Food hub farms

In-person interviews were conducted with 30 farms that sell product to RA (out of 86 located in NYS, 35% response rate).[23] The farms were located in every region of NYS except New York City and Long Island.[24] Of the farms from which RA purchased product, 50% classified their operation as 'small' ($1,000-$249,999 in gross sales), 20% percent as 'medium' ($250,000-$500,000 in gross sales), and 30% as 'large' (over $500,000 in gross sales). When asked to classify their farms' primary production

[23] A copy of the interview protocol is available upon request.
[24] Regional location of firms follows from Empire State Development's delineation of ten regions throughout the state, including Western New York, Finger Lakes, Southern Tier, Central New York, Mohawk Valley, North Country, Capital District, Mid-Hudson, New York City, and Long Island. For more information, see: http://esd.ny.gov/RegionalOverviews.html.

category, 37% percent identified meat and livestock, 30% fruit and vegetable, and 33% value-added.[25]

Deriving food hub farms' expenditure pattern

Table 1 presents the average expenditure patterns of the food hub farms interviewed. The average total expenditure was $601,110 per farm, of which 80% was spent in the local economy ($483,741). The largest percentage of total expenditure is allocated to employee compensation (24%), followed by food sold-farm (17%), manufacturing (16%), and support activities for agriculture and forestry (9%).

[Table 1 here]

IMPLAN model construction

Using 2011 IMPLAN data, two NYS models were constructed and aggregated according to the aggregation scheme presented in Appendix 1.[26] Both of the models utilize data collected from RA about their sales and expenses. Model 1 assumes that food hub farms' production functions are the same as the default IMPLAN agricultural sector data (i.e., none of the food hub farm data is utilized in this model). Model 2 utilizes the food hub farm data to separate the default IMPLAN agricultural sector data (i.e., the food sold-farm sector) into two distinct sectors: the 'food hub farm' sector and the 'other farm' sector (see below).

In both models, we need to margin RA reported expenditure and sales

[25] If a farm classified its primary production category as 'value added', it can be inferred that the farm grew/raised the raw commodity that it then processed. Examples of the value added products produced include cheese, butter, yogurt, honey, maple syrup, wine and juice.

[26] After aggregating the models, the SAM IxI transactions matrix was exported from IMPLAN into Microsoft Excel 2010. Margining, disaggregation of the default agricultural sector, along with all of the computations that follow, were conducted in Excel. Though this work can be done within IMPLAN, we determined that completing the work within Excel is more transparent.

information in IMPLAN's 'retail trade' and 'wholesale trade' sectors. As total gross output for these IMPLAN sectors reflects only the gross margin (revenue less cost of goods sold), the balance is reported in the supporting industry where the product is manufactured/produced. In our aggregation scheme, RA has expenditures in three sectors that require margining: retain store-gasoline stations, wholesale trade, and retail trade. To account for margining in the retail store-gasoline stations sector, we apply the retail trade-gasoline stations margin (sector 326), of 14.5% (available within the IMPLAN database) such that only $54,438 is included in the retail stores-gasoline stations. The balance ($320,998) is mapped to petroleum refineries (sector 115) and the local purchase percentage is taken from IMPLAN for that sector. The same approach was used for retail trade and wholesale trade.[27] Once we have aggregated relevant sector and accounted for margining, Model 1 is completed by routinely building the model.

Model 2: Creating a food hub farm sector

For Model 2, the food hub farm data were utilized to apportion transactions in the food sold-farm sector into two distinct sectors: the 'food hub farm' sector and the 'other farm' sector (i.e., everything in food sold-farm other than the food hub farm sector). The first step in separating the food hub farm sector from the food sold-farm sector is to determine the total size of the RA food hub farm sector in NYS—effectively calculating the total amount of a new expenditure column and a new sales row in the SAM. The average estimates from the interview data were multiplied by the total

[27] IMPLAN retail and wholesale margining is based on national data, and varies by year, see: http://implan.com/index.php?option=com_multicategories&view=article&id=680:680&Itemid=71.

number of RA farm vendors in NYS (86).

Food hub farm expenditure categories were then allocated to their corresponding IMPLAN sector. Importantly, this procedure does not change the size of the overall economy, but reallocates total local expenditures into its two distinct sector components. As above, we account for margining in the retail and wholesale trade sectors. In addition to selling product to RA, food hub farmers also identified purchases of goods and services from RA (e.g., transportation, warehousing and wholesaling). We divided these expenditures evenly between 'wholesale trade' and 'transportation and warehousing'. Additionally, we allocated the difference between the average sales and expense per farm ($601,110 - $569,167 = $31,913) as payments to owners (proprietor's income within IMPLAN).[28]

Just as expenditures of the food hub farms on their inputs were used to create a new sector with purchasing patterns that are distinct in relation to the overall food sold-farm sector (i.e., using SAM column transactions), food hub farm sector output or sales must be similarly disaggregated into a vector of sales (i.e., using SAM row transactions). Average sales per farm ($601,110) were initially scaled up by the size of the sector (86 farms). Then, sales designated as non-local were allocated to domestic trade (as exports). The balance of sales was divided between sales to other farms, sales to households (i.e., direct-to-consumer sales), intermediated sales not to RA, intermediated sales to RA, and commodity sales, as described below. Average sales by market outlet for food hub farms are presented in Table 2. All food hub farm direct-to-

[28] Within a SAM framework, there is an accounting identity in which the value of total outlays in each sector must equal the value of total outputs.

consumer sales were assigned to households (i.e., treated as sales directly to households, an average of $144,173/farm). Intermediated sales separate from those to RA were assigned to the aggregated food sold-nonfarm sector (an average of $279,701/farm). Sales to RA were apportioned equally to the sectors to which RA sells product, including: accommodation and food service; wholesale trade; education; food sold non-farm; retail trade; and health and social services. On average, food hub farms sold $37,200 to RA. Food hub farms reported an average of $37,152 in sales to commodity markets. These sales were allocated to IMPLAN's other manufacturing sector. Non-local sales (an average of $52,355/farm) were allocated to exports (domestic trade). Finally, sales to other farms (an average of $102,884/farm) were considered intra-industry linkages and mapped to the food hub farm sector.

[Table 2 here]

Once we complete mapping of the food hub farms expenditures and sales to the relevant IMPLAN sectors, we see that our case study farms have very different patterns of expenditure than the default food sold-farm sector within IMPLAN (see Table 3). Most importantly in terms of local economic impact, per unit of output, food hub farms spend $0.80 in the local economy versus the $0.65 in the food sold-farm sector. Food hub farms' additional expenditure is in intermediate purchases where the sector spends $0.44 per unit of output compared to the food sold-farm sectors $0.25. In total the food sold-farm sector has higher per unit of output expenditure in value added components ($0.40,compared to $0.36 in the food hub farm sector). Food hub farms spend double as much on employee compensation as the default food sold-farm sector per unit of output ($0.24 compared to $0.12), although they spend substantially

less on proprietor income ($0.05 compared to $0.16). Another way of comparing these expenditure patterns is that per unit of output, the total labor/owner direct income impact of food hub farms is $0.30 compared to $0.29 in the default IMPLAN data.[29] Food hub farms spend $0.08 per unit of output on support activities for agriculture and forestry, compared to $0.02 in the default agriculture sector per unit of output. And, food hub farms spend $0.16 per unit of output on purchases from other local farms compared to $0.06 per unit of output in the default farm sector.

[Table 3 here]

Customer surveys

An online survey of RA's customers was used to better understand the extent to which purchases from RA increase the demand for locally-grown farm products and offset purchases from other sectors.[30] At the time of the survey, RA customers numbered 110 households and 547 businesses, of which 57 households and 186 businesses responded to the online survey. To improve the response rate for business customers, follow up phone interviews were attempted with those customers who did not respond online. An additional 62 surveys were completed, increasing the total number of responses received to 305 (46% response rate), with 80% from business customers and 20%

[29] Even nationally, the U.S. does not collect employment and earnings data on a commodity basis. The U.S. Bureau of Economic Analysis' (BEA) Regional Economic Accounts program estimates county-level employment and income data, but these are farm totals, not differentiated by agricultural commodity. As a result, IMPLAN has developed procedures, using a combination of the USDA ERS farm count by commodity (as an indication of proprietors), employee compensation-to-output relationships from the BEA Benchmark I-O (to get a first estimate for wage and salary employment by commodity), and applying the resulting U.S. relationships to output to state outputs, to derive state employment numbers. Given the data challenges, we are wary about making too fine a point on the different value added component expenditures. For more information on the data challenges and IMPLAN's methodology, see: http://implan.com/index.php?option=com_multicategories&view=article&id=638:638&Itemid=14

[30] A copy of the online customer survey is available upon request.

from individual households.

RA's business customers are very diverse. They reported average annual gross sales of $5.7 million (median = $515,000, n=101), with a range from $3,000 to $414 million. On average, they have been in business 13 years (median = 8 years), although this ranged from new to over 130 years in operation (n=151). The average number of fulltime employee equivalents was 15 (median = 4, n=145). Business customers were also asked to identify the function their business most often performs; accordingly, 2% identified themselves as distributors, 3% as grocery/meal delivery service providers, 9% as processors/manufacturers, 11% as wholesalers, 25% as restaurants, 34% as retailers, and 17% as other—including bakery, fraternity/sorority house, caterer, coffee shop, farmers' market vendor, and institutional cafeteria (n=245).

Impact analysis

To understand the impact of an increase in final demand for RA food hub products and the extent of differential economy-wide impacts from the two models, we consider a scenario in which an exogenous shock increases final demand for food hub products and services by $1,000,000. The only difference between the allocation of the shock in Models 1 and 2 is that in Model 1 all local farm purchases by RA are allocated to the aggregate food sold-farm sector, whereas in Model 2, RA farm purchases are allocated to our new food hub farm sector.

In addition to the positive shock, we consider a simultaneous negative shock to the wholesale trade sector in order to account for the offsets, or opportunity cost. The customer survey results reveal that, on average, 49.39% of RA business customers decreased their purchases from other distributors due to their purchases from RA. Of

those who reported decreasing purchases from other distributors, the average decrease was 23.09%. Accordingly, a negative shock of $114,042 was applied to the wholesale trade sector (i.e., .4939 * .2309 * $1,000,000 = $114,042), in addition to the positive expenditures to this sector made by the food hub. The wholesale trade sector was chosen as business customers reported decreasing purchases from other distributors, which are included in IMPLAN's wholesale trade sector.

Results

Model 1: multiplier and distributional impacts

Model 1 results are shown in Table 4 illustrating the combined indirect plus induced output multiplier effects for the top affected industries,[31] the combined effects for the remaining industries, and the total effects across all industries. Without including opportunity costs, the combined multiplier effects in Model 1 are $683,642. When adding in the direct effect of $1M, this implies a total output effect of $1,683,642, or a gross output multiplier of 1.68.[32] In other words, for every dollar increase in final demand for food hub products, an additional $0.68 is generated in backward linked industries. While not shown, the total indirect multiplier effect is $0.46 and the total induced multiplier effect is $0.22 indicating that most of the multiplier effect is due to the business-to-business transactions.

[Table 4 here]

Alternatively, consider the results for Model 1 when incorporating opportunity

[31] Though not a top impacted industry sector in Model 1, we include support activities for agriculture and forestry for a point of comparison with Model 2.

[32] This result is similar to sectors that conduct activities that are, at least in part, similar to a food hub. For example, comparable output multipliers for wholesale trade, truck transportation, and warehousing and storage are 1.60, 1.69, and 1.73, respectively, for NYS.

costs. Here, the additional negative shock to the wholesale trade sector results in total indirect and induced effects of $502,011, implying an output multiplier of 1.50. While still a relatively strong multiplier effect, this represents a 12% decrease in the total multiplier effect (1 – 1.50/1.68) from that when opportunity costs are ignored. When accounting for opportunity costs, the indirect effect portion of the multiplier is $0.32 and the induced effect portion is $0.18.

Figure 2 supplements Table 4 by providing a visual representation of the industry effects, along with the component indirect and induced contributions. Since the relative distribution across industries is similar across versions of Model 1 (except for, obviously, the impact to wholesale trade), we restrict our attention to the model that explicitly accounts for opportunity costs. As expected, the food sold-farm sector receives the largest positive impact ($180,606) from the change in final demand. The impact is almost entirely from indirect effects. The finance and insurance sector has the second largest positive impact, $55,952 of which is from indirect effects, the remaining $24,908 is a result of induced impacts. The food sold-nonfarm sector has the third largest total impact ($77,988), almost entirely due to indirect impacts. Real estate and rental has the fourth largest impact ($47,340), of which roughly one-third are due to indirect impacts and the other two-thirds due to induced impacts. The health and social services sector is next ($30,319) where almost all of the impacts to this sector are attributed to consumer spending and are thus induced impacts.

[Figure 2 here]

Model 2: multiplier and distributional impacts

Comparable results to Table 4 (Model 1) are shown for Model 2 in Table 5. Here,

when opportunity costs are not considered, the combined indirect and induced effects are now $748,074. Considering the direct effect of $1M, this implies a gross output multiplier of 1.75, 4.0% higher than its counterpart in Model 1. The relative allocation to indirect effect (0.51) and induced effect (0.24) are similar to that for Model 1.

[Table 5 here]

The consideration of opportunity costs remains important to the impact results. Now, the additional negative shock to the wholesale trade sector results in reduced indirect and induced effects to $566,443, implying a net output multiplier of 1.56, and reflecting an 11% decrease when accounting for opportunity cost.

As with Model 1, the relative distribution of effects is similar across versions of Model 2. We restrict our attention to the model that explicitly accounts for opportunity costs. Figure 3 provides a visual representation of the industry effects, along with the component indirect and induced contributions. As expected, the food hub farm sector receives the largest positive impact ($194,582) from the change in final demand, and is almost entirely from indirect effects. When we compare the farm-level impacts to Model 1, we see a 7% increase.

[Figure 3 here]

The ranking of the top five sector effects remain the same as that with Model 1. Notably, support activities for agriculture and forestry are considerably higher in Model 2 ($15,477) than Model 1 ($3,196), reflecting the higher industry linkages with this sector by food hub farms (Table 5).

Food Hub customer survey results

Customers were asked a series of questions to better understand the extent to which

their purchases from RA displaced other purchases and/or expanded their total procurement of locally-grown or processed products. The majority of customers (79%) reported that the existence of RA enabled their business to expand product offerings (either in terms of type of items offered or quantity) (n=166). Of those businesses who responded that RA enabled them to expand offerings, on average, they indicated that their total number of available products increased by 17%.

We also asked businesses if they purchased fewer products from other distributors in 2011 due to their relationship with RA. Accordingly, 49% reported that they purchased less product, 46% report that their purchases from RA did not impact their purchases from other distributors, and 5% reported that they did not know (n=164). For those who responded that purchases from RA decreased their purchases from other distributors, they estimated their average amount of purchases from other distributors decreased by 23% (n=69). This was the information used above to estimate opportunity costs of expanded RA sales.

Finally, business customers were asked a series of questions addressing the market potential for the food hub sector to scale up (i.e., if RA expanded its delivery routes/days, more products, etc. would the customers purchase more product). Though we know asking questions about the possibility for expanded sales from RA's customers presents a limited view of the potential to scale the food hub sector, the responses provide some clarity into the unmet demand for food hub outputs. Most business customers (67%) reported that they were interested in making additional purchases if RA expanded its product availability, delivery routes, or times. (n=167). Customers were asked to elaborate on the ways in which RA could expand that would

cause them to purchase additional product: 73% of customers cited that expanded product offerings would result in their business purchasing more product; 40% of customers reported that improved logistics would support increased ordering. While some of customers mentioned they would create room for more local products if RA carried them, others explicitly said they would purchase more from RA at the expense of other distributors. This reiterates the importance of considering opportunity cost when considering the expandability/scalability of the food hub sector.

Discussion and conclusions

This paper provides a replicable empirical framework to conduct impact assessments for food hub organizations. By collecting detailed expenditure and sales information from food hubs, a SAM analysis-by-parts approach was used to estimate the multiplier effects of a change in final demand for food hub products. In addition, by collecting similar detailed-level information from food hub farms, the downward bias in using default agricultural production data can be lessened and result in more accurate assessments of a food hub's economic activity. Finally, by collecting detailed customer (downstream) information on purchasing patterns from food hubs, a better understanding of the important factors affecting the growth and scalability of food hubs as business enterprises can be attained, along with estimating the opportunity costs associated with increases in food hub product purchases (i.e., offsets via decreases in purchases in other sectors).

Our particular application considered RA, a food hub operating in NYS. Importantly, we demonstrate that the farms selling to the food hub have different production functions than those that are constructed by default using an aggregate

NYS farm sector in IMPLAN – i.e., the SAM coefficients found in the default IMPLAN agricultural sectors do not accurately reflect activities of the food hub farms in our study. From the comparative modeling exercise, we show that the estimated multiplier effects on the farm sector are 7% lower when using the default data and, overall, the total output multiplier is biased downward by 4%. If the farms in our case study are shown to be typical in other studies, the impact of food hubs utilizing default IMPLAN agricultural sector data will likely under-estimate the true magnitude of the local economic impact. This is an expected result, given that food hub farms spend more money in the local economy. Further, additional spending by the food hub farms per unit of output on employee compensation, other agricultural sectors, and support activities for agriculture and forestry, may be particularly important for rural economies. Of more fundamental importance to the rural economy is the ability of food hubs to strengthen the interlinked network of business to business and business to customer sales within the region is important.

Results from the model incorporating food hub-farm specific data show a gross output multiplier of 1.75. However, using customer data, we estimate that for every $1 increase in final demand for food hub products, a $0.11 net offset in purchases from other sectors occur. After accounting for this offsetting negative shock, the output multiplier is 1.57, reducing the gross multiplier by 12%. Future impact assessments on food hubs should importantly consider opportunity costs.

Customer survey results provide evidence that there are opportunities for expansion within the food hub sector, primarily through improved logistics (e.g., lower minimum order sizes and increased frequency of deliveries) and expanded

product offerings. Based on our findings, policies resulting in increased final demand for food hub products will have a positive community economic impact (even when opportunity costs are considered).

As discussed earlier in this paper, our results are based on one case study, and thus extending the results beyond the methodological recommendations may be problematic, particularly for food hubs whose business model is considerably different (e.g., include food processing). Though we caution against generalizing the results of our case study to other food hubs, in the context where a food hub operates in a region with similar scale producers growing similar commodities, and performs similar functions, analysts without the resources to collect local food hub and farm data are likely to find the case study data preferable to IMPLAN farm sector default data. Further, given that Fischer, et al. (2013) estimate a very similar level of COGS, and the Farm Credit Council (2013) estimate similar expenditures on employee compensation, this may give some indication that RA, in some capacities, exhibits an expenditure pattern similar to an average food hub. In any case, the data collection procedure described can be used by researchers interested in conducting similar studies of food hub operations.

Future research

There are many areas for future research that emerged from this project. We fully support the recommendations of O'Hara and Pirog (2013) that "collective understanding of the relationship between local foods and economic development can be enhanced through improving data collection, undertaking studies on larger geographic scales…and forming a learning community to review and critique studies"

(1).

Our results provide strong evidence that economic impact assessments of food hubs will underestimate local impacts if they depend on IMPLAN default data, and thus will benefit from data collection from farm participants. The challenge is that this type of data collection is time consuming and expensive; as presented, the data needs for this type of research are significant. The USDA Agricultural Resource Management Survey (ARMS) data provide a valuable source of information on farm expenditure patterns, but the sample size for local food system participants (not to mention those selling to food hubs) is extremely small. In addition, there is no useful information on *location* of expenditures. This information would be extremely useful, and facilitate more regular evaluation of these types of initiatives.

This study presents information based on one case study, and the broader application of its recommendations will clearly benefit from refinement via a learning community. Recently completed studies from Fischer, et al. (2013), as well as Farm Credit Council and Farm Credit East (2013), will help to determine, for example, the extent to which RA's expenditure pattern, as well as the expenditure pattern of food hub farms, are similar to other food hubs and participating producers. For example, how do the economic impacts of food hubs change when a hub works only with fresh product producers (i.e., no value added products)? Further, our food hub farm survey was designed to correspond to IMPLAN sectors, rather than to farm profit and loss statements. There are merits and weaknesses to this approach, and as data of this sort continues to be collected, future research to determine more standardized data protocol is extremely important – particularly to compare the results across studies.

Finally, we recommend additional research that compares different models and structures for aggregating and moving locally-grown products into different types of market outlets. Conducting market channel assessment studies similar to those conducted by Hardesty and Leff (2010) and LeRoux et al. (2010) are recommended to better understand the net impact of food hubs on participating producers, particularly in comparison to other available market outlets.

References

Abatekassa, G., and H.C. Peterson. 2011. Market access for local food through the conventional food supply chain. *International Food and Agribusiness Management Review* 14(1):63–82.

Barham, J. 2011. Regional Food Hubs: Understanding the scope and scale of food hub operations. Preliminary findings from a national survey of regional food hubs. Available at: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5090409. Accessed September 10, 2013.

Barham, J., J. Fisk, S. Collier, and D. Carmody. 2011. Food hubs: Viable regional distribution solutions. Available at: http://ngfn.org/resources/ngfn-cluster-calls/food-hubs-viable-regional-distribution-solutions. Accessed October 13, 2012.

Barham, J., D. Tropp, K. Enterline, J. Farbman, J. Fisk, and S. Kiraly. 2012. Regional food hub resource guide. Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service. Available at: http://www.ams.usda.gov/AMSv1.0/foodhubs. Accessed August 30, 2012.

Boys, K.A., and D.W. Hughes. 2013. A regional economics-based research agenda for local food systems. *Journal of Agriculture, Food Systems, and Community Development* 3(4):145–150.

Clancy, K. 2010. A priority research agenda for agriculture of the middle. Available at: http://www.agofthemiddle.org/archives/2010/05/a_priority_rese.html. Accessed December 12, 2013.

Clancy, K., and K. Ruhf. 2010. Report on some regional values chains in the Northeast. Unpublished, The Northeast Regional Lead Team Project. Available at: http://api.ning.com/files/IiF-TRTMJ7aJESrTdpgXWIRDMneztcST-OvdbJbYwLUa0w0bguBqWMHZoADw0bNSQY8CaJ3UL6Vzbx0vqCW6g6rKgpUkBAFY/NESAWGValueChainReport12710.pdf. Accessed August 31, 2012.

Conner, D., W. Knudson, M. Hamm, and H.C. Peterson. 2008. The food system as an economic driver: strategies and applications for Michigan. *Journal of Hunger & Environmental Nutrition* 3(4):371–383.

Conner, D., A. Nowack, J. Berkenkamp, G.W. Feenstra, J.V.S. Kim, T. Liquori, and M. Hamm. 2011. Value chains for sustainable procurement in large school districts: Fostering partnerships. *Journal of Agriculture, Food Systems, and Community Development* 1(4):55-68.

Cuomo, A. 2013. Governor Cuomo announces $3.6 million in CFA funding for food distribution hubs. *Governor's Press* Office. Available at: http://www.governor.ny.gov/press/cuomo-announces-3-6-million-cfa. Accessed December 12, 2013.

Day-Farnsworth, L., and A. Morales. 2011. Satiating the demand: Planning for alternative models of regional food distribution. *Journal of Agriculture, Food Systems, and Community Development* 2(1):227–247.

Diamond, A., and J. Barham. 2011. Money and mission: Moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development* 1(4):101-117.

Farm Credit Council and Farm Credit East. 2013. Financial Benchmark Metrics and Measurements for Regional Food Hubs. Available at: http://www.ngfn.org/resources/ngfn-cluster-calls/financial-benchmarks-for-food-hubs. Accessed September 10, 2013.

Feenstra, G., P. Allen, S. Hardesty, J. Ohmart, and J. Perez. 2011. Using a supply chain analysis to assess the sustainability of farm-to-institution programs. *Journal of Agriculture, Food Systems, and Community Development* 1(4):69–84.

Fischer, M., M. Hamm, R. Pirog, J. Fisk, J. Farbman, and S. Kiraly. 2013. Findings of the 2013 national food hub survey. The Center for Regional Food Systems, Michigan State University. Available at: http://foodsystems.msu.edu/activities/food-hub-survey. Accessed September 18, 2013.

Food Marketing Institute. 2008. Marketing costs. Available at: http://www.fmi.org/docs/facts-figures/marketingcosts.pdf?sfvrsn=2. Accessed June 26, 2013.

Gunter, A., and D. Thilmany. 2012. Economic implications of farm to school for a rural Colorado community. *Rural Connections: a Publication of the Western Rural Development Center* 6(2): 13-16.

Hardesty, S., G. Feenstra, D. Visher, T. Lerman, D. Thilmany-McFadden, A. Bauman, T. Gillpatrick, and G.N. Rainbolt. forthcoming. Values-based supply chains: Supporting regional food and farms. *Economic Development Quarterly*.

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.

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.

Jablonski, B.B.R., J. Perez-Burgos, and M.I. Gómez. 2011. Food value chain development in central New York: CNY Bounty. *Journal of Agriculture, Food Systems, and Community Development* 1(4):129–141.

Jensen, J.M. 2010. Local and regional food systems for rural futures. Columbia, MO: Rural Policy and Research Institute.

King, R., M.S. Hand, G. DiGiacomo, K. Clancy, M.I. Gómez, S.D. Hardesty, L. Lev, and E.W. McLaughlin. 2010. Comparing the structure, size, and performance of local and mainstream food supply chains (ERR-99). Washington, DC: U.S. Department of Agriculture, Economic Research Service.

Lazarus, W.F., D.E. Platas, G.W. Morse, and S. Guess-Murphy. 2002a. Evaluating the economic impacts of an evolving swine industry: The importance of regional size and structure. *Review of Agricultural Economics* 24(2):458-473.

Lazarus, W.F., D.E. Platas, and G.W. Morse. 2002b. IMPLAN's weakest link: Production functions or regional purchase coefficients? *Journal of Regional Analysis and Policy*, 32(1):33–49.

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.

Liu, Z., and M. Warner. 2009. Understanding geographic differences in child care multipliers: Unpacking IMPLAN's modeling methodology. *Journal of Regional Analysis & Policy* 39(1):71-85.

Low, S.A., and S. Vogel. 2011. Direct and intermediated marketing of local foods in the United States (ERR-128). Washington, DC: U.S. Department of Agriculture, Economic Research Service.

Martinez, S., M. Hand, M. DaPra, 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). Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Matson, J., M. Sullins, and C. Cook. 2011. Keys to success for food hubs. *Rural Cooperatives* 78(3):9-11.

Miller, R.E., and P.D. Blair. 2009. *Input-output analysis: foundations and extensions,* 2nd ed. New York, NY: Cambridge University Press.

Myles, A., and K. Hood. 2010. Economic impact of farmers' markets in Mississippi. Extension Service of Mississippi State University. Available at: http://msucares.com/pubs/publications/p2582.html. Accessed August 23, 2013.

National Good Food Network (NGFN). 2010. Food hub center. http://www.ngfn.org/resources/food-hubs#section-12. Accessed October 1, 2013.

O'Hara, J., and R. Pirog. 2013. Economic impacts of local food systems: Future research priorities. *Journal of Agriculture, Food Systems, and Community Development* 3(4):35-42.

Otto, D., and T. Varner. 2005. Consumers, vendors, and the economic importance of Iowa farmers' markets: An economic impact survey analysis. Iowa State University.

Richards, T.J., and G. Pofahl. 2010. Pricing power by supermarket retailers: A ghost in the machine? *Choices: The Magazine of Food, Farm & Resource Issues* 25(2):1-12.

Rozyne, M. 2009. Innovations in value chain infrastructure-Red Tomato. Available at: http://ngfn.org/resources/ngfn-cluster-calls/innovations-in-value-chain-infrastructure-red-tomato-1. Accessed October 13, 2012.

Sadler, R.C., M.A.R. Clark, and J.A. Gilliland. 2013. An economic impact comparative analysis of farmers' markets in Michigan and Ontario. *Journal of Agriculture, Food Systems, and Community Development* 3(3):61–81.

Schmidt, M.C., and J.M. Kolodinsky. 2011. Increasing farm income and local food access: A case study of a collaborative aggregation, marketing, and distribution strategy that links farmers to markets. *Journal of Agriculture, Food Systems, and Community Development* 1(4):157-175.

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 Series, Dyson School of Applied Economics and Management, Cornell University.

Sexton, R.J. 2010. Grocery retailers' dominant role in evolving world food markets. *Choices: The Magazine of Food, Farm & Resource Issues* 25(2):1-13.

Slama, J., K. Nyquist, and M. Bucknum. 2010. Local food system assessment for Northern Virginia. Oak Park, IL: FamilyFarmed.org. Available at: http://www.farmlandinfo.org/local-food-system-assessment-northern-virginia. Accessed December 11, 2013.

Stevenson, G.W., and R. Pirog. 2008. Values-based supply chains: Strategies for agrifood enterprises of the middle. In *Food and the mid-level farm: renewing*

an agriculture of the middle, T.A. Lyson, G.W. Stevenson, and R. Welsh (eds.). Cambridge, MA.: MIT Press, pp.119–143.

Swenson, D. 2011. Exploring small-scale meat processing expansions in Iowa. Leopold Center for Sustainable Agriculture, Iowa State University.

Swenson, D. 2010. Selected measures of the economic values of increased fruit and vegetable production and consumption in the Upper Midwest. Leopold Center for Sustainable Agriculture, Iowa State University.

The National Research Committee on Twenty-First Century Systems Agriculture (The National Research Committee). 2010. *Toward sustainable agricultural systems in the 21st Century*. Washington, D.C.: The National Academies Press.

Thilmany, D., N. McKenney, D. Mushinski, and S. Weiler. 2005. Beggar-thy-neighbor economic development: A note on the effect of geographic interdependencies in rural retail markets. *The Annuals of Regional Science* 39(3):593–605.

Tropp, D., E. Ragland, and J. Barham. 2008. Supply Chain Basics: The Dynamics of Change in the U.S. Food Marketing Environment. Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Tuck, B., M. Haynes, R. King, and R. Pesch. 2010. The economic impact of farm-to-school lunch programs: A Central Minnesota example. The University of Minnesota.

U.S. Department of Agriculture's Know Your Farmer, Know Your Food Regional Food Hub Subcommittee (USDA KYF). 2011. Potential USDA programs to support regional food hub development. Available at: http://www.ngfn.org/resources/ngfn-database/knowledge/Regional%20Food%20Hub%20Resources%20from%20USDA%20v1.pdf. Accessed October 1, 2013.

Appendix 1: Regional Access sector aggregation scheme

Regional Access Expense	Model Sector	Original 2-digit NAICS sectors	Revised IMPLAN sectors
--	11 Ag Forestry Fishing and Hunting*	1-19	5, 7-9, 15-18
Food Sold – farm	Food Sold – farm	--	1-4, 6, 10-14
--	Support activities for agriculture and forestry	--	19
--	21 Mining	20-30	20-30
Utilities – electric	22 Utilities	31-33	31-33
--	23 Construction	34-40	34-40
--	31-33 Manufacturing*	41-318	41, 42, 48, 49, 71-114, 116-318
Food Sold - Nonfarm	Food Sold - Nonfarm	--	43-47 + 50-70
Fuel Expense	Petroleum Refineries	--	115
	42 Wholesale trade [a]	319	319
--	44-45 Retail trade* [a]	320-331	320-325, 327-331
Fuel Expense	Retail stores – Gasoline stations [a]	--	326
--	48-49 Transportation and Warehousing	332-340	332-340
--	51 Information	341-353	341-353
--	52 Finance and Insurance	354-359	354-359
--	53 Real estate and rental*	360-366	360, 361, 363-366
Rental truck expense; lease trucks	Automotive equipment rental and leasing	--	362
--	54 Professional-scientific and technical services	367-380	369-380
--	55 Management of companies	381	381
--	56 Administrative and waste services	382-390	382-390
--	61 Educational Services	391-393	391-393
--	62 Health and social services	394-401	394-401
--	71 Arts-entertainment and recreation	402-410	402-410
--	72 Accommodation and food service	411-413	411-413
--	81 Other services*	414-426, 433-436	415, 416, 418-421, 423-426, 433-436
Truck repairs and maintenance	Automotive repair and maintenance, except car washes; Commercial and industrial machinery and equipment repair and maintenance	--	414, 417
--	92 Government and Non NAICS	427-432, 437-440	427-432, 437-440

*Edited 2-digit NAICS sector
[a] Sector requires margining

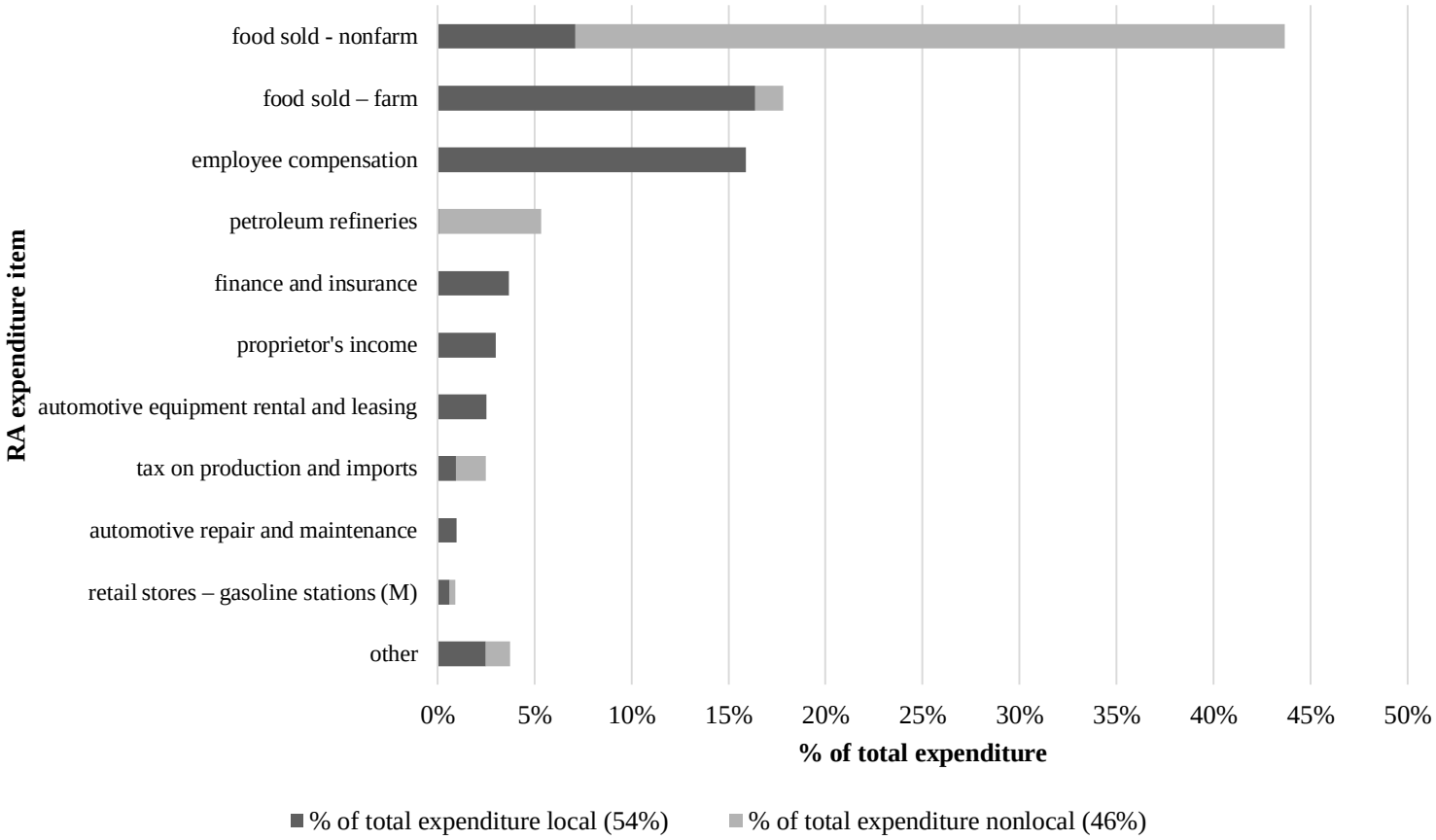

Figure 1. RA expenditures as percentage of total, local and nonlocal
(M) margined sector

Table 1. Food hub farm average expenditures by IMPLAN sector and % local

	Average Expenditure by Category		
Food hub farm expenditure by IMPLAN category	Local ($)	Local (%)	Total ($)
employee compensation	$ 141,644	100%	$ 141,644
food sold – farm	$ 95,282	93%	$ 102,884
manufacturing*	$ 16,330	16%	$ 99,089
support activities for agriculture and forestry	$ 47,377	92%	$ 51,496
tax on production and imports [b]	$ 33,694	100%	$ 33,694
proprietor's income	$ 31,913	100%	$ 31,913
transportation and warehousing [a]	$ 19,821	80%	$ 24,755
wholesale trade (M) [a]	$ 9,349	53%	$ 17,768
finance and insurance	$ 13,106	85%	$ 15,403
other property type income	$ 11,467	80%	$ 14,334
construction	$ 13,980	99%	$ 14,143
retail trade*(M)	$ 9,360	83%	$ 11,281
utilities	$ 10,901	100%	$ 10,901
real estate and rental*	$ 8,604	100%	$ 8,604
food sold - nonfarm	$ 5,872	75%	$ 7,843
professional-scientific and technical services	$ 5,569	98%	$ 5,690
automotive repair and maintenance	$ 5,646	100%	$ 5,646
information	$ 1,793	96%	$ 1,864
administrative and waste services	$ 1,217	100%	$ 1,217
other services*	$ 817	87%	$ 941
Total	$ 483,741	80% [b]	$ 601,110

*Edited 2-digit NAICS sector
(M) margined sector
[a] We asked food hub farms how much they purchased from Regional Access as a percentage of total expenses. On average, food hub farms reported spending $6,398 on products from RA, including freight service, other farm products (i.e., products for re-sale at a farm stand), and warehousing/storage. In this table we show these expenditures mapped evenly between 'wholesale trade' and 'transportation and warehousing'.

Table 2. Food hub farm sales, average and percent local

Food Hub Farm Sales by Outlet	Sales Average ($)	Local (%)
other farms	$102,884	93%
direct-to-consumer (households)	$144,173	100%
food hub (Regional Access)	$37,200	100%
other intermediated sales	$279,701	84%
commodity sales	$37,152	100%
Total	$601,110	91%

Table 3. Summary of expenditure patterns per dollar of output for the default agricultural sector (food sold-farm) and the food hub farm sector

	Value of purchases per dollar of output	
Selected Industry Sector/Value Added Components	Food Sold - Farm (Default)	Food Hub Farm
food sold-farm [a]	$0.06	NA
food hub farm [a]	NA	$0.16
other farm [a]	NA	$0.00
support activities for agriculture and forestry	$0.02	$0.08
utilities	$0.02	$0.02
construction	$0.00	$0.02
manufacturing	$0.02	$0.03
wholesale trade	$0.01	$0.02
retail trade	$0.00	$0.02
transportation and warehousing	$0.01	$0.03
finance and insurance	$0.04	$0.02
real estate and rental	$0.05	$0.01
professional scientific and technical services	$0.01	$0.01
automotive and machinery repair and maintenance	$0.00	$0.01
other sector purchases	$0.01	$0.02
Total intermediate purchases	$0.25	$0.44
employee compensation	$0.12	$0.24
proprietor's income	$0.16	$0.05
other property type income [b]	$0.12	$0.02
tax on production and imports [b]	$0.00	$0.05
Total payments to value added	$0.40	$0.36
Intermediate imports	$0.35	$0.20

[a] *This table reports results from Model 1 and Model 2. The default agricultural sector exists as the food sold - farm sector in Model 1, and the food hub farm sector and the other farm sector exist in Model 2; i.e., Model 2 splits the default agricultural sector into two distinct sub-sectors based on the survey data.*
[b] In our models, all of other property type income and tax on production and imports are rendered exogenous.

Table 4. Model 1 output results of a million dollar increase in food hub final demand

Industry Sectors	Indirect plus Induced Impacts	
	No Opportunity Cost	Opportunity Cost
food sold-farm	$180,742	$180,606
finance and insurance	$89,424	$80,860
food sold-nonfarm	$78,588	$77,988
real estate and rental	$57,853	$47,340
all other sectors	$54,412	$42,532
health and social services	$37,270	$30,319
automotive equipment rental and leasing	$25,854	$25,727
professional scientific and technical services	$23,894	$16,265
retail trade	$23,116	$18,903
utilities	$18,967	$17,261
information	$18,079	$14,435
accommodation and food service	$17,753	$15,264
wholesale trade	$17,534	-$100,236
manufacturing	$14,029	$12,246
automotive and machinery repair and maintenance	$11,705	$11,275
transportation and warehousing	$11,222	$8,032
support activities for agriculture and forestry	$3,199	$3,196
Total industry sectors	$683,642	$502,011

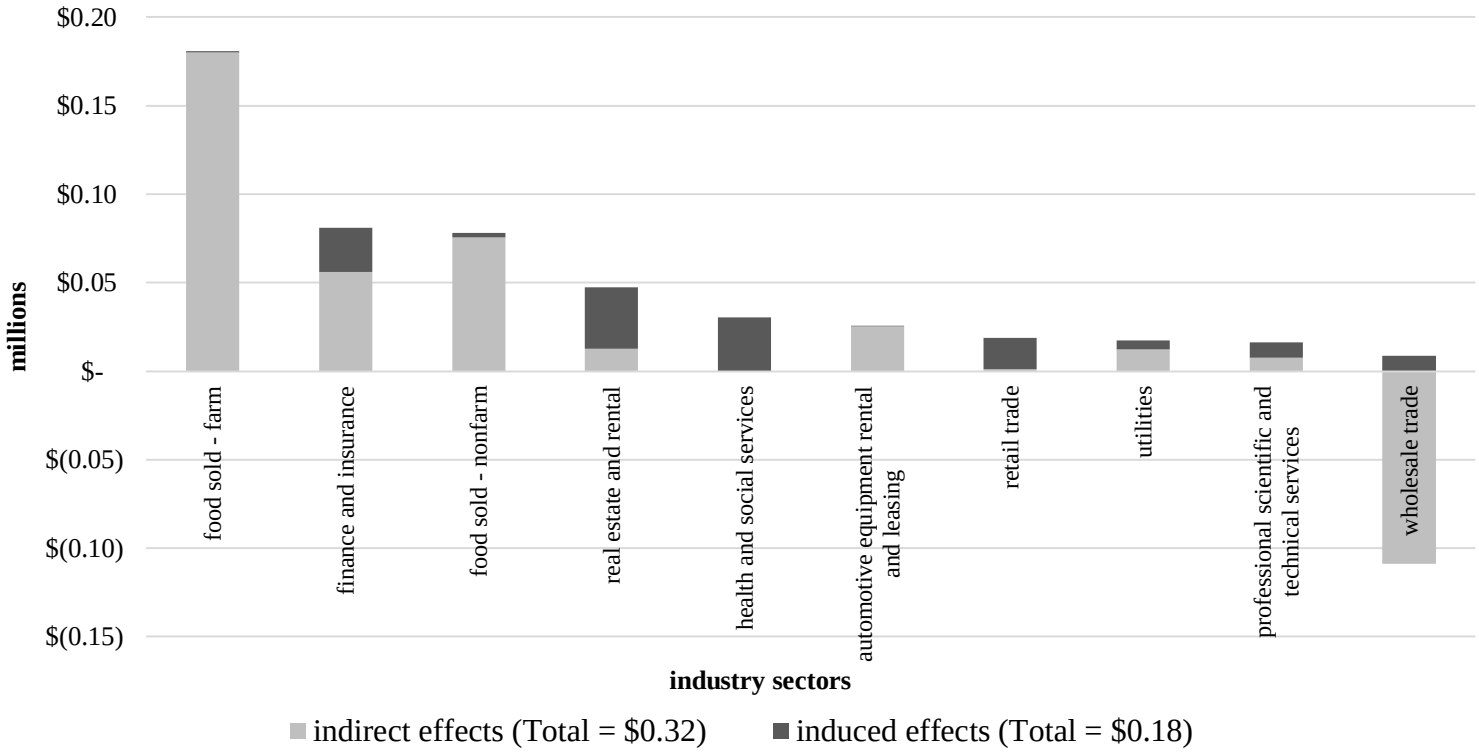

Figure 2. Indirect and induced effects per $1,000,000 increase in final demand (top impacted industry sectors), Model 1 including opportunity cost

Table 5. Model 2 impact results

Industry Sectors	Indirect plus Induced Impacts	
	No Opportunity Cost	Opportunity Cost
food hub farm	$194,583	$194,582
finance and insurance	$89,695	$81,131
food sold - nonfarm	$80,513	$79,912
all other sectors	$60,408	$48,528
real estate and rental	$54,820	$44,308
health and social services	$40,224	$33,272
retail trade	$27,898	$23,684
professional scientific and technical services	$26,374	$18,745
automotive equipment rental and leasing	$25,801	$25,674
utilities	$20,477	$18,771
information	$19,527	$15,884
wholesale trade	$19,226	-$98,544
accommodation and food service	$18,614	$16,125
manufacturing	$16,657	$14,873
transportation and warehousing	$16,402	$13,212
support activities for agriculture and forestry	$15,481	$15,477
automotive and machinery repair and maintenance	$13,598	$13,168
other farm	$7,775	$7,640
Total industry sectors	$748,074	$566,443

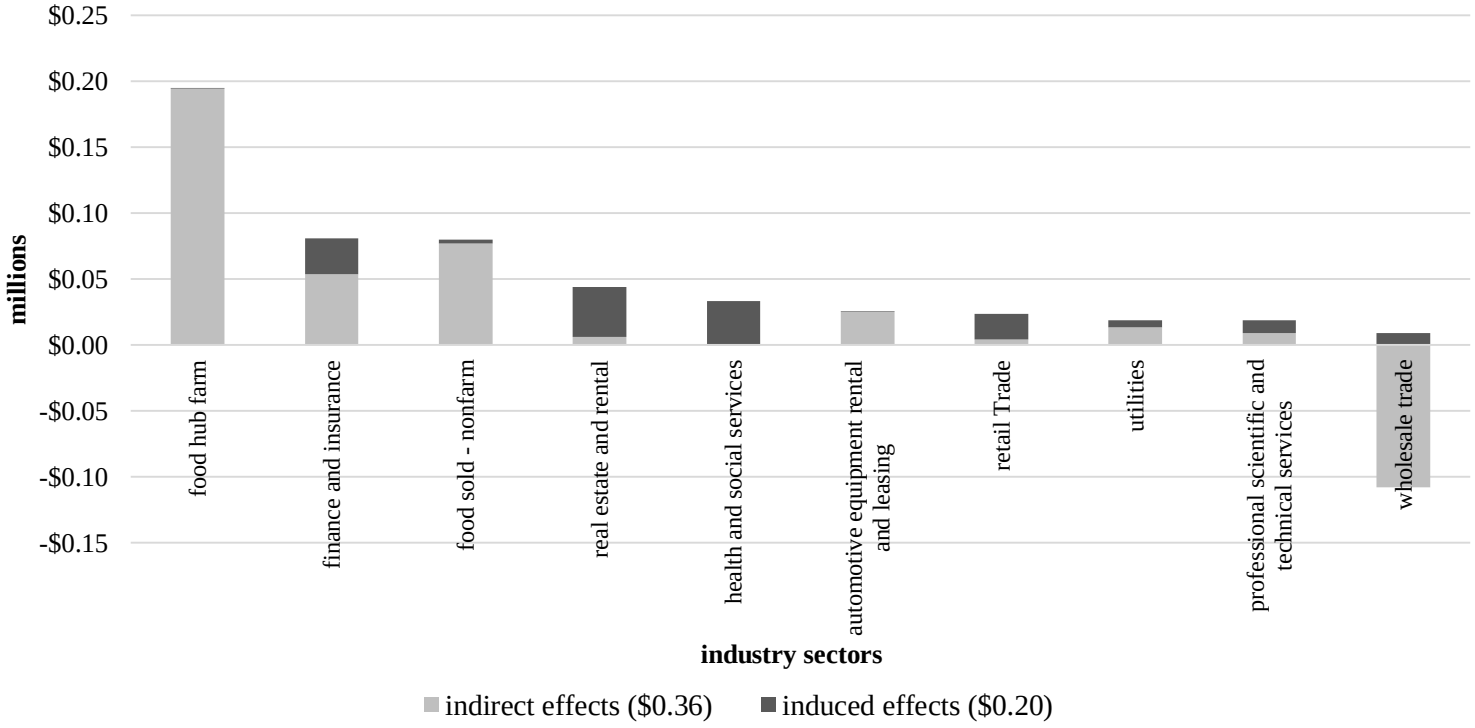

Figure 3. Indirect and induced effects per $1,000,000 increase in final demand (top impacted industry sectors), Model 2 including opportunity cost

PAPER 3

INCREASING ACCESS TO 'LOCAL' FOOD: EVALUATING THE FARM LEVEL IMPACTS OF FOOD HUB DEVELOPMENT

The demand for local food is concentrated in urban areas (Lichter and Brown 2011; Hinrichs and Charles 2012; Jablonski forthcoming; Jackson-Smith and Sharp 2008; Low and Vogel 2011; USDA ERS 2012). It is therefore no surprise that Low and Vogel (2011) use 2008 U.S. Department of Agriculture (USDA) Agricultural Resource Management Survey (ARMS) data to demonstrate that most local food is sold through intermediated markets (defined by King et al., 2010, as a supply chain for a local product that reaches consumers through one or more intermediaries). This suggests that growth in local food sales will require intermediaries to move product from farm-to-market.

The widespread agreement that there remains unmet demand for locally-grown food (e.g., Hardesty 2008; Baker, et al. 2009; Stephenson and Lev 2004; Schneider and Francis 2005) implies that there is a failure at some point (or multiple points) along the supply chain. Based on their comprehensive literature review, Martinez et al. (2010) conclude that the unmet demand is largely a result of the "lack of distribution systems for moving local foods into mainstream markets" (iv).

Accessing appropriately scaled markets can be difficult for small- and mid-

sized farms as supply chains become more vertically-integrated and consolidated. Large-scale supermarket retail and wholesale operations demand large volumes, low prices, and consistent quantities and qualities that must meet increasingly strict safety standards. The procurement systems in such markets are often vertically and horizontally integrated, global in scale, and aim to maximize efficiency (e.g., King et al. 2010; Richards and Pofahl 2010; Sexton 2010; Tropp, et al. 2008).

In order to facilitate market access for small- and mid-scale farms, and improve consumer access to locally-grown foods, public agencies and private foundations are increasingly financing and promoting 'food hub' development (e.g., NGFN 2013; USDA KYF 2011; Cuomo 2013). Following the USDA's working definition, a 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).

Despite the increase in public and private support for food hubs, there has been little work to evaluate their impact. Efforts to assess the impacts of local food system activities generally, and food hubs specifically, are often complicated by a lack of available data necessary for evaluation. The primary objective and contribution of this paper is to better understand the extent to which food hubs increase consumer access to locally-grown and processed products, enhance farm-entrée to markets, and support farm viability. Given the significant data needs to conduct this type of analysis, we use a case study approach, examining a food hub located in New York State (NYS). Accordingly, we conducted surveys with over 300 food hub customers, and in-depth

interviews with 30 farms and 15 processors that sell food products to our case study food hub.

The rest of this paper begins with a review of the literature related to assessment of food hub impacts on overall supply of local food and farm viability. Next, we present information about our methodology and case study food hub. We then conclude with our results, discussion, and recommendations for future research.

Literature review

There is a bourgeoning literature on food hubs mostly focused on descriptive statistics (e.g., Barham et al. 2012; Bloom and Hinrichs 2011; Clancy and Ruhf 2010; Matteson et al. 2013; Fischer et al. 2013), or feasibility, best practices, and opportunities to support farm and community development (e.g., Abatekassa and Peterson 2011; Conner et al. 2008; Diamond and Barham 2011; Feenstra et al. 2011; Hardesty et al., forthcoming; Hoshide 2007; Jarosz 2000; King and Venturini 2005; Stevenson and Pirog 2008; Day-Farnsworth and Morales 2011).[33] The espoused benefits of food hubs include: 1) expanded farm access to market, particularly for mid-scale producers; 2) price premiums for farms through maintained source identification; 3) decreased market costs for farms through resource-sharing; and 4) better access to healthy fruits and vegetables for low income consumers (e.g., Cohen and Derryck 2011; Diamond and Barham 2011; Hoshide 2007; Jablonski et al. 2011; King et al. 2010; Painter 2007; Stevenson and Pirog 2008; Trauger 2009; Schmidt et al. 2011).

Though this literature is useful in many respects, as a whole it does not provide

[33] For a more comprehensive literature review of food hubs and values-based supply chains, see: Lerman (2012a; 2012b)

a critical perspective with enough information to discern the ability of food hubs to expand total local food availability or assess the impact of food hub development on farm profitability. Pointedly, Boys and Hughes (2013) find that scant research exists that explores the extent to which local food infrastructure development 'cannibalizes' sales from other markets. They find that the limited available evidence points to what Thilmany et al. (2005) refer to as a 'beggar thy neighbor' phenomenon taking place, where support for new market development results in diverted sales from other previously established markets.

The extent to which food hub development displaces other local food sales has not been explored. King et al. (2010) studied 15 supply chains in five U.S. states and show that locally-grown food is available from mainstream, intermediate, and direct markets. However, they do not analyze the extent to which growth in sales in one market outlet impacts sales in another. Likewise, Abatekassa and Peterson (2011) identify competition between local independent food retailers and alternative market outlets in their examination of the relationships and linkages between the conventional supply chain actors (wholesale and retailers) and local food producers in Southeast Michigan, but they do not look at the impacts of this competition on total availability of local food or farm viability.

There are several studies that discuss farm-level impacts resulting from food hub development. Schmidt et al. (2011), for example, conducted a study of the Intervale Food Hub in Vermont and found that there were many farm-level benefits, including price premiums over other wholesale channels. They write that "many farmers reported an increase in their farm's food production, sales and income because

of their Intervale Food Hub account" but do not elaborate on this point (i.e., how many farms? by how much?). Additionally, the authors acknowledge that at the time the article was written, the hub had not reached a break-even point for operations and was supported by public and private grant subsidies. Jablonski et al. (2011) suggest that there is evidence that their case study food hub, CNY Bounty, reduced marketing and distribution costs for farmers. In their recommendations for future research they provide data from one farm comparing hours spent marketing and distributing product by market channel, percent of total sales, and percent of final price received (138). They find that though only eight percent of the farm's total sales are through the food hub, the marketing and distribution costs are relatively lower compared to other channels, and percent of final price received by the farm relatively high. However, they only conducted this type of analysis for one farm, thus limiting the expandability of their results. Further, like the Intervale Food Hub, the authors acknowledge that CNY Bounty is grant-dependent.

The report by King et al. (2010) is the only one that provides strong evidence that localized supply chains can enhance farm viability. They find that farms receive a greater share of retail prices in local food supply chains than in mainstream chains, with "net revenue per unit in local chains rang[ing] from about equal to more than seven times the price received in mainstream chains" (v). However, their report does not delineate the extent to which the availability of localized supply chains expand overall farm sales (versus diverting sales from one market to another) or consumer access to locally-grown goods.

Methodology: case study

We decided to use a case study approach given the detailed data needs to conduct this type of assessment. We chose Regional Access, LLC (RA) because they fit within the USDA's regional food hub definition as an aggregation and distribution business that is committed to supporting local farmers and preserve source-identification. In addition, we thought RA's length of time in operation, the diversity of its customer base, and its operation size made it an interesting business to examine. RA was established in 1989. In 2011, it had over $6 million in sales, and employed 32 full-time equivalent employees. Utilizing 9 vehicles and a 25,000 square foot warehouse, RA aggregates and delivers products primarily throughout NYS. RA has over 3,400 product listings, including beverages, breads, cereals, flour, meats, produce, prepared foods, grains, and fruits and vegetables. RA purchases products directly from 96 farm vendors, 65 specialty processors (nonfarm vendors), as well larger-scale foodservice distributors. The products are sold to over 600 customers, including: individual households, restaurants, institutions, other distributors, fraternities and sororities, buying clubs, retailers, manufacturers, and bakeries. RA also provides freight services to a range of businesses.

RA provided a list of the vendors from which they purchase product as well as the customers to which they sell product. We divided the vendor list into farm vendors and nonfarm vendors, and separated the list based on whether or not the vendor was located in NYS. We conducted in-person interviews with 30 farm vendors (out of 86 located in NYS) as well as with 15 nonfarm vendors (out of 55 located in NYS).[34] We

[34] A copy of the interview protocol for the farm vendor or nonfarm vendor interviews is available upon request.

conducted in-person interviews with the vendors due to the sensitive nature of some of the questions.

It is very difficult to discern the precise role that a food hub plays in terms of enhanced farm viability or profitability, as each aspect of the supply chain may play an important role (i.e., without access to credit a farm is unlikely to be viable even if it has terrific market access). Given this challenge, we determined to understand the farmer's perspective of the role that the food hub played in supporting business expansion or viability. Vendors were therefore asked a series of questions related to: 1) the percentage of their total sales facilitated by RA; 2) the extent to which their relationship with RA expanded their overall business; and 3) other key pieces of infrastructure that facilitated farm business expansion or viability.

The 30 farms interviewed were located in every region of NYS except New York City and Long Island.[35] Of the farms from which RA purchased product, 50% classified their operation as 'small' ($1,000-$249,999 in gross sales), 20% percent as 'medium' ($250,000-$500,000 in gross sales), and 30% as 'large' (over $500,000 in gross sales). When asked to classify their farms' primary production category, 37% percent identified meat and livestock, 30% fruit and vegetable, and 33% value-added.[36]

Of the 15 nonfarm vendors interviewed, they classified their primary business

[35] Regional location of firms follows from Empire State Development's delineation of ten regions throughout the state, including Western New York, Finger Lakes, Southern Tier, Central New York, Mohawk Valley, North Country, Capital District, Mid-Hudson, New York City, and Long Island. For more information, see: http://esd.ny.gov/RegionalOverviews.html.

[36] If a farm classified its primary production category as 'value added', it can be inferred that the farm grew/raised the raw commodity that it then processed. Examples of the value added products produced include cheese, butter, yogurt, honey, maple syrup, wine and juice.

function as: animal slaughtering and processing (3); frozen food manufacturing (3); snack food manufacturing (2); perishable prepared food manufacturing (2); grain and oilseed milling (1); soap and lotion manufacturing (1); wine wholesaling (1); bakery (1); and, canning and pickling (1). On average, the nonfarm vendors sold over $4.2 million in 2011 (range from $4,300 to $42,000,000) and had 32 full-time equivalent employees (range from 0 to 320).

RA's customers were surveyed using a combination of an online survey and follow up phone interviews.[37] At the time of the survey, RA customers included 110 households and 547 businesses. Of these totals, 57 households and 248 businesses responded to the survey (46% response rate). Customers were asked a series of questions related to: 1) expanded availability of local or source-identified products due to their relationship with RA; 2) reduction in purchases from other sources due to their relationship with RA; 3) potential for expanded local or source-identified purchases from RA (or another local food distribution company); 4) for business customers only, price premiums customers were willing to pay for local items; 5) unmet demand for local items.

RA's business customers reported average annual gross sales of $5.7 million (N=101), with a range from $3,000 to $414 million. On average, they have been in business 13 years, with a range from new to more than 130 years in operation (N=151). The average number of full-time equivalent employees was 15 (N=145).

[37] A copy of the online customer survey is available upon request.

Business customers were also asked to identify the function their business most often performs; accordingly, 2% identified themselves as distributors, 3% as grocery/meal delivery service providers, 9% as processors/manufacturers, 11% as wholesalers, 25% as restaurants, 34% as retailers, and 17% as other (N=245).

Results

We divide our results into three sections. The first two examine how the food hub impacted the availability of local food, with the first section looking specifically at the impact on consumer access and the second looking at farm and nonfarm vendor access to markets. The third section examines farmers' perception of the impact that food hub sales had on farm viability.

Impact on the availability of local food: consumer access

Both household and business consumers report increased availability of locally-grown and processed items due to the existence of RA. The majority of customers (62% households, 57% businesses) responded that if RA did not exist, they did not know or were unsure of a place to purchase similar products. Almost 80% of businesses reported that working with RA enabled their businesses to expand their product offerings, on average by 31%.

Both household and business customers also reported additional demand for the types of items carried by RA. Though over one-half of household customers (51%) responded they were unsure or did not know if they would purchase additional items from RA if they expanded, 33% responded they would (thus only 16% responded they would not). Business customers on the other hand reported overwhelmingly (67%) that they were interested in making additional purchases if RA expanded its product

availability, delivery routes, or times. Perhaps this is because their customers are willing to pay a premium for locally-grown and source-identified products. We asked businesses to rank on a scale from 1 to 5 the premium that they received from their customers for items marked 'locally-grown' (1 = significantly lower price for local, 3 = no price difference, 5 = significantly higher price for local). On average, customers responded that they received a slightly higher price from consumers for items labeled locally-grown (3.49), with 3% reporting significantly higher prices, 49% somewhat higher prices, 42% no price difference, 5% somewhat lower prices, and 1% significantly lower prices.

Impact on the availability of local food: farm and nonfarm vendor access to markets

Farm and nonfarm vendors reported enhanced market access due to their relationship with RA. Of the farm vendors, those that were mid-scale (farms with gross sales between $250,000 and $500,000) reported being most reliant on RA's services (see top panel of figure 1). All six of the mid-scale farmers interviewed reported that over 20% of their farm's total sales were facilitated by RA – three between 20 and 50% and 3 over 50%. Of the small farms we interviewed (those that earned under $250,000 in gross sales), six had less than 20% of their total gross sales facilitated by RA, three had 20-50%, and six had over 50%. Large farms (those with over $500,000 in gross annual sales) reported much less reliance on RA-facilitated sales than the farmers in the other farm size categories. Of the nine large farms interviewed, seven reported that under 20% of their sales were facilitated by RA. Of those respondents, three reported less than one percent of total sales facilitated by RA, the others reported two percent, three percent, and five percent. Interestingly, the remaining two large farms reported

51% and 93% of total sales facilitated by RA.

[Figure 1 here]

We also looked at RA facilitated sales by primary farm commodity (livestock, fruit and vegetable, and value added), see middle panel of figure 1. Accordingly, we found that the distribution of RA facilitated sales by commodity was fairly evenly distributed. Between 27-56% of the producers from each primary commodity category had less than 20% of their sales facilitated by RA (fruit and vegetable producers 56%, value added 50%, livestock 27%), and 33-40% from each category had over 50% of their sales facilitated by RA. Livestock producers had a larger share of 20-50% of sales facilitated by RA, compared to fruit and vegetable or value added producers (36%, 11%, and 10%, respectively).

Of the nonfarm vendors that we interviewed, the smaller businesses, particularly those that earned less than $500,000 in gross annual sales, were more reliant on RA (see bottom panel in figure 1). Of them, over one-half had at least 50% of their sales facilitated by RA. None of the nonfarm vendors with over $500,000 in gross annual sales had over 50% of their sales facilitated by RA, and only 20% had between 20-50% of their sales facilitated by RA. The rest of these large nonfarm vendors (80%) reported less than 20% of their sales were facilitated by RA.

Impact on farm viability

Of the farm vendors interviewed, 60% reported that their business relationship with RA enabled their business to expand. An additional 10% were unsure if RA had supported farm business expansion, and 30% reported that RA had not enabled farm business expansion. Of the farms that responded that RA had not enabled their

business to expand, two reported that their business was not currently interested in expanding, and another five mentioned the importance of gaining access to the NYC market through RA.

Only one farm vendor with over $1,000,000 in total annual gross sales responded affirmatively that RA had enabled their business to expand. These larger farms generally felt that the volume of sales facilitated by RA was too small to make a significant difference in their business' total sales or production, and that they had other market options.

Access to the New York City market was the most frequently cited reason for expanded sales, though improved market access generally was consistently reported. Even farms that were unsure about RA's role in its expanded sales frequently cited RA's freight service and its pick-up and delivery flexibility as the primary reasons farmers chose RA over other freight services to NYC. Others used RA's 'good reputation' as a 'values-based distributor' to gain market access. This sentiment was particularly true among newer businesses that had not developed direct wholesale purchasing agreements with stores or restaurants.

RA's warehouse capacity was also cited as facilitating business expansion for farms too small to have significant cooler or storage space. Many farms keep frozen meat or storage crops (i.e., potatoes, root vegetables) at RA's warehouse, retrieving them periodically to sell through winter markets, community supported agriculture (CSA), or wholesale outlets. As a result of access to additional storage, some farmers reported putting more acres into operation specifically for storage crops as a way to increase winter (year-round) income.

Discussion and directions for future research

The purpose of this paper is to better understand the extent to which food hubs increase consumer access to locally-grown and processed products, enhance farm-entrée to markets, and support farm viability. Using RA as a case study, we conducted surveys with over 300 of their customers, and in-depth interviews with 30 farm vendors and 15 processors (nonfarm vendors).

Our survey results demonstrate that RA increased household and business customer access to locally-grown and processed items. Further, the survey results reveal unmet demand for these products, and consumer willingness to pay a modest premium, on average. Mid-scale farmers and smaller nonfarm vendors appear to be particularly reliant on market access facilitated by RA. And the majority of farmers reported that their relationship with RA enhanced their farm's viability, particularly through increased access to the New York City market and warehousing.

Despite these positive impacts, understanding a food hub's impact on farm profitability is very difficult. In this case study, we found that there are many ways that RA may support farm viability indirectly. And it is difficult to parse out the relative importance of aggregation, warehousing, distribution, and marketing infrastructure (provided by a food hub) compared to the host of other pieces of infrastructure that farms mentioned were also critical in facilitating sales. In other words, part of the challenge for future research is in considering the opportunity cost – would the farm have found other ways to distribute the product, for a proportionate amount of time and money, had RA not existed?

These results also reflect only one case study. It is possible, for example, that

due to the physical location of RA, proximate to the NYC market, there is a particular need for a food hub type business to expand the availability of locally-grown and processed food. More study is needed with additional hubs and locations to assess the robustness of food hub impacts.

References

Abatekassa, G., and H.C. Peterson. 2011. Market Access for Local Food through the Conventional Food Supply Chain. *International Food and Agribusiness Management Review* 14:63–82.

Baker, D., K. Hamshaw, and J. Kolodinsky. 2009. Who Shops at the Market? Using Consumer Surveys to Grow Farmers' Markets: Findings from a Regional Market in Northwestern Vermont. *Journal of Extension* 47:1-9.

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.

Bloom, J.D., and C.C. Hinrichs. 2011. Informal and Formal Mechanisms of Coordination in Hybrid Food Value Chains. *Journal of Agriculture, Food Systems, and Community Development* 1:143-156.

Boys, K.A., and D.W. Hughes. 2013. A Regional Economics-Based Research Agenda for Local Food Systems. *Journal of Agriculture, Food Systems, and Community Development* 3:145–150.

Clancy, K., and K. Ruhf. 2010. Regional Value Chains in the Northeast: Findings from a Survey. The Northeast Sustainable Agriculture Working Group.

Cohen, N., and D. Derryck. 2011. Corbin Hill Road Farm Share: A Hybrid Food Value Chain in Practice. *Journal of Agriculture, Food Systems, and Community Development* 1:85–100.

Conner, D., W. Knudson, M. Hamm, and H.C. Peterson. 2008. The Food System as an Economic Driver: Strategies and Applications for Michigan. *Journal of Hunger & Environmental Nutrition* 3:371–383.

Cuomo, A. 2013. Governor Cuomo Announces $3.6 Million in CFA Funding for Food Distribution Hubs. Governor's Press Office.

Diamond, A., and J. Barham. 2011. Money and Mission: Moving Food with Value and Values. *Journal of Agriculture, Food Systems, and Community Development* 1(4):101–117.

Day-Farnsworth, L., and A. Morales. 2011. Satiating the Demand: Planning for Alternative Models of Regional Food Distribution. *Journal of Agriculture, Food Systems, and Community Development* 2(1):227–247.

Feenstra, G., P. Allen, S. Hardesty, J. Ohmart, and J. Perez. 2011. Using a Supply Chain Analysis to Assess the Sustainability of Farm-to-Institution Programs. *Journal of Agriculture, Food Systems, and Community Development* 1(4):69–84.

Fischer, M., M. Hamm, R. Pirog, J. Fisk, J. Farbman, and S. Kiraly. 2013. Findings of the 2013 National Food Hub Survey. Michigan State University Center for Regional Food Systems. Available at: http://foodsystems.msu.edu/resources/2013-food-hub-survey [Accessed February 1, 2014].

Hardesty, S.D. 2008. The Growing Role of Local Food Markets. *American Journal of Agricultural Economics* 90:1289–1295.

Hardesty, S., G. Feenstra, D. Visher, T. Lerman, D. Thilmany-McFadden, A. Bauman, T. Gillpatrick, and G. Nurse Rainbolt. forthcoming. Values-Based Supply Chains: Supporting Regional Food and Farms. *Economic Development Quarterly*.

Hinrichs, C.C., and L. Charles. 2012. Local Food Systems and Networks in the US and UK. In *Rural Transformations and Rural Policies in the US and UK,* edited by M. Shucksmith, D.L. Brown, S. Shortall, J. Vergunst, and M.E. Warner, 156-176. New York: Routledge.

Hoshide, A.K. 2007. Values-Based & Value-Added Value Chains in the Northeast, Upper Midwest, and Pacific Northwest. University of Maine.

Jablonski, Becca B.R. forthcoming. Evaluating the Impact of Farmers' Markets using a Rural Wealth Creation Approach. In *Rural Wealth Creation*, edited by J. Pender, T. Johnson, B. Weber, and J.M. Fannin, chapter 14. New York: Routledge.

Jablonski, B.B.R., J. Perez-Burgos, and M.I. Gómez. 2011. Food Value Chain Development in Central New York: CNY Bounty. *Journal of Agriculture, Food Systems, and Community Development* 1(4):129–141.

Jackson-Smith, D., and J. Sharp. 2008. Farming in the Urban Shadow: Supporting Agriculture at the Rural-Urban Interface. *Rural Realities* 2:1-12.

Jarosz, L. 2000. Understanding Agri-Food Networks as Social Relations." *Agriculture and Human Values* 17: 279–283.

King, R.P., M.S. Hand, G. DiGiacomo, K. Clancy, M.I. Gómez, S.D. Hardesty, L. Lev, and E.W. McLaughlin. 2010. Comparing the Structure, Size, and Performance of Local and Mainstream Food Supply Chains. Economic Research Report ERR-99., U.S. Department of Agriculture, Economic Research Service.

King, R.P., and L. Venturini. 2005. Demand for Quality Drives Changes in Food Supply Chains. Agriculture Information Bulletin 794, U.S. Department of Agriculture, Economic Research Service.

Lerman, T. 2012a. Values-Based Supply Chain Annotated Bibliography. University of California Sustainable Agriculture Research and Education Program and the Agricultural Sustainability Institute.

---------2012b. A Review of Scholarly Literature on Values-Based Supply Chains. University of California Sustainable Agriculture Research and Education Program and the Agricultural Sustainability Institute.

Lichter, D.T., and D.L. Brown. 2011. Rural America in an Urban Society: Changing Spatial and Social Boundaries. *Annual Review of Sociology* 37: 565–592.

Low, S.A., and S. Vogel. 2011. Direct and Intermediated Marketing of Local Foods in the United States. Economic Research Report ERR-128, U.S. Department of Agriculture, Economic Research Service.

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. Economic Research Report ERR-97, U.S. Department of Agriculture, Economic Research Service.

Matteson, G., C. Gerencer, and E. Pirro. 2013. Pathways to Food Hub Success: Financial Benchmark Metrics and Measurements for Regional Food Hubs. National Good Food Network (NGFN). Webinar. Available at: http://www.ngfn.org/resources/ngfn-cluster-calls/financial-benchmarks-for-food-hubs/Food%20Hubs%20Benchmark%20slides.pdf

National Good Food Network (NGFN). 2013. Food Hub Center. Available at: http://www.ngfn.org/resources/food-hubs

Painter, K. 2007. An Analysis of Food-Chain Demand for Differentiated Farm Commodities: Implications for the Farm Sector. Washington State University.

Richards, T. J., and G. Pofahl. 2010. Pricing Power by Supermarket Retailers: A Ghost in the Machine? *Choices: The Magazine of Food, Farm & Resource Issues* 25:1–12.

Schmidt, M.C., J.M. Kolodinsky, T.P. DeSisto, and F.C. Conte. 2011. Increasing Farm Income and Local Food Access: A Case Study of a Collaborative Aggregation, Marketing, and Distribution Strategy that Links Farmers to Markets. *Journal of Agriculture, Food Systems, and Community Development* 1:157–175.

Schneider, M.L., and C.A. Francis. 2005. Marketing locally produced foods: Consumer and farmer opinions in Washington County, Nebraska. *Renewable Agriculture and Food Systems* 20: 252–260.

Sexton, R.J. 2010. Grocery Retailers' Dominant Role in Evolving World Food Markets. *Choices: The Magazine of Food, Farm & Resource Issues* 25:1–13.

Stephenson, G., and L. Lev. 2004. Common Support for Local Agriculture in Two Contrasting Oregon Communities. *Renewable Agriculture and Food Systems* 19: 210–217.

Stevenson, G.W., and R. Pirog. 2008. Values-Based Supply Chains: Strategies for Agrifood Enterprises of the Middle. In *Food and the Mid-Level Farm: Renewing an Agriculture of the Middle*, edited by T.A. Lyson, G.W. Stevenson, and R. Welsh, 119-143. Cambridge: MIT Press.

Thilmany, D., N. McKenney, D. Mushinski, and S. Weiler. 2005. Beggar-Thy-Neighbor Economic Development: A Note on the Effect of Geographic Interdependencies in Rural Retail Markets. *The Annuals of Regional Science* 39:593–605.

Trauger, A. 2009. Social Agency and Networked Spatial Relations in Sustainable Agriculture. *Area* 41: 117–128.

Tropp, D., E. Ragland, and J. Barham. 2008. Supply Chain Basics: The Dynamics of Change in the U.S. Food Marketing Environment. Agriculture Handbook 728-3, U.S. Department of Agriculture, Agricultural Marketing Service.

U.S. Department of Agriculture, Economic Research Service (USDA ERS). 2012. USDA ERS - Chart: Farmers' Markets Concentrated in Metro Counties. *Amber Waves: The Economics of Food, Farming, Natural Resources and Rural America* 10 (4).

U.S. Department of Agriculture, Know Your Farmer (USDA KYF). 2011. Know Your Farmer, Know Your Food. Available at: http:///www.usda.gov/wps/portal/usda/usdahome?navid=KYF_MISSION

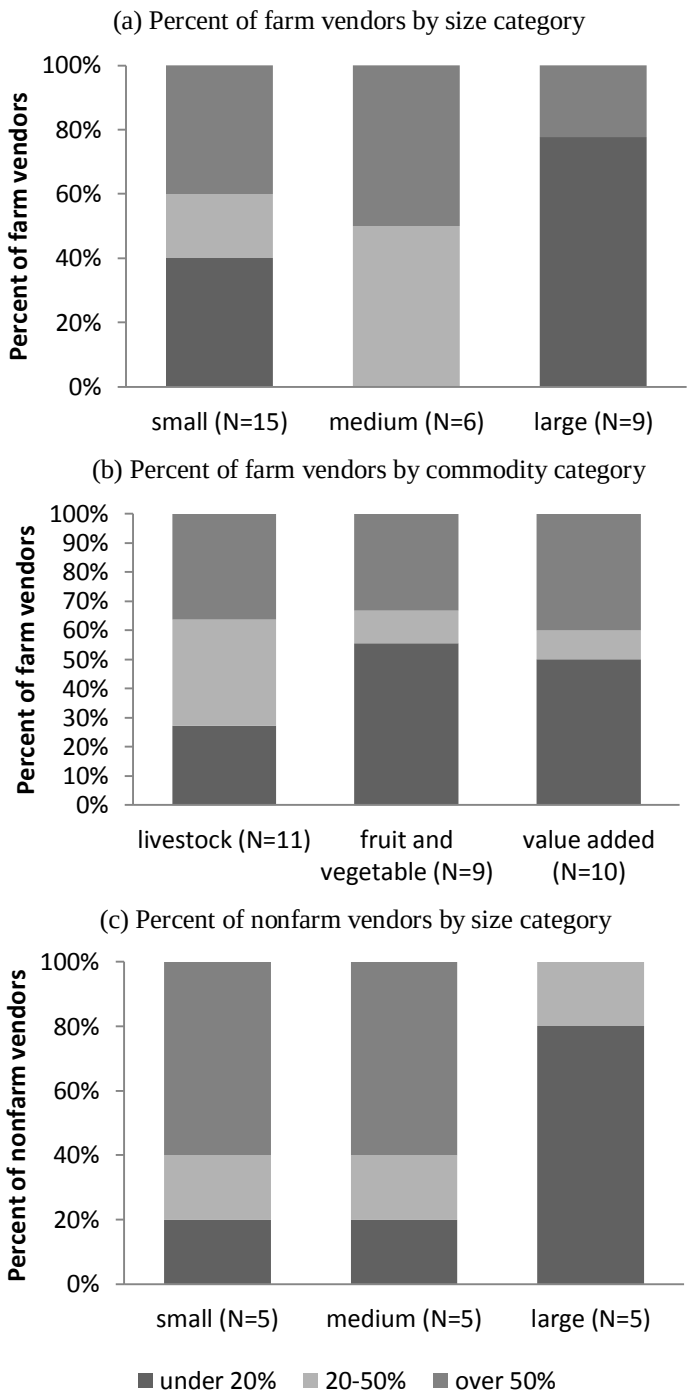

Figure 1. Percent of vendors by level of facilitated sales with Regional Access

(a) Farm vendors by size category (small = less than $250,000 in sales, medium = $250,000 to $500,000, and large = more than $500,000), (b) Farm vendors by commodity category (livestock, fruit and vegetable, and value added), and (c) Nonfarm vendors by size category (small = less than $50,000 in sales, medium = $50,000 to $500,000, and large = more than $500,000).

CONCLUSION AND FUTURE RESEARCH

The three papers in this dissertation make important contributions towards assessing the regional economic and farm-level impacts of policies supporting re-localized food systems, and thus for thinking more critically about the relationship between food systems and rural economic development. However, assessing the impacts of policies supporting local and regional food systems is still nascent and this dissertation raises many important questions and directions for future research, including: 1) assessing net farm-level impacts; 2) evaluating the rural-urban distribution of impacts; 3) estimating opportunity cost; and, 4) employing broader metrics of impact evaluation.

Evaluating farm-level impacts

The first and second papers of this dissertation provide strong evidence that local food system participants in NYS spend more money locally per unit of output, and have relatively higher expenditures on labor than do producers who do not utilize local outlets. The extent to which there are tradeoffs between additional local expenditures (particularly on labor), and farm profitability, is a key area for future research. Given that local food system participants tend to be relatively smaller in scale (Low and Vogel 2011), and that most small farms have a negative operating profit margin (Hoppe and Banker 2010), understanding the extent to which additional local expenditure impedes profitability, and potentially survivability, is critical for planning future interventions.

The data collected and highlighted in the first paper do not provide sufficient information to discern whether the differential expenditure patterns of local food

system participants are due to market channel selection, or their relatively smaller scale. Examining whether smaller scale producers generally (and not just local food system participants) spend a larger percentage of inputs locally (per unit of output) has potentially important implications for policymakers, planners, and economic developers. For example, if an explanation for the negative operating profit margin of small-scale producers is their lack of access to affordable inputs, there are strategies to enhance the viability of these businesses (for example, establishing buying clubs for bulk purchasing by smaller producers).

The first and second papers also highlight the different sectors in which local food system participants spend money. Research is needed to look at how these impacted sectors effect opportunities for rural economic development. For example, are communities with more local food system participants likely to have more vibrant farming communities and input supply infrastructure given that these farms spend a larger percentage of input expenditure on purchases from other farms (i.e., intra-industry linkages) as well as on support activities for agriculture and forestry sectors?

More research is also needed as to the net farm-level impacts of policies supporting local food systems. Given the evidence that local food system participants take on additional supply chain functions such as processing, distribution, and marketing to get their products to market (King et al. 2010), there is more work to do in determining the net impacts resulting from these policies. Do local markets yield sufficient additional income (either through higher prices or larger volumes) to compensate for the likely higher per unit of output costs associated with these sales?

The results from the third paper show that farmers overwhelmingly reported

that the food hub did support expanded sales, but that it was one of a confluence of factors and pieces of critical marketing infrastructure. Parsing out the precise role that a food hub (or other local food system infrastructure) plays in supporting farm viability is difficult. Discerning the net impacts of participation in a market channel is even more challenging. Future research utilizing a market channel assessment approach (e.g., LeRoux et al 2010; Hardesty and Leff 2010) may help to more critically evaluate differential farm-level impacts of market channel selection, although gaining access to this type of data comes with its own challenges.

Rural-urban distribution of impacts

There is now strong evidence that regionalized strategies to strengthen local food systems involve rural or urban-adjacent farms selling into urban markets—i.e., strengthened rural-urban linkages—rather than rural farms intra-region sales to rural customers or urban farms intra-region sales to urban customers. For example, a USDA ERS (2012) report shows that farmers' markets are concentrated in metro areas. Lichter and Brown (2011) provide justification for this phenomena, stating that urban customers are willing to pay higher prices for goods. Trivette (2012) notes that urban settings allow for a greater number of vendor outlets, especially restaurants and grocery stores. Aleci (2004) and Aleci and Smith (2011) corroborate this, remarking that the historic central farmers' market in Lancaster, PA has difficulty retaining vendors who are increasingly drawn to better-trafficked farmers' markets in more affluent Philadelphia suburbs. And, Carroll and Jensen (2012), in their case study of Crescent City market vendors, remark that many would not be in business today or as successful if they had not participated in the urban farmers markets. Concomitantly,

studies of rural farmers' markets, for example, corroborate these findings. Stephenson et al. (2008), for example, cite small market size as being positively associated with market failure. Malone and Whitacre (2012) found that the most rural counties were under-represented in direct-to-consumer sales generally. Schmit and Gomez (2011) and Jablonski et al. (2011) report limited overall vendor sales in their studies of rural markets across Northern and Central New York, respectively. Even in studies of rural communities demonstrating consumer willingness to pay a premium for locally-grown produce, evidence shows that there are often not enough customers to generate enough revenue to overcome costs (Biermacher et al. 2007).

Yet there is little research to support the efficacy of strengthened rural-urban linkages as an effective strategy for rural development. From a global perspective, rural and urban areas are obviously economically linked as there are goods produced in rural areas that are consumed in urban markets. However, in a globalized world, the importance of localized rural-urban linkages becomes much more complex, and is understudied (Dabson 2007; Holland et al. 2011). Holland et al. (2011), in their work on Oregon, claim that not much is known about the relationship between urban centers and their rural peripheries, and that a clearer understanding of these linkages could support more appropriate policies and strategies for investment. Likewise, Snoxell (2005) states that there is no body of research specifically focused on linkages between communities, nor is there a prevailing analytical framework for understanding these linkages. He calls for more research in identifying linkages between communities and assessing the impact of the linkages on communities. Similarly, Porter (2003) and Porter et al. (2004) call for future research to examine the

relationship between rural-urban linkages and rural economic growth.

The customized SAM approach taken in paper two enables one to assess the resulting economic impacts of a policy shock, but not the distribution of the shock in urban versus rural parts of NYS. One important next step for future research is to utilize a customized SAM methodology as presented in the second paper, and extend it to a multi-regional model. There are several studies that utilize this type of multi-regional modeling approach to look at the distributional impacts of a shock, but none customize the model, or look at the impacts resulting from re-localized food system initiatives (Dabson et al. 2009; Holland et al. 2011; Hughes and Litz 1996; Lewin et al. 2013; Searls 2011; Waters et al. 1994).

Evaluating opportunity cost

The second paper includes the first research to empirically-derive the opportunity cost associated with policies supporting local food system initiatives, indicating the importance of including these impacts in future assessments. The approach demonstrates empirically that businesses make choices about where to purchase inputs due to the availability of local food. Indeed almost half of the businesses purchasing product from food hubs reported decreasing expenditure from other sources, thus purchases from local sources cannot be considered all new final demand. However, the methodology used was limited in that the survey only included current food hub customers. More critical consideration about how opportunity cost can be assessed in this context is needed, as are opportunities for policymakers and practitioners to craft and support initiatives that minimize opportunity cost.

In light of the fact that local food initiatives are concentrated in urban places,

the distribution of opportunity cost also requires additional consideration. How are rural communities impacted by farmers participating in urban markets? Do farmers derive additional net income through participation in urban markets that is spent in rural communities? Where are the workers located that farmers hire to support urban market participation? The papers in this dissertation only brush the surface of evaluating the spatial distribution of the impacts resulting from local food system policies; the opportunities for future research in this area are truly exciting.

Evaluating the impact on rural wealth creation and prosperity

Assessing the economic impact of re-localized food systems using more traditional job creation, sales, and value added generation approaches (e.g., through IO/SAM models or standard CGE models) are important, but are primarily designed to consider short-term impacts on a limited set of indicators of economic activity. The ability to understand longer-term and broader community impacts is needed for a more comprehensive evaluation, as well as to inform future programming. As discussed throughout this dissertation, SAM approaches model the dollar values of annual flows of goods and services. They are thereby incidentally related to incremental changes to stocks of various types of market-valued capitals, but they do not endogenously account for the contributions to productivity that investment in capital typically involves. Expenditures on education, information, intellectual assets, and social relationships, for example, are either excluded or treated as consumption or as intermediate goods rather than investments (Johnson et al. forthcoming). Indeed, there is growing interest within the literature in examining a broader mix of inputs and community assets as key components of long-term economic growth in rural

communities and in expanding national accounting systems to include various non-market and intangible capitals, as well as their associated flows (Arrow et al. 2012; Johnson et al. forthcoming; Pender et al. 2012; Stauber 2007, World Bank 2011).

The rural wealth creation framework conceptualizes wealth as a community's assets (net of liabilities) that contribute to the wellbeing of an individual or group (Pender and Ratner forthcoming). The rural wealth creation framework lends itself to assessing the spatial distribution of impact by distinguishing between people-based and place-based wealth. People-based wealth expands the typical personal financial wealth assets (i.e., owned real estate, personal property, stocks, bonds, automobiles) to include, for example, one's human capital assets (i.e., education, work experience, and health) and social capital assets (i.e., access to networks). Place-based wealth includes housing stocks, fixed commercial and industrial capital, public infrastructure, environmental quality, and social networks (Johnson et al. forthcoming). The bridge between place-based and people-based wealth is the spatial distribution of asset ownership; only local ownership is counted as part of a community's wealth (Pender 2011).

Despite the fact that it is a promising framework for assessing opportunities for rural economic development, efforts to conceptualize a formal rural wealth creation approach are just starting to emerge (e.g., Pender et al. 2012; Pender and Ratner forthcoming; Johnson et al. forthcoming, World Bank 2011), and application and measurement of the framework has been limited (Pender et al. 2012). Jablonski (forthcoming) published the first peer-reviewed research contextualizing rural wealth creation within the construct of local food systems. Her research shows that impact

assessment using a rural wealth creation framework can elicit very different results, and thus policy implications, than a more traditional economic impact assessment. However, given it is a new framework for evaluation, and metrics and data requirements remain unknown and largely unavailable from secondary sources (Pender et al. 2012), Jablonski (forthcoming) used a literature review for analysis and was limited in her ability to draw many conclusions. Gathering the data necessary for complete analysis remains a critical next step in fully actualizing a rural wealth creation framework to assess the impacts resulting from re-localized food system efforts.

Data Needs

Part of the reason that there are so many areas for future research is due to the data challenges highlighted throughout this dissertation. Official tracking of local and regional food systems has not kept pace with the sector's growing importance (Tropp 2008), "agricultural data collection efforts usually focus on farm production issues, not…marketing practices" (Matteson and Hunt 2012, 10). As a result, expensive and time consuming case study data collection efforts are necessary in order to accurately assess policy impacts. This dissertation offers strong evidence of the value of data tracked by market channel, and provides fodder to agency staff and policymakers to advocate for data collection by market channel at the national level. In its absence, researchers working at the local case study level should work together in developing questionnaires and methodologies such that "collective understanding of the relationship between local foods and economic development can be enhanced through improving data collection, undertaking studies on larger geographic scales…and

forming a learning community to review and critique studies" (O'Hara and Pirog 2013, 1). It is my hope that this dissertation contributes to this worthy recommendation, and can help frame the discussion on the path ahead as we carefully consider and evaluate policies with impactful implications for rural communities, farmers, and consumers.

REFERENCES

Aleci, L. 2004. Central Market and Lancaster's Community Food System: Issues, Challenges, Opportunities. Conference Schedule and Transcripts. Lancaster Economy Forum: Toward a Research Agenda. Franklin and Marshall College. Available at: http://www.fandm.edu/lec/lec-conferences/lec-conference-2004-2005/lancaster-economy-forum-toward-a-research-agenda/conference-schedule-transcripts/product-networks-and-community-economies/linda-aleci-associate-professor-of-art-and-art-history [Accessed December 13, 2012].

Aleci, L., and D.T. Smith, D.T. 2011. Mapping the Eastern Market in Lancaster, PA. A Case Study for Emerging Trends in Farmers Markets and Sustainable Food Systems. *Appetite*. 56(2):517.

Arrow, K.J., P. Dasgupta, L.H. Goulder, K.J. Mumford, and K. Oleson. 2012. Sustainability of the Measurement of Wealth. Working Paper 16599. National Bureau of Economic Research. Available at: http://www.nber.org/papers/w16599 [Accessed August 10, 2012].

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.

Carroll, M. M., and J.M. Jensen. 2012. Building a Regional Food System: a Case Study of Market Umbrella in the New Orleans Region. Columbia, MO: RUPRI Rural Futures Lab.

Dabson, B., R.G. Johnson, K.K. Miller, and D.P. Robinson. 2009. Rural-Urban Interdependence in Central Appalachia. Discussion Paper: Wealth Creation and Rural-Urban Linkages in Working Regions. New York, NY: Rural Policy Research Institute.

Dabson, B. 2007. Rural-Urban Interdependence: Why Metropolitan and Rural America Need Each Other. The Blueprint for American Prosperity Metropolitan Policy Program. The Brookings Institution.

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.

Holland, D., P. Lewin, B. Sorte, and B. Weber. 2011. The Declining Economic Interdependence of the Portland Metropolitan Core and Its Periphery. In M. Hibbard, E. Seltzer, B. Weber, and B. Emshoff, eds. *Toward One Oregon: Rural-Urban Interdependence and the Evolution of a State*. Corvallis, OR: Oregon State University Press, 79–98.

Hoppe, R.A., and D.E. Banker. 2010. Structure and Finances of U.S. Farms: Family Farm Report, 2010 edition. EIB-66. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service. Available at: http://www.ers.usda.gov/media/184479/eib66_1_.pdf [Accessed March 15, 2014].

Hughes, D.W., and V.N. Litz. 1996. Rural-Urban Economic Linkages for Agriculture and Food Processing in Monroe, Louisiana, Functional Economic Area.

Journal of Agricultural and Applied Economics. 28(2):337–355.

Jablonski, B.B.R. forthcoming. Evaluating the Impact of Farmers' Markets Using a Rural Wealth Creation Approach. In J.L. Pender, T.G. Johnson, B. Weber, and J.M. Fannin, eds. *Rural Wealth Creation*. New York: Routledge, 218-231.

Jablonski, B.B.R., J. Perez-Burgos, and M.I. Gómez. 2011. Food Value Chain Development in Central New York: CNY Bounty. *Journal of Agriculture, Food Systems, and Community Development*. 1(4):129–141.

Johnson, T.G., N. Raines, and J.L. Pender. forthcoming. Comprehensive Wealth Accounting. In J.L. Pender, T.G. Johnson, B. Weber, and J.M. Fannin, eds. *Rural Wealth Creation*. New York: Routledge, 30-54.

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. ERR-99. U.S. Department of Agriculture, Economic Research Service.

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.

Lewin, P., B. Weber, and D. Holland. 2013. Core-Periphery Dynamics in the Portland Oregon Region: 1982 to 2006. *Annuals of Regional Science*. 51(2):411-433.

Lichter, D.T., and D.L. Brown. 2011. Rural America in an Urban Society: Changing Spatial and Social Boundaries. *Annual Review of Sociology*. 37(1):565–592.

Low, S.A., and S. Vogel. 2011. Direct and Intermediated Marketing of Local Foods in the United States. ERR-128. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service. Available at: http://www.ers.usda.gov/Publications/ERR128/ [Accessed November 8, 2011].

Malone, T., and B. Whitacre. 2012. How Rural Is Our Local Food Policy. *The Daily Yonder*. Available at: http://www.dailyyonder.com/local-food-policy-it-it-truly-focussed-rural/2012/08/24/4364 [Accessed October 23, 2012].

Matteson, G., and A.R. Hunt. 2012. The Emergence of Retail Agriculture: Its Outlook, Capital Needs, and Role in Supporting Young, Beginning, and Small Farmers. Report to the Farm Credit Council. Available at: http://fccouncil.com/wp-content/uploads/2012/09/Emergence_of_Retail_Ag_2012_Revisions_for_web.pdf [Accessed September 3, 2013].

O'Hara, J., and R. Pirog. 2013. Economic Impacts of Local Food Systems: Future Research Priorities. *Journal of Agriculture, Food Systems, and Community Development*. 3(4):35-42.

Pender, J. 2011. A Conceptual Framework for Rural Wealth Creation: an Application to Ethanol Development in the United States. North American Regional Science Council Conference. Miami, FL.

Pender, J., A. Marre, and R. Reeder. 2012. Rural Wealth Creation: Concepts, Measures, and Strategies. *American Journal of Agricultural Economics.* 94(2):535-541.

Pender, J., and S. Ratner. forthcoming. Wealth Concepts. In J.L. Pender, T.G.

Johnson, B. Weber, and J.M. Fannin, eds. *Rural Wealth Creation*. New York: Routledge, chapter 2.

Porter, M. 2003. The Economic Performance of Regions. *Regional Studies.* 37(6-7):545–546.

Porter, M., K. Miller, and R. Bryden. 2004. *Competitiveness in Rural U.S. Regions: Learning and Research Agenda.* Harvard Business School, Institute for Strategy and Competitiveness.

Schmit, T.M., and M.I. Gómez. 2011. Developing Viable Farmers Markets in Rural Communities: An Investigation of Vendor Performance Using Objective and Subjective Valuations. *Food Policy*. 36(2):119–127.

Searls, K. 2011. Pilot Study: Estimating Rural and Urban Minnesota's Interdependencies, Minnesota Rural Partners, Inc.

Snoxell, S. 2005. An Overview of the Literature on Linkages between Communities. Prepared for: Building, Connecting and Sharing Knowledge: A Dialogue on Linkages Between Communities. Infrastructure Canada.

Stauber, K., 2001. Why Invest in Rural America—And How? A Critical Public Policy Question for the 21st Century. *Economic Review.* Second Quarter:33–63.

Stephenson, G., L. Lev, and L. Brewer. 2008. 'I'm Getting Desperate': What We Know About Farmers' Markets That Fail. *Renewable Agriculture and Food Systems.* 23(3):188–199.

Trivette, S.A. 2012. Farm-to-Fork: Understanding Locally-Oriented Farm-to-Vendor

Food Systems: Access, Boundaries, and Power-Relations. Ph.D. Dissertation. Amherst, MA: University of Massachusetts-Amherst.

Tropp, D. 2008. The Growing Role of Local Food Markets: Discussion. *American Journal of Agricultural Economics.* 90(5):1310–1311.

Waters, E.C., D.W. Holland, and B.A. Weber. 1994. Interregional Effects of Reduced Timber Harvests: The Impact of the Northern Spotted Owl Listing in Rural and Urban Oregon. *Journal of Agricultural and Resource Economics*. 19(1):141–160.

World Bank. 2011. The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium. Available at: http://issuu.com/world.bank.publications/docs/9780821384886/7?e=1107022/3577693 [Accessed April 1, 2014].