



Developing viable farmers markets in rural communities: An investigation of vendor performance using objective and subjective valuations

T.M. Schmit*, M.I. Gómez

Department of Applied Economics and Management, Cornell University, Ithaca, NY 14850, USA

ARTICLE INFO

Article history:

Received 17 February 2010
Received in revised form 27 August 2010
Accepted 4 October 2010
Available online 30 October 2010

Keywords:

Farmers markets
Food access
Vendor performance
Rural communities

ABSTRACT

Farmers markets are drawing increasing attention by consumers as a local source of fresh foods; by producers as an alternative marketing opportunity to improve farm sales; and by policy makers concerned about the limited availability of affordable, nutritious foods in low-income, sparsely-populated rural areas. Using unique data collected from customers, vendors, and markets in a rural region of New York State, we develop an empirical model of subjective and objective measures of vendor performance to identify important factors for improved market sustainability. The empirical results suggest four inter-related planning recommendations when considering market and public policy interventions: (1) establishing larger, centrally located markets with public sector contributions, (2) targeting variety in products and vendors, (3) prioritizing attention to marketing and promotion, and (4) reducing cost burdens to underserved, low-income residents. As rural areas are spatially unique, future research across a variety of rural communities and regions will be important to the further development of sound initiatives aimed at improving market performance and access to healthy foods.

© 2010 Elsevier Ltd. All rights reserved.

Introduction

In the United States, consumer interest in local foods has increased sharply in recent years prompting substantial changes in food supply chains. Increasing utilization of direct marketing channels by producers, such as farmers markets (FMs), is providing an important market mechanism linking farmers and consumers. Direct marketing channels can allow farmers more control over their distribution and marketing activities relative to wholesale or commodity channels, while they offer an alternative outlet for consumers to seek local, fresh products directly from the source. FMs have also attracted the attention of policymakers concerned about the ability of consumers to access and afford nutritious diets, with particular attention to rural areas of lower socio-economic status (e.g., Black and Mackinko, 2008; Morton and Blanchard, 2007; Dubowitz et al., 2008; Rose and Richards, 2004). A recent study mandated by the US Congress shows limited availability of affordable, nutritious foods in low-income, sparsely-populated rural areas because there is little incentive for food retailers to provide a wide assortment of food products (Whitacre et al., 2009).

Limited food access influences food insecurity, poverty, and obesity in rural communities. For example, individuals at risk of

food insecurity are more likely to live in poor households and in rural areas (Lutfiyya et al., 2007; Sharma et al., 2010). Schafft et al. (2009) find a positive relationship between the percentage of the population residing in rural 'food deserts' (i.e., rural or urban low-income communities with limited access to affordable and nutritious foods) and increased rates of childhood obesity. The unique physical environments in rural areas constrain the availability of retail outlets to consumers (Smith and Morton, 2009; Powell et al., 2007), leading to limited choices and more expensive foods (Hendrickson et al., 2006). This is particularly problematic for rural residents without vehicles or sufficient financial resources (Sharkey, 2009).

FMs may also provide opportunities for local municipalities to address broader community objectives. They can improve community economic performance by keeping dollars local, build social capital, make small family farms more viable, and preserve rural landscape amenities (Oberholtzer and Grow, 2003). Morton et al. (2005) find that individuals depend on personal connections and civic structure to help solve food insecurity issues and that community investment in FMs can provide an opportunity to strengthen social capital.

Innovative approaches are needed to expand the availability of healthy, affordable foods. Supporting FMs has been suggested as one approach to expanding food supply chains to increase food access (Story et al., 2008) and to deliver federal food assistance programs (e.g., Supplemental Nutrition Assistance Program, SNAP). Today, Farmers Market Nutrition Programs (FMNP) operate in

* Corresponding author. Address: Department of Applied Economics and Management, Cornell University, 248 Warren Hall, Ithaca, NY 14850, USA. Tel.: +1 607 255 3015; fax: +1 607 255 9984.

E-mail addresses: tms1@cornell.edu (T.M. Schmit), mig7@cornell.edu (M.I. Gómez).

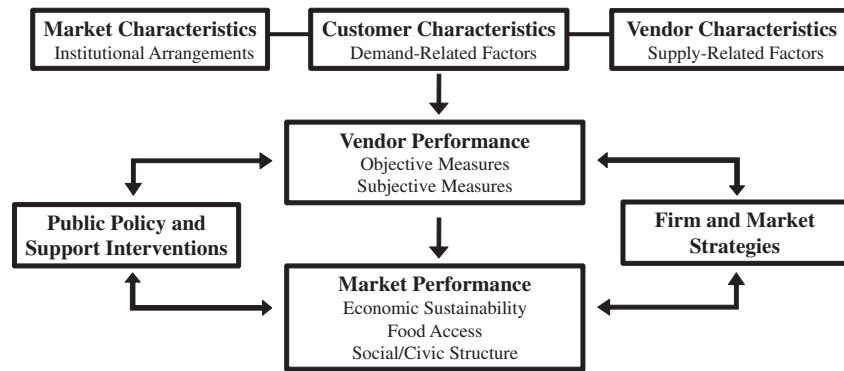


Fig. 1. Conceptual framework of vendors' farmers market performance and linkages to public policy and market strategy interventions.

nearly all states providing federal income subsidies to low-income and nutritionally-at-risk households (including senior citizens) to increase consumption of locally-grown fresh fruits and vegetables, while improving nutrition among underserved communities (USDA, 2010a). Additional public programs are becoming widespread at the state and local levels. For example, the Healthy Foods/Healthy Communities Initiative in New York State addresses food access issues by coordinating food market revolving loan funds and matching grants programs to support the establishment of FMs (Barker, 2009).

Although the number of FMs is increasing (USDA, 2010b), many of them are failing (Stephenson et al., 2008). If FMs are to provide critical services concerning healthy food access, community development, and improved farm returns, further research is needed to investigate the determinants of their success. However, evaluating FM performance is inherently difficult because producers and consumers use a variety of criteria, both objective and subjective, to determine the extent of their local market participation (Brown and Miller, 2008; LeRoux et al., 2010; Thilmany et al., 2008). Common generalizations associated with market performance are problematic given the highly heterogeneous nature of participating vendors and community demographic conditions.

The objectives of this paper are to identify the factors driving FM vendor performance in rural communities with lower socio-economic conditions, to provide valuable marketing and planning information to FM managers, and to suggest policy interventions for community leaders and policy makers. A conceptual framework for our approach is outlined in Fig. 1. With the inherent assumption that successful markets require successful vendors, an empirical model of subjective and objective measures of vendor performance is developed as a function of three broad dimensions: market, vendor, and customer characteristics. Improved vendor performance is expected to enhance the overall economic sustainability of the markets they participate in, thereby, improving food access and strengthening the social or civic structures of rural communities. The empirical results related to the characteristics considered can then be used to substantiate alternative firm and market strategies and public policy interventions.

This study makes several contributions to the emerging literature focusing on FM performance. First, FMs in rural communities with declining populations and symptoms of economic stagnation are primarily considered. In particular, we use data from numerous FMs operating in a six-county region of Northern New York (NNY) that encompass these particular characteristics. Most previous studies have focused on either a limited number markets or those operating in more populated urban areas, with two notable exceptions (Varner and Otto, 2008; Biermacher et al., 2007). Second, we use a unique data set to investigate determinants of vendor performance, which includes comprehensive data collected from the

primary stakeholders associated with these markets; i.e., vendors, FM managers, and customers of the FMs. Previous partial assessments have generally focused on a more limited set of players and, therefore, may have omitted relevant variables that could bias the results. Finally, our study considers objective (financial) and subjective (vendor satisfaction) factors in assessing vendor performance and participation; facilitating a more comprehensive assessment necessary for these types of market institutions.

Next, we highlight important food environment factors between metropolitan and rural communities in the US, along with statistics from the study area. This is followed by the empirical framework, including a description of the statistical models, the data collected, and the estimation results. The empirical results are then discussed in light of possible private strategies and public policies aimed at improving vendor performance and expanding food access. We close with conclusions and directions for future research.

Food environments in rural communities

In Table 1, we summarize indicators pertaining to the differing food environments in metropolitan (metro) and non-metropolitan (non-metro) areas including socio-economic characteristics, food access, food assistance, health, and local food marketings (USDA, 2010c). We also include indicators from our focal area, the six-county NNY region.¹ Average household income is lower and the child poverty rate is higher in non-metro counties than in their metro counterparts. The spatial issues surrounding limited food access are also evident when comparing the higher prevalence of low-income residents living more than one mile from the nearest grocery store in non-metro counties, including the study region. Although the number of grocery stores (fast food restaurants) per capita is higher (lower) in non-metro than in metro areas, this does not imply greater access to healthy foods in rural areas. Grocery stores in urban areas tend to be larger and offer a wider assortment of products because they benefit from economies of scale with higher population densities. While the US population in urban areas increased over 14.0% between 1990 and 2000, population in rural areas grew by just over half that amount, 8.1% (US Census Bureau, 2004). In NNY, population changes have been considerably more stagnant, increasing just 0.3% between 1990 and 2000, and only 0.9% from 2000 to 2009 (US Census Bureau, 2009).

Although student eligibility for free school lunches is higher in non-metro counties (based on household income and size), the rate of overall participation in SNAP is lower than in metro counties, and particularly so for NNY (Table 1). This may indicate

¹ For our purposes, Northern New York is defined as the six-county region of Jefferson, Lewis, St. Lawrence, Franklin, Clinton, and Essex counties.

Table 1
Average food environment factors by metro, non-metro, and Northern New York counties. Source: USDA (2010c).^a

| Food environment factor | United States | | | Northern New York |
|--|---------------|-----------|---------------------|-------------------|
| | Metro | Non-metro | Correl ^b | |
| Socio-economic characteristics | | | | |
| Median household income, 2008 (\$000) | 51.84 | 40.08 | −0.49 | 43.68 |
| Residents with household income below poverty level, 2008 (%) | 12.85 | 16.50 | 0.29 | 14.82 |
| Children (<18) in households below poverty level, 2008 (%) | 17.47 | 23.38 | 0.32 | 20.27 |
| Food access and availability | | | | |
| Low-income residents living more than one mile from grocery store, 2006 (%) ^c | 15.84 | 23.15 | 0.43 | 23.08 |
| Number of grocery stores per 1000 residents, 2007 | 0.21 | 0.35 | 0.28 | 0.36 |
| Number of limited-service (fast food) restaurants per 1000 residents, 2007 | 0.64 | 0.57 | −0.10 | 0.59 |
| Food assistance | | | | |
| Low-income residents enrolled in SNAP, 2006 (%) ^d | 32.33 | 28.99 | −0.13 | 24.93 |
| Students eligible for Free School Lunch Program, 2006 (%) | 31.72 | 38.12 | 0.18 | 27.83 |
| Health | | | | |
| Adult diabetes rate, 2007 (%) | 9.25 | 9.81 | 0.13 | 8.12 |
| Adult obesity rate, Body Mass Index (BMI) >30 kg/m ² , 2007 (%) | 27.68 | 28.61 | 0.12 | 26.55 |
| Low-income preschool obesity rate, 2006–2008 (%) | 13.43 | 12.54 | −0.08 | 13.32 |
| Local foods | | | | |
| Farms selling directly to final consumers, 2007 (%) | 8.38 | 5.23 | −0.25 | 15.10 |
| Total value of farm sales sold directly to final consumers, 2007 (%) | 1.53 | 0.69 | −0.18 | 1.02 |
| Value of direct farm sales per capita, 2007 (\$) | 5.46 | 8.20 | 0.10 | 11.99 |
| Number of farmers' markets per 1000 residents | 0.02 | 0.04 | 0.16 | 0.09 |
| Counties with one or more farm-to-school programs, 2009 (%) ^e | 0.11 | 0.04 | −0.15 | 0.17 |

^a Averages are simple county averages, they do not account for differences in population across counties. Metro areas are defined for all urbanized areas; outlying counties are also classified as metro if they are economically tied to the central counties. Non-metro counties are outside the boundaries of metro areas and have no cities with 50,000 residents or more.

^b Correl. = Pearson correlation coefficients between US metro (metro = 0) and non-metro counties (non-metro = 1), with all estimates statistically different from zero at the 99% significance level.

^c Low-income persons are defined as members of households in which household income is at or below 200% of the Federal Poverty Level.

^d SNAP = Supplemental Nutrition Assistance Program.

^e Farm-to-school programs include: direct sourcing from local producers, local sourcing through the Department of Defense procurement systems, school gardens, farm tours, farm-related nutrition education, and school menus highlighting locally-sourced or locally-available foods.

accessibility issues in administering these programs in rural areas. More limited availability of healthy food choices may also contribute to higher adult diabetes and obesity rates in non-metro counties, even though preschool obesity rates are comparable (Table 1). We note that diabetes and obesity rates are lower in the rural study area.

Improved access to larger population centers likely contributes to a higher proportion of farmers in metro counties selling direct-to-consumers (8.4% versus 5.2%, Table 1). However, nearly twice as many farmers are participating in direct-to-consumer sales in NNY (15.1%). The relative value of total farm sales sold directly to consumers is still very low; i.e., between 0.7% (non-metro) and 1.5% (metro), but for particular producers, this channel can contribute significantly to overall returns (LeRoux et al., 2010). Importantly, the value of direct farm sales per capita and existence of community FMs is considerably higher in rural areas, and particularly so for NNY. This may be indicative of rural areas with prioritized community development objectives towards increasing local foods availability and stronger connections to agriculture.

Empirical framework

Building on previous literature, we argue that FM vendor performance depends simultaneously on a host of factors comprising market, customer, and vendor characteristics. Market characteristics take into account the different institutional arrangements established to facilitate transactions between vendors and customers, while customer and vendor characteristics account for the demand- and supply-related aspects of FMs, respectively.

Vendor performance is measured in both objective and subjective dimensions. Objective measures are related to the financial performance of the vendor, while subjective (satisfaction)

measures also encompass other, non-financial objectives. This distinction is important. For example, vendors may utilize FMs as a way to advertise their farm/products available through alternative channels, while others may simply appreciate the opportunity to interact with customers and/or promote particular forms of production. In either case, vendors may well be satisfied if they simply cover their costs or reach some minimal level of sales.

Empirical model

To account for the potential correlation in residuals between the objective and subjective models, a joint continuous–discrete simultaneous equations model was initially estimated. In general, the model can be expressed as:

$$SC_{ij} = \delta_1 + MARKET_j \beta_1 + CUSTOMER_j \gamma_1 + VENDOR_i \alpha_1 + \varepsilon_{ij,1}$$

$$PS_{ijk} = \delta_{2,k} + MARKET_j \beta_2 + CUSTOMER_j \gamma_2 + VENDOR_i \alpha_2 + \varepsilon_{ij,2,k}$$

where SC_{ij} is the sales per customer for vendor i at market j , PS_{ijk} is the k th level of profit satisfaction for vendor i at market j ($k = 1, \dots, K$), $MARKET_j$ is a vector of market characteristics for market j , $CUSTOMER_j$ is a vector of customer characteristics for market j , $VENDOR_i$ is a vector of vendor characteristics for vendor i , β , γ , α , and δ are vectors of parameters to be estimated, and $\varepsilon_{ij,1}$, $\varepsilon_{ij,2,k}$ is a matrix of residual errors with a multivariate normal joint distribution, mean 0 and covariance matrix

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \psi_2 \end{bmatrix},$$

where σ_1^2 is a $K \times K$ diagonal matrix with $\text{var}(\varepsilon_{ij,1}) \forall k$, σ_{12} is a $K \times K$ diagonal matrix with $\text{cov}(\varepsilon_{ij,1}, \varepsilon_{ij,2}) \forall k$, and $\psi_2 = [\varphi_{k,l}]_{k,l=1,\dots,K}$ is $K \times K$ covariance matrix with $\varphi_{k,l} = \text{cov}(\varepsilon_{ij,2,k}, \varepsilon_{ij,2,l}) \forall k, l$

The model is estimated using maximum likelihood, where the probability of the multivariate normal distribution is computed using the GHK recursive simulation method (Hajivassiliou, 1993).² Single-equation models were also estimated (implying $\sigma_{12} = 0$) using a multinomial logit specification for PS_{ij} and ordinary least squares (OLS) for SC_{ij} .

Data collection

Data were collected in the summer of 2008 from 27 FMs operating in NNY. Surveys were administered to market managers, customers, and vendors at each of the participating markets.³ Market managers provided information on market characteristics, expenditures, promotion activities, customer traffic, sales, and vendor composition. Of the 27 markets originally included, 21 surveys were returned, with 19 containing complete data (70.3%).

To collect customer information, Rapid Market Assessments (RMA) were conducted. The RMAs asked a limited number of multiple-choice questions displayed on easels, with customers recruited to participate as they entered the market. One RMA was conducted at each market on a 'typical' market day (i.e., not during special festivals or events), with questions addressing attendance motivations, purchase amounts per visit, travel distance, and influences of market promotion activities. On average, around 50 customers participated per market.

Approximately 200 vendors were asked to complete a survey providing information on firm characteristics, the number and location of FMs attended, products sold, market channels utilized, sales, and the level of satisfaction with their FM profitability. Of 124 vendor surveys returned, 68 vendor surveys could be matched with the market survey data (19 of 27 markets) and contained sufficient vendor data (34%). Given that some vendors attended more than one market in the focal area, the final data set included 103 unique vendor-market observations.

Empirical specification

The existing literature was used to guide the identification of important variables for the vendor performance models (Table 2). The markets represented a broad range of size, with the number of vendors per market (VEN_NO) ranging from 5 to 52 (Table 2). Markets were relatively mature (average $MKT_AGE = 8.9$); however, around 20% have been operating for less than two years. Vendor distribution by production method varied across markets but, on average, 7.8% of the vendors were certified organic ($VEND_CO$), 18.2% were non-certified organic ($VEND_NCO$), and the balance were non-organic, conventional vendors.

Customer variables included the percent of customers with average purchase amount per visit of less than \$25 (APA_LT25) and the percent of customers traveling less than five miles to the market ($TRVL_LT5$). These variables serve as reasonable proxies for customer disposable income and market-area population density, respectively.

The average years of vendor experience ($FMSELL$) was almost six, but ranged from first-year vendors to those with 30 years of experience. Vendors attended 2.8 FMs ($MKTS$), on average, that generated 41.0% of total firm sales (INC_FM), but the percentage varied from very small (5%) to exclusively (100%). Producers selling fruits and vegetables ($SELL_FV$) made up the largest proportion of vendors (50%); however, there were significant numbers of vendors in all categories; i.e., meat and dairy ($SELL_MD$), processed foods and beverages ($SELL_PFB$), arts, crafts, and jewelry ($SELL_ACJ$),

and plants and nursery ($SELL_PN$). It was common for individual vendors to sell products from multiple categories.

Vendors categorized the average number of customers who stopped by their booth ($CUST$) and average sales ($SALES$) per market day. Objective measures of performance were created using mid-point levels for each category. Average sales per customer ($SALES_CUST$) were then computed by dividing $SALES$ by $CUST$, and translated into an average sales per customer of \$3.93 (Table 2). Vendors also categorized how satisfied they were with their level of FM profitability; approximately 34% were very satisfied, 59% were satisfied, and 7% were not satisfied or indifferent.

Empirical results

Estimated coefficients between the single-equation and joint models were similar; however, the joint model generally showed lower levels of statistical significance. Further, one could not reject the null hypothesis for the joint model that the estimated correlation between the equations' residuals was zero (i.e., $H_0: \sigma_{12} = 0$, p -value = 0.209). As such, the presentation of results focuses on the single-equation estimates (Table 3).⁴ To account for potential non-linear effects and to improve the estimation results, quadratic terms for continuous variables were included where appropriate. Both models perform reasonably well, explaining 40% or more of the variation in the dependent variables.

Since the estimated logit coefficients are not easily interpretable, a more detailed discussion of the results follows using the estimated log odds ratios (Table 3). These ratios are interpreted as the odds of being in a higher satisfaction category when the variable under consideration increases by one unit, holding all else constant. Likewise, for the sales per customer equation, elasticities (marginal effects) for the continuous (binary) variables were computed at sample means from the sales model estimates.

Vendor factors

While selling experience ($FMSELL$) was positively associated with sales per customer, it did not statistically impact vendors' profit satisfaction. The sales elasticity was 0.23, implying that a 1% increase in years selling improves vendor sales per customer by 0.23% (Table 3). The results are appealing in that experience positively contributes to sales, but given the strong recent growth in new markets with relatively new participants, it is not surprising that overall satisfaction did not differ significantly.

A log odds ratio of 0.81 for the number of markets attended ($MKTS$) indicates that vendors prefer selling at a limited number of markets. Full-time farmers (STA_FULL) in this region were much more satisfied with their performance (odds ratio = 4.95) and had higher sales per customer (marginal effect = 1.17), relative to part-time/hobby farmers (Table 3). In our sample, vendors selling arts and crafts ($SELL_ACJ$), processed foods and beverages ($SELL_FOTH$), or meat and dairy products ($SELL_MD$) were much less satisfied with their level of profitability relative to those who didn't sell these products. Processed food and beverage vendors' lower satisfaction was reinforced by lower sales per customer (\$-1.67). Sales per customer were higher for meat and dairy product vendors (\$+1.34), but presumably by not enough relative to their higher priced products. While fruit and vegetable ($SELL_FV$) and plants and nursery ($SELL_NFOTH$) vendors were indifferent regarding their satisfaction relative to other types of vendors, per customer sales were lower (\$-3.02 and \$-2.28, respectively), reflecting lower-priced raw or unprocessed products typically sold.

² The joint model was estimated with the PROC QLM procedure in SAS, v. 9.2.

³ Full copies of the vendor, market manager, and customer surveys are available upon request from the corresponding author.

⁴ The full set of regression results for both the single- and jointly-estimated models is available upon request from the corresponding author.

Table 2
Descriptive statistics of market, customer, and vendor characteristics and vendor performance.^a

| Variable | Definition | Mean | Std. dev. | Min. | Max. |
|--------------------------------|---|--------|-----------|-------|--------|
| Farmers market characteristics | | | | | |
| VEN_NO | Average number of vendors | 17.65 | 9.93 | 5.00 | 52.00 |
| MKT_AGE ^b | Age of market (years) | 8.88 | 4.13 | 1.00 | 12.00 |
| MGR_TIME | Manager at least half-time = 1, else 0 | 0.37 | 0.48 | 0.00 | 1.00 |
| PRDRQT | Minimum requirement own-product sale (%) | 67.67 | 23.27 | 0.00 | 100.00 |
| AM_COUNT | Number of market amenities | 7.16 | 2.06 | 4.00 | 11.00 |
| VEND_CO | Vendors selling certified organic (%) | 7.78 | 13.31 | 0.00 | 38.00 |
| VEND_NCO | Vendors selling non-certified organic (%) | 18.22 | 21.86 | 0.00 | 88.00 |
| Customer Characteristics: | | | | | |
| APA_LT25 | Average purchase amount less than \$25 (%) | 85.48 | 14.13 | 50.00 | 100.00 |
| TRVL_LT5 | Travel distance less than 5 miles (%) | 61.00 | 16.49 | 31.03 | 89.29 |
| Vendor characteristics | | | | | |
| FMSELL | Years selling at farmers markets | 5.78 | 6.21 | 0.05 | 30.00 |
| MKTS | Number of markets regularly attend | 2.76 | 2.98 | 1.00 | 18.00 |
| INC_FM | Sales from farmers markets (%) | 41.03 | 32.10 | 5.00 | 100.00 |
| STA_FULL | Full-time farmer or business = 1, else 0 | 0.32 | 0.47 | 0.00 | 1.00 |
| SELL_FV | Sell fresh fruits or vegetables = 1, else 0 | 0.50 | 0.50 | 0.00 | 1.00 |
| SELL_MD | Sell meat or dairy products = 1, else 0 | 0.23 | 0.42 | 0.00 | 1.00 |
| SELL_PFB | Sell processed foods or beverages = 1, else 0 | 0.35 | 0.48 | 0.00 | 1.00 |
| SELL_ACJ | Sell arts, crafts, or jewelry = 1, else 0 | 0.27 | 0.45 | 0.00 | 1.00 |
| SELL_PN | Sell plants or nursery products = 1, else 0 | 0.32 | 0.47 | 0.00 | 1.00 |
| MGR_SAT | Satisfied with management = 1, else 0 | 0.52 | 0.50 | 0.00 | 1.00 |
| Vendor performance measures | | | | | |
| Objective: ^c | | | | | |
| SALES | Average sales per day (\$, N = 93) | 204.30 | 129.63 | 12.50 | 550.00 |
| CUST | Average number of customers per day (N = 93) | 63.17 | 39.45 | 12.50 | 200.00 |
| SALES_CUST | Average sales per customer stop (\$, N = 93) | 3.93 | 2.82 | 0.33 | 12.00 |
| Subjective | | | | | |
| SAT_VS | Very satisfied with profitability = 1, else 0 | 0.34 | 0.48 | 0.00 | 1.00 |
| SAT_S | Satisfied with profitability = 1, else 0 | 0.59 | 0.49 | 0.00 | 1.00 |
| SAT_NS | Not satisfied with profitability = 1, else 0 | 0.07 | 0.25 | 0.00 | 1.00 |

^a Unless otherwise noted, $N = 103$.

^b A continuous market age variable was constructed by using mid-point values for the corresponding categories included in the survey; i.e., less than 2 years, 2–5 years, 6–10 years, and over 10 years. The extreme values were assumed to be 1 year and 12 years, respectively.

^c Continuous sales and customer variables were constructed by using mid-point values for the corresponding categories included in the survey; i.e., less than 25, 25–50, 51–100, 101–150, and more than 150 for customers, and less than \$25, \$25–50, \$51–100, \$100–200, \$200–300, \$300–400, \$400–500, and more than \$500 for sales. The extreme values were assumed to be 12.5 and 200 for customers and \$12.50 and \$550.00 for sales.

The percent of total sales received from FMs (*INC_FM*) can be interpreted as a proxy for a vendor's level of market channel diversification. Vendors that concentrated more sales at FMs were associated with higher levels of FM performance satisfaction (odds ratio = 1.03). This result is in contrast to Govindasamy et al. (2003) who found no statistical association between the proportional share of FM sales with vendor profit satisfaction; however, they did find that vendors with 70% or more of their sales through retail channels (including FMs) were more satisfied. The fact that sales per customer was indifferent to FM sales proportion is somewhat expected given that only FM sales are considered, rather than total farm sales that would be more comparable in assessing a firm's overall channel distribution strategy.

Market factors

Nearly all market variables had statistically significant impacts on vendor satisfaction, but only time commitments of market managers (*MGR_TIME*) affected sales per customer. Even so, the marginal impact of this factor was quite large, increasing average sales per customer by \$2.33, all else held constant (Table 3). This may be due to managers more fully employed having additional specialized training that can improve overall market operations and efficiencies.

A higher number of vendors (*VEN_NO*) was associated with higher levels of vendor satisfaction (odds ratio = 1.11, Table 3), implying that vendors prefer to participate in larger markets, and is consistent with the vendor *MKTS* effect discussed above. In contrast to Varner and Otto (2008) who found a positive effect

on total market sales per capita, the impact on sales per customer for this sample of rural markets was not statistically significant; however, we use vendor reported sales rather than customer reported purchases.

Vendors at older markets were less satisfied than those at markets more recently established. For each one-year increase in the age of the market, the odds of improving vendor satisfaction drops 21% (1–0.79, Table 3). The issues of market age are often logistically linked with amenities available. In our case, the number of market amenities was also shown to be important to vendor satisfaction, with each additional (average) amenity improving the odds of vendors being more satisfied by 2.0 times.

Our results suggest that higher proportions of vendors at markets that provide organic products (certified or non-certified) contribute to overall vendor satisfaction (Table 3). These results are consistent with other studies that found positive contributions from organic products on vendor satisfaction (Govindasamy et al., 2003) and direct market sales (Wier et al., 2008).

Customer factors

Vendors were found to be more satisfied at markets with higher customer spending levels (*APA_LT25* odds ratio of 0.96) and at markets located in areas with shorter average travel distances (*TRVL_LT5* odds ratio of 1.03); however, neither variables were shown to impact vendor sales per customer. While most studies on direct marketing-participation find positive consumer income effects on vendor performance (Feenstra et al., 2003; Gandee et al., 2003; Griffin and Frongillo, 2003; Morgan and Alipoe,

Table 3
Regression results from subjective and objective vendor performance models, and estimated logs odds ratios (subjective) and elasticities and marginal effects (objective)^a.

| Variable | Vendor performance model parameter estimate | | Log odds ratio | Elasticity or marginal effect ^b |
|--------------------------------|---|---------------------|----------------|--|
| | Vendor satisfaction | Sales per customer | | |
| Vendor characteristics | | | | |
| FMSELL | 0.003 (0.051) | 0.158** (0.071) | 1.003 | 0.229** |
| MKTS | -0.206** (0.101) | 0.579 (0.389) | 0.814** | 0.246 |
| MKTS ² | | -0.041** (0.020) | | |
| STA_FULL | 1.599** (0.625) | 1.169* (0.664) | 4.950** | 1.169* |
| SELL_FV | -0.459 (0.616) | -3.021** (0.699) | 0.632 | -3.021** |
| SELL_MD | -1.855** (0.691) | 1.344* (0.764) | 0.156** | 1.344* |
| SELL_PFB | -1.047* (0.605) | -1.669** (0.692) | 0.351* | -1.669** |
| SELL_ACJ | -1.429* (0.765) | -0.923 (0.968) | 0.240* | -0.923 |
| SELL_PN | 0.125 (0.622) | -2.829** (0.789) | 1.133 | -2.283** |
| INC_FM | 0.013 [‡] (0.008) | -0.077** (0.038) | 1.013* | -0.148 |
| INC_FM2 | | 0.001** (0.000) | | |
| MGR_SAT | 0.840 (0.561) | -0.605 (0.673) | 2.316 | -0.605 |
| Farmers market characteristics | | | | |
| MGR_TIME | -1.547 (1.150) | 2.334* (1.333) | 0.213 | 2.334* |
| VEN_NO | 0.106** (0.037) | 0.044 (0.039) | 1.112** | 0.196 |
| MKT_AGE | -0.232** (0.085) | 0.048 (0.090) | 0.793** | 0.108 |
| AM_COUNT | 0.694** (0.225) | -0.228 (0.244) | 2.001** | -0.412 |
| VEND_CO | 0.086** (0.040) | -0.049 (0.045) | 1.090** | -0.097 |
| VEND_NCO | 0.046** (0.019) | -0.025 (0.019) | 1.047** | -0.115 |
| PRDRQT | -0.950 (1.596) | -2.602 (1.741) | 0.387 | -0.446 |
| Customer characteristics | | | | |
| APA_LT25 | -0.044* (0.024) | 0.008 (0.028) | 0.957* | 0.178 |
| TRVL_LT5 | 0.032** (0.016) | -0.005 (0.019) | 1.033** | -0.076 |
| Intercept1 | -3.650 (3.039) | 7.807** (3.676) | | |
| Intercept2 | 0.706 (3.020) | | | |
| R-squared | 0.393 | 0.448 | | |
| N | 103 | 93 | | |

^a Vendor satisfaction is modeled assuming a logit distribution with three dependent variable categories (very satisfied, satisfied, not satisfied), while sales per customer is modeled using ordinary least squares (OLS). Standard errors for parameter estimates in parentheses.

^b Elasticities computed at variable means.

* Sig. at 10%.

** Sig. at 5%.

2001; Schatzer et al., 1989; Varner and Otto, 2008), some find the opposite (Govindasamy and Nayga, 1997). Measuring population or density effects are less common in the literature, with mixed results showing both positive (Henneberry and Agustini, 2004) and negative (Morgan and Alipoe, 2001) effects. However, all of these past studies used only sales measures as their performance metric, and most used only secondary population and income data.

Discussion of results

Here, we relate our empirical results to possible policy and strategy interventions. In particular, we identify where food policy

and related programs can impact these drivers of vendor performance and how emerging programs and policies may address the issues we find to be most significant.

Vendor training programs

Our results provide strong support to policies directed to strengthen entrepreneurship and marketing skills among vendors, particularly those with less years of experience. Opportunities for regional or market-oriented mentoring and training programs for new vendors, perhaps facilitated by municipal consortiums or cooperate extension programs, would contribute to higher vendor

satisfaction and to improved sales performance. Marketing oriented educational programs developed by FMNPs for vendors to improve product displays and customer service should also contribute to FM success and sustainability.

Location, size and scope of FMs

Our results suggest that vendors prefer to sell in a limited number of FMs. This finding supports recommendations for more centrally located markets that provide more convenient shopping locations, with a sufficient number of customers to be economically sustainable (SFC, 1995; Karpyn et al., 2010). Local municipal investments in additional transportation options in rural areas, such as added busing routes or shuttle services to FMs, would aid in increasing access for low-income and/or disparately located residents (Fisher, 1999; Whitacre et al., 2009). Such efforts would ameliorate the customer travel distance effect estimated here, and would have positive contributions associated with increasing market amenities.

We find that larger markets with more vendors contribute to vendor performance. The importance of appropriate site selection is reinforced to capture sufficient supplies of vendors and attraction of consumers. Community-based financial incentives and infrastructural support (buildings, utilities) to promote larger markets may be necessary to attract sufficient vendors up front. In addition, promotion activities to keep alluring customers to FMs are critical. The increased popularity of FMs may be having a 'halo' effect on new markets with vendors actively promoting themselves and their operations to attract new customers. However, all markets must consider the importance of marketing and promotion efforts to continue attracting new and existing customers (Treuhaft and Karpyn, 2010). Such programs as the USDA's Farmers Market Promotion Program (2010d) can help facilitate these efforts, along with prioritized activities that integrate FM and community events. Community infrastructure support can also be used to invest in market amenities or aid in site selection near areas with high site visibility and convenient parking.

Selection of FM vendors

Full-time farmers exhibit higher levels of performance, perhaps because of their larger, more varied product offerings. Because rural food deserts are often characterized as having limited food choices, attracting full-time farmers with larger product supplies and potentially lower unit production costs may offset some deficiencies of local food supply chains. For this, alternative vendor policies may be needed (e.g., alternative fee structures based on volume and/or variety) to provide incentives for larger producers to increase their participation in FMs.

Product mix is a concern of any food market operation. FMs need to consider an array of vendor possibilities, including both fresh and processed foods, as well as non-food vendors. Customer convenience is a valuable strategy in this regard as the more variety and one-stop-shopping environments FMs can foster, higher vendor performance and customer satisfaction should result. In addition, increasing concentrations of total farm sales at FMs would seem to imply larger FMs in terms of product availability and assortment. A wider variety of production-based vendors also improves vendor satisfaction and contributes to wider product assortments for customers looking for alternatively priced goods suitable to their own income levels. Establishing formal vendor policies that are clear and cognizant of a need for a wide variety of vendors and governed by vendor-controlled boards of directors may help facilitate larger commitments from existing vendors. A wider variety of vendors also increases managerial responsibilities, and vendor-controlled organizations, such as FM cooperatives,

may provide an improved governance structure to support a wide diversity of stakeholders.

Strengthening FM management

Our results indicate that full-time managers contribute to improved vendor performance. This may be due to managers more fully employed having additional specialized training or skills that can improve overall market operations and efficiencies. But keeping a full-time manager increases FM operational costs. It has been shown that strong management and community partnerships are often key factors in improving market success (Karpyn et al., 2010; Stephenson et al., 2008). Therefore, in the presence of financial constraints, community staffing support, along with hosting training programs for managers and vendor-directors would be beneficial to FM success.

Links to food assistance programs

Improving utilization and availability of federal nutrition benefits to low-income households at FMs would support higher customer purchases. Indeed, some evidence supports locating FMs near SNAP offices to increase low-income participation (SFC, 1995). The recently initiated Healthy Incentives Pilot (with funding from the 2008 US Farm Bill) is another promising effort, where for every dollar participants spend on fruits and vegetables using their SNAP Electronic Benefit Transfer (EBT) cards, 30 cents will be added to their benefit balance (Black, 2010).

While increasing availability of EBT machines at FMs is currently supporting these efforts; markets should also consider availability of other electronic transactions (e.g., debit and credit cards) in an increasingly 'paperless' world (Treuhaft and Karpyn, 2010). For instance, vendor-governed FM cooperatives may be able contract for reduced fees associated with utilizing debit and credit card readers at multiple vendor stations.

Conclusions

FMs continue to draw increasing attention by consumers and policy makers as a local affordable source of fresh and nutritious foods in rural communities and a mechanism to improve farm sales. To generate comprehensive programming and policy prescriptions, our results suggest that vendor and FM success should be considered by more than just financial sales performance. Indeed, market customers, vendors, and community planners are all likely to have multiple objectives for developing and participating in this market channel.

The expectation that community FMs can improve access to nutritious, affordable foods to residents in rural areas requires considerable planning, management and marketing experience, and involvement by all participating stakeholders (vendors, residents, community governments, and federal and state policy makers). Establishing public-private councils to consider diverse stakeholder interests and market and community goals may better facilitate planning market operations and enhance chances for success.

Ultimately, the question that must be answered is: To what extent can local farmers/vendors and rural community leaders sustainably address a void in rural food systems that grocery retailers are reluctant to address? The answer relies importantly on whether market channel diversification into FMs can improve vendor performance, while also improving social structures and community development goals to substantiate public investment. From our assessment of vendor performance at FMs in rural communities, we suggest four inter-related planning recommendations for private and public interventions.

Larger, centrally located markets

While mobile markets may be successful in reaching underserved urban communities (Mead, 2008), lower population densities in rural areas may limit customer traffic at such markets. Having centrally located regional or multi-community markets can increase customer traffic and support higher vendor recruitment with larger product assortments. Site selection becomes critical and can benefit from public–private council input and municipal investments in market amenities, particularly in public transportation services or travel subsidies for lower-income residents. Larger markets require additional support for expanded management and vendor training programs, which may be offered through cooperative extension or regional direct marketing associations.

Target variety in products and vendors

Targeted vendor recruitment to increase product assortment and availability is key to attracting a wide customer base. Variety needs to be considered in multiple dimensions, including the balance between full- and part-time vendors, organic and conventional products, food and non-food vendors, and fresh and processed foods. Wider product assortments and availability can add to a more one-stop-shopping environment, consumer convenience, and should increase customer traffic. Additional community infrastructure investments or changes in market policies and incentives may be necessary to increase the long-run availability of a wider variety and supply of products and vendors.

Increased attention to marketing

Higher vendor satisfaction at relatively newer markets emphasizes the importance for more established markets to continually develop new and innovative market features or activities, and to upgrade facilities to maintain and improve market attendance. Integration of FMs with existing or new community events can go a long way in facilitating social and civic structure improvements. At the same time, market directors should consider adopting marketing strategies utilized by grocery retailers (e.g., FM coupons) or pairing promotions across vendors (e.g., wine, bread, and cheese specials) to improve customer traffic and support repeat purchases, perhaps with municipal financial support. Existing federal programs can also be better utilized and managed for these purposes (e.g., value-added producer grants and FM promotion programs).

Reducing cost burdens to underserved residents

Although federal and state nutritional assistance and poverty program benefits at FMs are expanding, additional efforts are needed to improve market attendance. Given the vendor preference to participate in fewer and larger FMs, alternative transportation services and coordinated bussing to regional, multi-community markets will likely be needed. Transportation services add to the attractions of a market's amenities and reduces travel cost burdens. Considering ways that FM organizations can work with local school systems to purchase produce from local farmers and take advantage of funding provided by the Healthy, Hunger-Free Kids Act of 2010 (Eisler, 2010) may be a potential growth opportunity. For all residents, availability of credit and debit card readers can increase purchasing convenience, and transaction costs can be negotiated on behalf of vendors by market management, local governments, or public–private FM councils.

An important limitation of this study is that it focused on only one small rural region of the US. Rural communities are spatially

unique, given physical, financial, and human capital resources. As our study focused on one particular area in Northern New York, general policy prescriptions or strategies are problematic. Continued research across a variety of rural communities and regions will be important to the further development of sound initiatives aimed at improving market performance and healthy food access. Extending the model further would also be useful in developing benefit-cost ratio estimates or 'expert systems' for policy makers to more easily justify public sector support and attract private sector investment.

Acknowledgements

The authors would like to thank Bernadette Logozar and Allyson Jones-Brimmer for coordinating the data collection for this study. This material is based upon work supported by the College of Agriculture and Life Sciences – Cornell Cooperative Extension Summer Internship Program, the Northern New York Regional Local Foods Initiative, and USDA National Institute for Food and Agriculture Hatch funds NYC-127431. Although the research described in the article has been funded in part by USDA National Institute for Food and Agriculture funds, it has not been subjected to USDA review and therefore does not necessarily reflect the views of the Agency, and no official endorsement should be inferred.

References

- Barker, N., 2009. New New York program finances food stores in low-income communities. *The Gouverneur Times* (December 17). <<http://www.gouverneurtimes.com>> (verified 14.01.10).
- Biermacher, J., Upson, S., Miller, D., Pittman, D., 2007. Economic challenges of small-scale vegetable production and retailing in rural communities: an example from rural Oklahoma. *Journal of Food Distribution Research* 38, 1–13.
- Black, J., 2010. USDA pilot to subsidize fruits and vegetables. *The Washington Post* (20 August). <<http://voices.washingtonpost.com/all-we-can-eat/food-politics/usda-creates-pilot-to-subsidize-1.html>> (verified 22.08.10).
- Black, J.L., Mackinko, J., 2008. Neighborhoods and obesity. *Nutrition Reviews* 66, 2–20.
- Brown, C., Miller, S., 2008. The impacts of local markets: a review of research on farmers markets and community supported agriculture (CSA). *American Journal of Agricultural Economics* 90, 1296–1302.
- Dubowitz, T., Heron, M., Bird, C.E., Lurie, N., Finch, B.K., Basurto-Dávila, R., Hale, L., Escarce, J.J., 2008. Neighborhood socioeconomic status and fruit and vegetable intake among whites, blacks, and Mexican Americans in the United States. *American Journal of Clinical Nutrition* 87, 1883–1891.
- Eisler, P., 2010. Who qualifies for free/reduced-price lunch. *USA Today* (25 March). <http://www.usatoday.com/news/education/2010-03-24-school-lunch-safety_N.htm> (verified 19.08.10).
- Feenstra, G.W., Lewis, C.C., Hinrichs, C.C., Gillespie Jr., G.W., Hilchey, D., 2003. Entrepreneurial outcomes and enterprise size in U.S. retail farmers' markets. *American Journal of Alternative Agriculture* 18, 46–55.
- Fisher, A., 1999. Hot Peppers and Parking Lot Peaches: Evaluating Farmers' Markets in Low Income Communities. Community Food Security Coalition, Venice CA. <<http://www.foodsecurity.org/HotPeppersPeaches.pdf>> (verified 04.08.10).
- Gandee, J., Brown, C., D'Souza, G., 2003. The Role of Spatial and Demographic Characteristics in Direct Farm Marketing: An Econometric Approach. Selected Paper, American Agricultural Economics Association Annual Meeting, Montreal, CAN.
- Govindasamy, R., Nayga, R., 1997. Determinants of farmer-to-consumer direct market visits by type of facility: a logit analysis. *Agricultural and Resource Economic Review* 26, 34–38.
- Govindasamy, R., Italia, J., Zurbruggen, M., Hossain, F., 2003. Producer satisfaction with returns from farmers' market related activity. *American Journal of Alternative Agriculture* 18, 80–86.
- Griffin, M.R., Frongillo, E.A., 2003. Experiences and perspectives of farmers from Upstate New York farmers' markets. *Agriculture and Human values* 20, 189–203.
- Hajivassiliou, V.A., 1993. Simulation estimation methods for limited dependent variable models. In: Maddala, G.S., Rao, C.R., Vinod, H.D. (Eds.), *Handbook of Statistics*, vol. 11. Elsevier Science Publishing, New York.
- Hendrickson, D., Smith, C., Eikenberry, N., 2006. Fruit and vegetable access in four low-income food deserts communities in Minnesota. *Agriculture and Human Values* 23, 371–383.
- Henneberry, S., Agustini, H.N., 2004. An Analysis of Oklahoma Direct Marketing Outlets: Case Study of Produce Farmers' Markets. Selected Paper, Southern Agricultural Economics Association Annual Meeting, Tulsa, OK.
- Karpyn, A., Manon, M., Treuhart, S., Giang, T., Harries, C., McCoubrey, K., 2010. Policy solutions to the 'Grocery Gap'. *Health Affairs* 29, 473–480.

- LeRoux, M.N., Schmit, T.M., Roth, M., Streeter, D., 2010. Evaluating market channel options for small-scale fruit and vegetable producers. *Renew. Agric. Food Syst.* 25, 16–23.
- Lutfiyya, M.N., Lipsky, M.S., Wisdom-Behounek, J., Inpanbutr-Martinkus, M., 2007. Is rural residency a risk factor for overweight and obesity for U.S. children? *Obesity* 15, 2348–2356.
- Mead, M.N., 2008. The sprawl of food deserts. *Environmental Health Perspectives* 119, A335.
- Morgan, T., Alipoe, D., 2001. Factors affecting the number and type of small-farm direct marketing outlets in Mississippi. *Journal of Food Distribution Research* 32, 126–130.
- Morton, L.W., Blanchard, T.C., 2007. Starved for access: life in rural America's food deserts. *Rural Realities* 1, 1–9.
- Morton, L.W., Bitto, E.A., Oakland, M.J., Sand, M., 2005. Solving the problems of Iowa food deserts: food insecurity and civic structure. *Rural Sociology* 70, 94–112.
- Oberholtzer, L., Grow, S., 2003. Producer-only Farmers' Markets in the Mid-Atlantic Region: A Survey of Market Managers. Henry A. Wallace Center for Agricultural and Environmental Policy at Winrock International, Arlington, VA.
- Powell, L.M., Slater, S., Mirtcheva, D., Bao, Y., Chaloupka, F.J., 2007. Food store availability and neighborhood characteristics in the United States. *Preventive Medicine* 44, 189–195.
- Rose, D., Richards, R., 2004. Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. *Public Health Nutrition* 7, 1081–1088.
- Schafft, K.A., Jensen, E.B., Hinrichs, C.C., 2009. Food deserts and overweight schoolchildren: evidence from Pennsylvania. *Rural Sociology* 74, 153–177.
- Schatzer, R., Tilly, D., Moesel, D., 1989. Consumer expenditures at direct produce markets. *Southern Journal of Agricultural Economics* 21, 131–138.
- Sustainable Food Center (SFC), 1995. Access Denied: An Analysis of Problems Facing East Austin Residents in their Attempts to Obtain Affordable, Nutritious Food, Austin, TX. <http://www.sustainablefoodcenter.org/library/Access_Denied.pdf> (verified 04.08.10)
- Sharkey, J., 2009. Rural Food Deserts: Perspective from Rural Texas. Unpublished. Presented at the Institute of Medicine-National Research Council Workshop on the Public Health Effects of Food Deserts, Washington, DC, January 26–27.
- Sharma, A.J., Grummer-Strawn, L.M., Dalenius, K., Galuska, D., Anandappa, M., Borland, E., Mackintosh, H., Smith, R., 2010. Obesity prevalence among low-income, preschool-aged children—United States, 1998–2008. *Journal of the American Medical Association* 303, 28–30.
- Smith, C., Morton, L.W., 2009. Rural food deserts: low-income perspectives on food access in Minnesota and Iowa. *Journal of Nutrition Education and Behavior* 41, 176–187.
- Stephenson, G., Lev, L., Brewer, L., 2008. 'I'm getting desperate': what we know about farmers' markets that fail. *Renewable Agriculture and Food Systems* 23, 188–200.
- Story, M., Kaphingst, K.M., Robinson-O'Brien, R., Glanz, K., 2008. Creating healthy food and eating environments: policy and environmental approaches. *Annual Review of Public Health* 23, 253–272.
- Thilmany, D., Bond, C.A., Bond, J.K., 2008. Going local: exploring consumer behavior and motivations for direct food purchases. *American Journal of Agricultural Economics* 90, 1303–1309.
- Treuhaf, S., Karpyn, A., 2010. The Grocery Gap: Who Has Access to Healthy Food and Why It Matters. PolicyLink and The Food Trust. <http://www.thefoodtrust.org/catalog/download.php?product_id=171> (verified 20.08.10).
- United States Census Bureau, 2004. Urban and Rural Populations by State: 1990 and 2000. 2000 Census of Population and Housing, Population and Housing Unit Counts, Washington, DC. <<http://www.census.gov/prod/cen2000/phc3-us-pt1.pdf>> (verified 04.08.10).
- United States Census Bureau, 2009. Cumulative Estimates of Resident Population Change for the United States, NST-EST2009-02. Population Division, Washington, DC. <<http://www.census.gov/popest/estimates.html>> (verified 04.08.10).
- USDA, 2010a. WIC Farmers' Market Nutrition Program. Food and Nutrition Service, Washington, DC. <<http://www.fns.usda.gov/wic/fmnp>> (verified 29.01.10).
- USDA, 2010b. USDA Announces that National Farmers Market Directory Total 6132 Farmers Markets. Agricultural Marketing Service, Washington, DC. <<http://www.ams.usda.gov/farmersmarkets>> (verified 12.08.10).
- USDA, 2010c. Food Environment Atlas. Economic Research Service, Washington, DC. <<http://www.ers.usda.gov/foodatlas>> (verified 12.08.10).
- USDA, 2010d. Farmers Market Promotion Program. Agricultural Marketing Service, Washington, DC. <<http://www.ams.usda.gov/AMSV1.0/fmpp>> (verified 12.08.10).
- Varner, T., Otto, D., 2008. Factors affecting sales at farmers' markets: an Iowa study. *Review of Agricultural Economics* 30, 176–189.
- Whitacre, P.T., Tsai, P., Mulligan J. (Eds.), 2009. The Public Health Effects of Food Deserts: Workshop Summary, Institute of Medicine and National Research Council, National Academies Press, Washington, D.C..
- Wier, M., O'Doherty, J.K., Andersen, L.M., Millock, K., 2008. The character of demand in mature organic food markets: Great Britain and Denmark compared. *Food Policy* 33, 406–421.