The Potential for Restaurants in Expanding Markets for Locally Grown Food

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This study used primary data to characterize New Hampshire food service establishments sourcing local food products and assess potential for increasing intermediate purchase of local food. Recent studies imply New England consumers are not overly keen to purchase directly from farmers, but still want to consume locally grown food. Increasing local sourcing to intermediate channels may lower opportunity costs of buying local. Statewide surveys assessed practices, characteristics, and perceptions affecting purchasing of local food. We examined which variables affect the likelihood restaurants will buy local. Using binary logistic analyses (the dependent variable defined local purchasing as $\geq 41\%$ of total), we found restaurants serving less than 750 meals/week were less likely to purchase locally produced food, and restaurants making food purchasing decisions longer than two years have a negative propensity to buy local. Advocating the importance of knowing who and where their food comes from may help increase intermediate purchases.

Key words: Local Agriculture, Logit, New England, Restaurants, Survey

Local agriculture in the United States has expanded substantially in recent years. Local food sales accounted for $4.8 billion in 2008, with $2.7 billion spent through intermediary channels such as restaurants (Low and Vogel, 2011). In 2015, farmers sold $8.7 billion of edible food commodities directly to consumers, retailers, institutions, and a variety of local food intermediaries (Census of Agriculture Highlights, 2016). These channels have been somewhat neglected despite being a large part of local food distribution, and most U.S. research on the topic has focused on the Midwest and West. Many restaurants do not realize that local producers often provide equivalent or higher quality goods, and local food products can directly benefit restaurants via improved customer perception (Starr et al., 2003; Brain, Curtis, and Hall, 2015). Serving local food in restaurants benefits farmers who receive more of the goods' final prices, and recent New England research has shown consumers want options besides purchasing directly

from farmers (Werner et al., 2019). In short, it would be to the mutual benefit of producers and restaurants if they were better connected, and increasing local sourcing may help lower the opportunity cost of buying local.

Currently, an information gap exists between New Hampshire restaurants and local food producers. This study examines what affects the likelihood that a New Hampshire restaurant will make local food purchases. A statewide survey explores practices, characteristics, and perceptions affecting restaurant purchasing of local food products. Results provide missing information on purchasing trends, inform policy initiatives, and assist expansion plans in local food economies.

Research Questions and Approach

This study seeks an empirical understanding of factors affecting decisions to purchase local food products. Our research goals are to:

1. Identify factors that impact New Hampshire restaurants' abilities and decisions to purchase local food products through logistic analysis
2. Uncover restaurant purchasing trends, perceptions, and restraints to local sourcing in New Hampshire
3. Propose strategies for increasing indirect purchases of locally grown food products in Northern New England

We used a statewide survey informed by a pilot study of New Hampshire's Seacoast restaurants. The pilot study provided insight on what was considered valuable information for farmers, local food distributors, and restaurant owners and chefs. The survey gathered data about restaurant perspectives on local sourcing and barriers to increasing local purchases.

What is "Local?"

According to Low et al. (2015), local food systems refer to place-specific clusters of agricultural producers, along with consumers and institutions involved with producing, processing, distributing, and selling foods. The U.S. Department of Agriculture (USDA) considers food that travels 400 miles or less, or that is sold within the state where it is grown, to be locally and/or regionally sourced (Martinez et al. 2010). A recent New Hampshire study found a majority of residents defined "local" as grown or produced within a 50-mile radius (Pyburn et al., 2016). Since the definition of "local" remains ambiguous, focusing on the two different types of local markets helps direct empirical

research (Martinez et al., 2010). Local food market transactions can be made directly or indirectly; this study focuses on the latter. Here, "local" is defined as grown or raised within New England (a definition attributed to the New England 50/60 Food Vision).

Intermediate Markets

Local food products may be distributed to a variety of intermediate buyers including grocery stores, food service establishments, food hubs, retail stores, and state or federal institutions. Distribution to grocers can pose extra challenges as many stores require price look-up and universal product codes, and produce must meet grading standards (Moldovan, 2016). Nonetheless, expansion of indirect food sales and local branding initiatives has been rising with retailers, such as Wal-Mart and Hannaford, therefore increasing support for locally grown produce (Martinez et al., 2010). Identifying specific needs of intermediate buyers can be time-consuming for producers but is essential to developing long-term business relationships.

It is unclear which channel has the greatest potential. Restaurants offer greater flexibility since they can change menus based on seasonal or weekly availability of local food (Moldovan, 2016; Washington State Department of Agriculture (WSDA), 2010b). On the other hand, restaurants rely on timely deliveries and adequate supply, whereas grocery stores can direct consumers to other readily available products if a local distributor falls short. Moreover, local producers have the ability to supply intermediate markets, and restaurants in particular, with a diverse variety of high-quality products as well as a competitive edge through product differentiation.

Our research helps develop a better understanding of obstacles to local sourcing in intermediate channels, and aids in highlighting key distributor perceptions and how those match up with buyers. Understanding information gaps is key to increasing market efficiency. Further, statewide surveys provide information on perceptions of local food sourcing and impacts beyond the transaction. Identifying food- and supplier-related attributes helps inform marketing strategies for distributors and producers. Qualitative input from respondents also helps steer possible solutions to bridge the gap between producer and buyer.

Policies Supporting Local and Regional Food Systems

Empirical research finds that expanding local food systems can increase employment and income within a community (Martinez et al., 2010). Thus, a number of state and federal policies have been passed to support local food movements: the Agricultural Act of 2014

(USDA, 2014, Farm Bill, P.L. 113-79) includes provisions to help support local and regional food systems (Low et al., 2015), with expansions to the Bill since its approval including the Farmers' Market Promotion Program (FMPP, Sec. 10003), Specialty Crop Block Grants (SCBG, Sec. 10010), and Value-Added Producer Grants (Sec. 6203). Changes to the Farm Bill were designed to help market local food through direct-to-consumer outlets, indirect channels, funding for projects related to regionally marketed food, and farm-based "value-added" products (Low et al., 2015). At the state level, local initiatives such as the New England Food Vision encompass a vision for the region to produce 50% of its own food by 2060, to increase the amount of food-producing land from 5% to 15%; and for policy changes expanding farm-to-plate programs, increasing protection for farmland, and promotion of farmland access and training programs (Donahue et al., 2014). The Granite State Farm to Plate Food Policy and Principles Bill promotes "local food producers, farming, and fisheries, including businesses engaged in agriculture…and the associated local and regional businesses that process, purchase, distribute, and sell such food…" (Sec 425:2-a). Vermont's Farm to Plate Initiative seeks to "increase economic development in Vermont's farm and food sector, create jobs in the farm and food economy, and improve access to healthy local food for all Vermonters" (Kahler et al., 2013; Sec. 35. 10 V.S.A chapter 15A § 330).

Previous Research

A growing body of research is analyzing local food sourcing. Ortiz (2010) surveyed customers' willingness to pay premiums for locally sourced menu options. Over six trial days, 44% of participants selected local menu options and indicated they would pay a premium for locally sourced menu choices. The Food Processing Center (2003) surveyed members of the Chefs Collaboration and found respondents preferred to purchase directly from farmers. How a product was grown, freshness, and quality were highly valued, while availability and delivery were obstacles to local sourcing. If greater variety or quantity was provided, 38% of respondents would increase local food purchases; 33% would increase purchases only if a larger variety were available. Curtis and Cowee (2009) surveyed Nevada restaurants and found chefs bought locally sourced products for quality, taste, and freshness. An obstacle for 75% of respondents who did not purchase locally was unawareness of local options. Chefs concerned with production issues, knowledge of the farmer, and representing gourmet and independently owned restaurants were more likely to purchase local foods. The Gregoire et al. (2005) Iowa survey revealed only 25% of producers were selling to food service operations, while 44% had never sold to one, noting unreceptive buyers or farmers could not keep up with quantity

and year-round demand. Lack of knowledge for purchasers and suppliers impeded local sourcing to intermediate operations.

Schneider and Francis (2005) surveyed farmers and consumers in Nebraska on the potential of the local food system. Results revealed low farmer interest for providing to local markets even though there was a high level of consumer interest in purchasing local food. Sharma, Gregoire, and Strohbehn (2009) conducted face-to-face interviews of restaurateurs in the Midwestern United States and found no significant difference in the cost of using local ingredients, though there were higher costs for delivery and transportation. Inwood et al. (2008) collected quantitative and qualitative data from interviews with Ohio restaurants and found distribution problems and a lack of convenience to be limiting factors for the use of local products.

Starr et al. (2003) used telephone surveys of Colorado farmers and food service buyers and found price was not a major factor in purchasing decisions, while quality was among the top priorities of intermediate buyers. Many were not aware that local farmers could provide a comparable or higher quality product and service. Another study used focus groups to investigate shoppers' beliefs and behaviors regarding local foods in Madison, Wisconsin (Zepeda and Leviten-Reid, 2004). A significant finding was that respondents were not concerned with local food labels, but were concerned with product qualities of local foods. The authors found that marketing strategies catering to consumer concerns were needed for local food promotions.

Brain et al. (2015) studied the Utah Farm-Chef-Fork Program, connecting producers and restaurants through workshops, farm and restaurant tours, and other local-sourcing events via pre- and post-assessments, and found that 71% of purchasers indicated they would increase the percentage of ingredients sourced locally as a result of the program's workshops. Market activities such as contacting a local farm for the first time, knowing the best time of day to make a new contact, knowing what area farms sell locally, and understanding needs of local farmers were a central focus of the study. Post-assessment revealed participants' confidence in these marketing activities increased significantly from confidence scores on the pretest.

Smith II et al. (2013) conducted an online survey in the Northeastern United States to identify factors influencing hospitals' decisions to adopt "farm-to-hospital" programs (FTH). The survey, sent to a random sample of 160 hospital food and nutrition service directors, identified agriculture and county characteristics of areas in which hospitals are located and how they may affect a hospital's propensity to adopt FTH. The authors found that the Healthy Food in Healthcare Pledge, number of hospital meals prepared daily, percent of farms participating in Community Supported Agriculture, and a hospital's county classification had the greatest impacts on the decision to adopt FTH. O'Hara and

Benson (2017) used probit and OLS to explore how local food purchases by schools are influenced by local agricultural conditions using data from the 2015 Farm to School Census. Results implied that the value of local direct-to-consumer agriculture, number of students, and relative prosperity of the school district had positive impacts on the probability of a School Food Authority making local food purchases. Ralston et al. (2017) studied school districts using the 2013 Farm to School Census, school district data, and state and county attributes from USDA's Economic Research Service's Food Environment Atlas. Districts with enrollment above 5,000, in counties with high farmers market density, higher per capita income, higher level of college attendance, and those in states with more policies supporting farm-to-school programs were more likely to serve local foods. Moldovan (2016) surveyed Missouri buyers, including restaurants, grocery stores, distributors, government and academic institutions, and other intermediate buyers, with data split into institutional and intermediated. Results showed institutions were 22% less likely to purchase local products than intermediate buyers.

Surveying this literature, common themes emerge. First, not knowing where and what local producers have available was a common reason for intermediate buyers not purchasing local food (Food Processing Center (FPC), 2003; Curtis and Cowee, 2009; Gregoire et al. 2005; Starr et al. 2003). Second, most research has been done in the Midwest, leaving an information void on intermediate markets in the Northeast. Size, location, farm-to-institution policies, and various sociodemographic characteristics all play significant roles in intermediate establishments' willingness and abilities to source locally (O'Hara and Benson, 2017; Smith et al., 2013; and Ralston et al., 2017).

Pilot Study

To investigate the role that restaurants play in distributing local food, a pilot study was conducted in the Seacoast Region of New Hampshire, where the local food movement has been gaining strength. According to the 2012 Census of Agriculture data, 51.4% of New Hampshire is woodland, 24.9% cropland, and 8.9% pastureland (Vilsack and Clark, 2014). Due to the state's topography, expansion of farms may be difficult at best, and recent research does indeed indicate that land availability is a major constraint to expanding local agriculture (Werner et al., 2019). However, little research has been conducted to examine this possibility and linkages between the local and regional food systems. The main goal of the pilot study was to highlight perceptions and barriers between producers and restaurants in Seacoast New Hampshire.

A series of interviews was conducted with local food distribution outlets, including Farm Fresh Connection, Unity Food Hub, Three Rivers Alliance, and Farm to Restaurant

Connection. These provided insights on the supply side of the market and how the food network typically operates in New England. An interesting takeaway was that local food distributors felt they could compete with national suppliers in terms of price, quality, and quantity. Interview questions were shaped by these findings and previous surveys by FPC (2003), Ortiz (2010), and Starr et al. (2003). The definition of local was left to respondents for this portion of the research. A list of restaurants along New Hampshire's seacoast was used to select interview subjects. Selected subjects were asked if an owner or kitchen manager would participate in a 20- to 30-minute interview. Survey answers were recorded manually.

In total, 16 restaurants along the Seacoast participated, self-identifying as nine casual/family, one fine dining, three pub fare, and two seafood. The top three reasons for making local food purchases were 1) support for the local economy and farmers, 2) freshness, and 3) locally sourced menu options were desired by patrons. Additionally, eight interviewees cited quality as their top concern when making purchases and three considered price their top concern. Among independently owned restaurants, availability was cited by seven restaurants as the main obstacle to sourcing local food products, whereas franchises were more concerned with consistency across restaurant locations. Other concerns included customer service, seasonality, lack of farmers markets in the area, communication, and price increases during the offseason.

Of interest was that 15 of 16 restaurateurs perceived local food as a "profitable" asset to their business despite obstacles encountered in the purchasing process. In regard to contacting suppliers, 25% of interviewees were actively seeking new local suppliers, 37% relied on "word of mouth," 13% waited for farmers to approach them, 13% went to farmer's markets, and 12% were not seeking new suppliers. Eight of the restaurants estimated that 35% or less of their budget was spent on local food sources while the other half estimated at least 50% of their budget was spent on local suppliers.

One product that a number of restaurants would like to purchase locally more often was meat, particularly red meat, which can be sourced year-round. The main obstacle to sourcing local beef, however, was cost. Lastly, 14 restaurants stated that their menus featured "seasonal" items which offer greater flexibility when doing business with local farmers.

Methods

Objectives

Following Smith II et al. (2013), O'Hara and Benson (2017), Moldovan (2016), FPC (2003), Curtis and Cowee (2009), and questions inspired by the pilot study, a logit model was specified to examine the propensity of New Hampshire restaurants to purchase locally grown food. The model includes explanatory variables such as buyer classification, supplier attributes, perceptions of food-related attributes, buyer autonomy, and other restaurant demographics.

Ordered and binary logit models were estimated. The dependent variable for the binary model equaled one if the respondent's percentage of monthly local food purchases is $\geq$ 41%, and zero when the respondent's percentage of monthly local food purchases is $<$ 41%. The threshold parameter (41%) was based on previous research by FPC (2003). This screening prevents establishments which purchase small percentages of local food from being classified as local buyers, so that the model identifies characteristics of only major purchasers.

Survey Design

There are 3,063 eating and drinking establishments in New Hampshire (New Hampshire Lodging and Restaurant Association (NHLRA), 2017). In order to gather data, an online survey was issued to these establishments via Qualtrics survey software. The statewide survey contained 25 questions pertaining to food service establishment demographics, purchasing power, perceptions of local food, obstacles related to sourcing local food, and marketing local menu options. Survey invitations were sent via email through the NHLRA to its members. This yielded only 10 responses, so an additional 1,145 email addresses were extracted from New Hampshire's Licensing Verification Site Facility Search to conduct another survey launch. One caveat is that the website only includes restaurants with active liquor licenses. Data were collected from October 2017 until March 2018. STATA statistical software was used to obtain descriptive statistics and estimate regression models.

Conceptual Model

A binary choice of the *i*th individual is represented by a random variable y_i that takes on a value of 1 if local sourcing occurs and 0 otherwise. P_i is the probability that y_i takes on the value 1, and $1 - P_i$ is the probability that y_i is 0. This can be written as

(1)

$$F(y_i) = P_i^{y_i}(1 - P_i)^{1-y_i} \qquad y_i = 0,1$$

$$\text{and}$$

$$y_i = \left\{ \begin{array}{ll} 1 & \text{with probability } p \\ 0 & \text{with probability } 1 - p \end{array} \right.$$

In this case, *y*=1 when the respondent's percentage of monthly local food purchases is $\geq$ 41% of total food purchases and *y*=0 otherwise a logistic regression model is outlined below. For *k* explanatory variables and *i* =1,…, T individuals, the logistic model is

(2)

$$\log\left[\frac{p_i}{1 - p_i}\right] = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik}$$

where p_i is the probability that y_i takes on the value 1, and then $1 - p_i$ is the probability that that y_i is 0. Solving the logit equation for p_i

(3)

$$p_i = \exp \frac{(\alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik})}{(1 + \exp(\alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_k x_{ik})}$$

Using the property $\log(e^x)$= x, we further simplify the last equation

(4)

$$p_i = 1 /(1 + \exp(\alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_k x_{ik})$$

The marginal effect of an increase in a regressor x_i on the probability of selecting y_i is

(5)

$$\frac{\partial P_{ij}}{\partial x_{ri}} = \beta p_i (1 - p_i)$$

If the explanatory variable is discrete, $\partial p_i / \partial x_{ij}$ does not exist and the discrete explanatory variable is obtained by evaluating P_i at alternative values of x_{ij} taking on values of 1 and 0. The marginal effect of a discrete variable is expressed as

(6)
$$\frac{\partial p_i}{\partial x_{ij}} = P(x_{ij} = 1) - P(x_{ij} = 0)$$

Ordered Logit Theory

The conceptual theory for an ordered logistic model differs slightly. Ordered outcomes are modeled to arise sequentially as a latent variable, y^*, crosses progressively higher thresholds (Cameron and Trivedi, 2009). For this model, y^* is an unobserved measure of local sourcing levels. For individual *i,* we specify

(7)
$$y^* = x_i' \beta + u_i$$

where a normalization is that the regressors x do not include the intercept. For very low local sourcing y^*, local sourcing is 0-20%; for $y^* > \alpha_1$, local sourcing increases to 21-40%; for $y^* > \alpha_2$, local sourcing increases to 41-60%; for $y^* > \alpha_3$, local sourcing increases further to 61-80%; for $y^* > \alpha_4$, local sourcing increases to 81-100%.

For an *m*-alternative ordered model, we define

(8)
$$y_i = j \text{ if } \alpha_j - y_i^* \leq \alpha_j, \qquad j = 1, \ldots, m$$

where $\alpha_0 = -\infty$ and $\alpha_m = \infty$. Then

(9)
$$\begin{aligned}
\Pr(y_i = j) \quad &= \Pr(\alpha_{j-1} < y_i^* \leq \alpha_j) \\
&= \Pr(\alpha_{j-1} < x_i'\beta + u_i \leq \alpha_j) \\
&= \Pr(\alpha_{j-1} - x_i'\beta < u_i \leq \alpha_j - x_i'\beta) \\
&= F(\alpha_j - x_i'\beta) - F(\alpha_{j-1} - x_i'\beta)
\end{aligned}$$

where F is the cumulative distribution function of u_i. The regression parameters, β

and $m-1$ threshold parameters $\alpha_1, ... \alpha_{m-1}$, are obtained by maximizing the log-likelihood with $p_{ij} = \Pr(y_i = j)$ as previously defined (Cameron and Trivedi, 2010).

For the ordered logit model, u is logistically distributed with $F(z) = \frac{e^z}{1+e^z}$. The sign of the regression parameters, β, can be interpreted as the predicted probability of a respondent operating in each local sourcing level, and cumulative probabilities can be predicted as well. The model assumes the outcome variable is a latent variable (Liu, 2010). It is expressed as

(10)

$$\ln(Yj') = \text{logit } [\pi(x)] = \ln\left(\frac{\pi_j(x)}{1 - \pi_j(x)}\right) = \alpha_j + \left(-\beta_1 X_1 - \beta_2 X_2 - \cdots - \beta_p X_p\right)$$

where $\pi_j(x) = Y \leq j | x_1, x_2, ... x_p)$, the probability of being at or below category j, given a set of predictors (Liu, 2010). For the model, α_j are cut points, and $\beta_1, \beta_2 ... \beta_p$ are logit coefficients.

Variable Definitions

Based on previous literature, the pilot study, and theory, our model takes the form

(11)
BUY_LOCAL $(0, 1) = \beta_0 + \beta_1 BUS\_TYPE + \beta_2 MEALS750 + \beta_3 MEALS1250 + \beta_4 MEALS1750 + \beta_5 MODERATE\_AUTONOMY + \beta_6 COMEPLETE\_AUTONOMY + \beta_7 STORE\_LOCATIONS + \beta_8 SUPPLIER\_ATTRIBUTES + \beta_9 PRODUCTION + \beta_{10} PURCHASING\_VOLUME + \beta_{11} AUTO\_LENGTH + \beta_{12} FOOD\_ATTRIBUTES + \beta_{13} CHALLENGES + \beta_{14} IMPACTS + \in$

Respondents from each establishment were asked if they had purchased locally produced food products within the past calendar year ("local" = grown or raised in New England). Respondents were then asked what percentage of their food purchases were locally sourced, on a scale of 0-20%, 21-40%, 41-60%, 61-80%, and 81-100%. Responses were transformed into the model's binary dependent variable.

Of 14 explanatory variables in the model, one is continuous, eight are discrete, and five are composite variables based on factor analysis (Table 1). For *Food Attributes*, respondents were asked to rank the importance of 11 different food characteristics over a

range of 1-5 (1 being Not Important; 5 being Very Important), making the overall range of the variable 4-20. Of the 11 attributes, four were selected based on buyers' reasons for making local food purchases: 1) product's brand 2) product's quality, 3) personally know who raised or grew product, and 4) product is nutritious and healthy. *Production* includes questions on farming methods. Respondents were asked to rank the importance of 1) knowing how a product was grown, 2) if the product was New England-grown, and 3) ability to process and package products according to buyer needs. The range on each question was 1-5 (1 being Not Important; 5 being Very Important), making the overall range of the composite variable 3-15.

The third composite variable, *Supplier Attributes*, is based on supplier perceptions. Respondents ranked the importance of the following characteristics when making purchasing decisions: 1) guaranteed consistent delivery, 2) ability to provide promotional samples, 3) ability to develop a long-term business relationship, and 4) product knowledge, making the overall range of the composite variable 4-20. The composite variables *Supplier Attributes* and *Production* are based on work by Curtis and Cowee (2009). *Challenges* and *Impacts* controlled for perceptions of local sourcing obstacles and broader impacts of local food production. The range on each question was 1-5 (1 = Strongly Disagree; 5 = Strongly Agree). Respondents were asked if they agreed or disagreed that 1) inconsistent quality, 2) price, 3) lack of availability, and 4) inconsistent deliveries impeded their ability to source locally, making the overall range of the composite variable 4-20 for *Challenges*. For *Impacts*, respondents were asked if they agreed or disagreed that local food production 1) reduces the carbon footprint, 2) helps sustain the environment, and 3) helps support the local economy, for a maximum composite score of 15.

This study tests if restaurants serving less than 1,750 meals/week are more likely to buy local. Curtis and Cowee (2009) classified restaurants serving over 1,750 meals/week as "large" which were found to negatively impact a restaurant's likelihood of purchasing locally. It is hypothesized that restaurants serving less than 1,750 meals/week (small-midsized) will not require the consistent and large volumes local distributors may have difficulty supplying and will, therefore, be more likely to source more from local suppliers.

Table 1. Variable Definitions.

Variable	Definition	Coefficent
Bus Type:	Indicator variable representing the type of ownership of the establishment; Chain or franchise (=1), Independent (=2), Corporate (=3), and Other (=4)	+ (chain), -independent, - (corporate)
Meals (750):	Average number of meals served per week for each establishment; =0 if the establishment serves ≥750 meals per week and =1 if the establishment serves <750 meals per week	+
Meals (1250):	Average number of meals served per week for each establishment; =0 if the establishment serves ≥1250 meals per week and =1 if the establishment serves <1250 meals per week	+
Meals (1750):	Average number of meals served per week for each establishment; =0 if the establishment serves ≥1750 meals per week and =1 if the establishment serves <1750 meals per week	+
Store Locations:	Continuous variable representing the number of store locations the establishment owns and operates.	
Moderate Autonomy	Dummy variable representing the level of autonomy, =1 if mostly autonomous and =0 all else	
Complete Autonomy	A dummy variable representing the level of autonomy; =1 if completely autonomous and =0 all else	-
Supplier Attributes	Composite variable comprised of questions based on the buyer's perception of important supplier related attributes, including 1) Guaranteed consistent delivery, 2) Ability to provide promotional samples, 3) Ability to develop a long-term business relationship, and 4) Product knowledge. The range on each question is 1-5 (1 being Not Important; 5 being Very Important), making the overall range of the composite variable 4-20.	+
Production	Composite variable comprised of questions based on the buyer's perception of important production related attributes, including 1) Knowing how a product was grown, 2) If the product was New England grown or raised, and 3) Ability to process and package products according to their needs. The range on each question is 1-5 (1 being Not Important; 5 being Very Important), making the overall range of the composite variable 3-15.	+
Purchasing Volume	Represents total annual purchasing volume, in dollars, of fresh fruits and vegetables for the establishment ranging on a scale from less than $5,000 to Greater than $500,000	-
Autonomy Length	Represents the number of years the respondent has had their indicated level of autonomy. Less than 2 years (=1), 2 to 5 years (=2), 5 to 7 years (=3), 8 to 10 years (=4), and Greater than 10 years (=5).	+
Food Attributes	Composite variable comprised of questions based on the buyer's perception of food-related attributes, including 1) Product's brand 2) Product's Quality, 3) Personally know who raised or grew product, and 4) Product is Nutritious and healthy. Range on each question is 1-5 (1 Not Important; 5 Very Important), making the overall range of the composite variable 4-20.	-
Challenges	Composite variable comprised of questions based on the buyer's perception of local sourcing related challenges, including 1) Inconsistent quality, 2) Price, 3) Lack of availability, 4) Inconsistent delivery. The range on each question is 1-5 (1 Strongly Disagree; 5 being Strongly Agree), making the overall range of the composite variable 4-20.	+
Impacts	Composite variable comprised of questions based on the buyer's perception of broader local sourcing impacts, including 1) Reducing the carbon footprint, 2) Help sustain the environment, and 3) Help support the local economy. The range on each question is 1-5 (1 Strongly Disagree; 5 being Strongly Agree), making the overall range of the composite variable 3-15.	+

Table 1 shows predicted signs by variable. Following Curtis and Cowee (2009) and Starr et al. (2003), variables such as *Bus Type, Store Locations, Autonomy,* and *Autonomy Length* are predicted to have statistically significant and positive impacts on the likelihood of a food service establishment purchasing local food products. Independently owned restaurants may not have to abide by product uniformity and, thus, may be more likely to purchase food from local suppliers, whereas franchises or corporations may not have that luxury. Establishments with greater autonomy are predicted to source a higher percentage of local food products owing to greater input on purchasing decisions. *Food*

Attributes and *Production* are predicted to have positive yet marginal effects. Specifically, if respondents indicate a mean score ≥ 8, they may be more apt to source locally as they value attributes and production methods associated with local food and sourcing. *Supplier Attributes* is hypothesized to have a negative sign as local food suppliers may not have long-standing relationships with buyers and the consistent supply that restaurants require.

Descriptive Results

A sample of 145 food service establishments completed the survey; 109 were usable for analysis. Of respondents, 81% were independent, 3.6% were part of a chain or franchise, and 7.2% were corporate (6.3% other). Of the 109, 20.1% were buying ≥ 41% of total monthly purchases from local sources. The most frequent source of food purchased by restaurants was from a national food supplier, but nearly one-third of respondents indicated they made purchases directly from a farmer or regional foodservice distributor (Table 2). When asked where they would *prefer* to make the majority of food purchases, almost half of respondents indicated they would like to purchase directly from a farmer. For the purpose of this study, "local" was defined as raised or grown in New England, but respondents were also asked how they personally define "local." Of those who answered, 26.6% considered local as being grown or produced within New England, 25.6% within 50 miles, 19.2% within New Hampshire, and 17.4% within 100 miles.

Table 2. Purchases Made from Various Food Suppliers.

Supplier Type	Frequency	Percent
National food service distributor	54	49.5
Direct from a farmer	40	36.6
Regional food service distributor	40	36.6
Local manufacturer or processor	26	23.8
Direct from a farmers' co-op	14	12.8
Farmer's market	13	11.9
Food hub	10	9.1
Other	7	6.4

Note: Buyers could select all that apply.

Respondents were most interested in purchasing locally produced vegetables (73%), fresh-cut produce (50%), local cheese (49%), and local beef (48%); and least interested in

grains, wine, and yogurt. All buyers cited taste as important or very important, also noting quality (98%), cost (74%), and product marketability (67%) as important. A majority of respondents (97%) cited consistent supply and quality as important or very important. Buyers were least concerned with kitchen/staff training and promotional samples. Approximately 74% of buyers had promoted their use of locally sourced products. The top form of advertisement was word of mouth (87% cited as very or extremely effective); 0% cited newspaper advertisement as effective for promoting local food use.

  Buyers cited seasonal availability of produce as the top challenge to purchasing local food products (Table 3); 96% agreed or strongly agreed local sourcing helps keep local farmers in business, and 93% felt it supports the local economy. Lastly, buyers were asked how they would like to be notified about availability of local food products, with a plurality (47%) preferring online newsletters, and less interest in social media and in-person visits (16% each).

Table 3. Challenges to Sourcing Local Food Products.

Challenge Type	Frequency	Percent
Season availability of vegetables	83	76.1
Seasonal availability of fruits	82	75.2
Lack of availability	79	72.4
Price	67	61.4
Inconsistent delivery times	45	41.2
Undeveloped relationship with farmers	40	36.6
Inconsistent quality	35	32.1
Lack of farmers' markets	27	24.7
Lack of commitment by farmers	26	23.8
Lack of food safety certification	21	19.2
Lack of interest by farmers	15	13.7
Additional food preparation required	12	11
Packaging issues	9	8.2
Negative relationship with farmers	4	3.6
Other	3	2.7
Low quality	0	0

Qualitative Results

Respondents were asked open response questions on strategies to increase local sourcing, why they continue to source locally, or why they have not sourced locally. Top reasons for sourcing local food products include: 1) higher quality, 2) supporting local businesses, and 3) supporting local farmers; also cited were freshness, customer preferences, sustainable practices, and knowing who and where the food comes from. Those not purchasing local cited availability and cost as barriers (Figure 1). Providing better networking and distribution systems were the top solutions suggested to connect farmers with food service establishments (Figure 2).
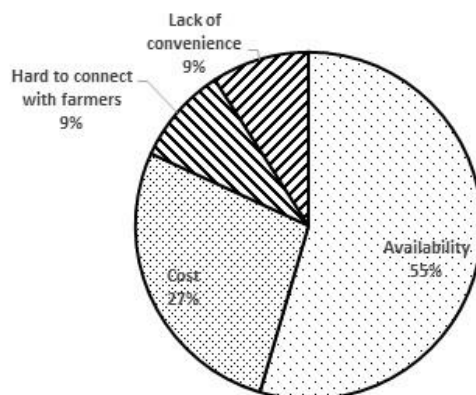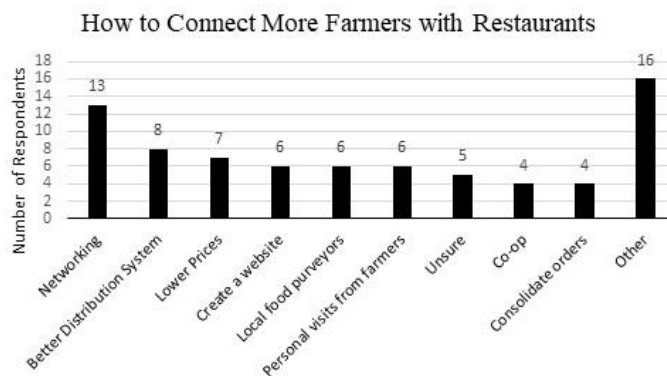

Figure 1. Reasons for Not Buying Locally.

Figure 2. Proposed Solutions for Increasing Local Sourcing.

Logit Model Results

Parameter estimates from the logistic model were used to calculate probability of a buyer's willingness to purchase at least 41% of their food from local sources. The χ^2 results imply that the model is statistically significant as a whole. The Hosmer-Lemeshow χ^2 shows no evidence of poor fit, implying a correctly specified model. Estimated coefficients and marginal effects were obtained using STATA (Table 4). Of 109 respondents, 20% were buying local ($\geq$ 41%). Coefficients for meals (< 750), *Autonomy Length,* Level (*Moderately Autonomous*), and the composite variable for *Production* were statistically significant at the 5% level. The estimated coefficient for *Impacts* was positive and statistically significant at the 10% level. Length of autonomy and number of meals served per week (<750) had negative marginal effects.

Table 4. Broader Impacts Associated with Local Food Production and Purchasing.

Broader Impacts	Frequency	Percent
They help keep local farmers in business	105	96.3
They help support the local economy	101	92.6
They help local farmers expand their operations	90	82.5
Locally produced food products taste better	79	70.4
They are safe to eat	75	68.8
They reduce the carbon footprint	79	72.4
They help sustain the environment	76	69.7
There is a growing preference for local menu options among customers	74	67.8
Locally sourced menu options attract a higher number of customers	66	60.5
Other	3	2.7

   Buyers serving less than 750 meals/week were 19% less likely to buy local than those serving more than 750 meals/week. Buyers with an autonomy length of 5-7 years were 27% less likely to buy local than those with autonomy under two years. Buyers with an autonomy length of 8-10 years were 30.5% less likely, and buyers with autonomy greater than 10 years were 29% less likely to buy local than buyers with autonomy less than two years. Marginal effects implied buyers who were mostly autonomous (12% of total) were 38% more likely to purchase locally than those with minimal autonomy. An additional one-unit increase in *Production* increases the probability of buying local by 4.4%. When there is no perceived value in local production techniques, buyers are only 4.4% more likely to make local food purchases, but at a score of 15, are 52.8% more likely to

purchase locally. An additional one-unit increase in *Impacts* increases probability of buying local 4.7%. When there are no perceived broader impacts of local production, buyers are only 4.7% more likely to make local purchases. If a buyer thinks local food had a positive impact on the environment and the local economy for a maximum composite score of 15, they are 56.4% more likely to buy local.

Odds Ratio

The odds ratio in logistic regression is interpreted as the effect of a one-unit change in X in the predicted odds ratio (other variables held constant) (Table 5). The odds ratio of .102 for *Meals (<750)* implies the odds of buying local for a restaurant serving less than 750 meals per week are 89.7% lower than the odds for a restaurant serving more than 750 meals. The odds ratio of 1.59 for *Production* implies a 59% increase in the odds of buying local for a one-unit increase in the composite variable score. For *Impacts*, there is a 63% increase in the odds of buying local for every one-unit increase in the composite variable score. For restaurants making purchasing decisions 5-7 years, odds of buying local are 46% lower than the odds for restaurants making purchasing decisions less than two years. Level of autonomy appears to play a positive role in the odds of buying local. Results imply that odds of buying local for mostly autonomous restaurants are 24 times higher than restaurants with minimal autonomy.

Attributes by Restaurant Size and Length of Autonomy

Overall, 30 restaurants served less than 1,750 meals/week, 28 served less than 1,250 meals/week, and 51 served less than 750 meals/week. Similar trends for the level of autonomy across the board were displayed, but restaurants serving less than 750 meals/week were the majority of completely autonomous establishments. The majority of restaurants serving less than 750 meals/week have been making purchasing decisions more than 10 years. For composite variable scores, no differences were found by restaurant size. Average composite scores for the 5 variables remained consistent across categories. Each variable's mean scores were within one point of each other, implying no major differences in business practices or perceptions by size of establishment. Similar trends held across length of autonomy: years making purchasing decisions do not change perceptions or business practices. Results show 17 restaurants making purchasing decisions less than two years, 17 for 2-4 years, 11 for 5-7 years, 11 for 8-10 years, and 54 over 10 years. In each group, the majority were independent restaurants. The majority of restaurants making purchasing decisions more than 10 years mainly had complete

autonomy over purchasing. No differences were found among mean composite variable scores by length of autonomy. Results imply no strong correlation between restaurant size or autonomy length with establishment attributes or perceptions of local food.

Table 5. Estimated Coefficients and Marginal Effects Accompanied with p-Values of Independent Variables on Willingness to Purchase Local Food Products for Binary Logit Model.

Variable	Coefficient	P-Value	Marginal Effect	P-Value	Odds Ratio
Meals (≥750)	-2.278	0.021	-0.19	.003***	0.102
Meals (≥1250)	-0.624	0.714	-0.061	0.719	0.545
Meals (≥1750)	-1.42	0.405	0.126	0.349	4.13
Moderate Autonomy	3.185	0.067	0.381	.033**	24.17
Complete Autonomy	0.754	0.513	0.069	0.482	2.12
Store Locations	-0.168	0.517	-0.016	0.514	0.845
Supplier Attributes	0.014	0.929	0.001	0.929	1.01
Production	0.463	0.064	0.044	.046**	1.59
Volume	0.217	0.229	0.021	0.217	1.24
Autonomy Length					
2 (2 To 4 Yrs)					
3 (5 To 7 Yrs)	-0.607	0.582	-0.076	0.58	0.544
4 (8 To 10 Yrs)	-2.437	0.101	-0.268	.045**	0.087
5 (>10 Yrs)	-2.952	0.099	-0.305	.025**	0.052
	-2.695	0.017	-0.288	.006***	0.067
Food Attributes	-0.011	0.949	-0.001	0.949	0.988
Impacts	0.488	0.067	0.047	.055*	1.62
Challenges	-0.036	0.819	-0.003	0.819	0.964
Business Type					
2	-1.478	0.371	-0.163	0.462	0.227
3	0.302	0.884	0.039	0.884	1.35
4	0.711	0.728	0.092	0.722	2.03
Constant	-10.624	0.014	---		--- ---

*** $\chi 2$ Chi-square significant at p<.01

** $\chi 2$ Chi-square significant at p<.05

 * $\chi 2$ Chi- square significant at p<.10

$\chi 2$ Chi Squared: 39.80***

 Prob > $\chi 2$: 0.0035

 McFadden Pseudo R2: 0.3771

 N = 106 (due to missing values in remaining 3 surveys)

 Hosmer-Lemeshow $\chi 2(8)$: 11.74

 Prob > $\chi 2$: 0.1632

Table 6. Ordered Logit Results.

Variable		Coefficient	Standard Error	P Value	Odds Ratio
Meals (≥750)		-0.049	0.49	0.92	0.951
Meals (≥1250)		-0.374	1.07	0.727	0.687
Meals (≥1750)		0.358	1.111	0.747	1.431
Moderate Autonomy		0.61	0.776	0.432	1.84
Store Locations		-0.119	0.127	0.349	0.887
Supplier Attributes		-0.064	0.093	0.487	0.937
Production		0.589	0.136	.000***	1.8
Volume		0.16	0.109	0.141	1.174
Autonomy Length					
	2	0.214	0.783	0.784	1.239
	3	-1.378	0.874	0.115	0.252
	4	-0.428	0.91	0.638	0.651
	5	-0.273	0.635	0.667	0.76
Food Attributes		-0.068	0.084	0.419	0.933
Impacts		0.079	0.099	0.426	1.082
Challenges		-0.001	0.084	0.99	0.998
Business Type					
	2	-1.682	1.45	0.246	0.185
	3	-1.57	1.639	0.338	0.208
	4	-1.851	1.672	0.268	0.157
Cut 1		3.088	2.431		
Cut 2		4.161	2.444		
Cut 3		5.9	2.478		
Cut 4		7.423	2.531		

** Chi-squared significant at p<.05

 * Chi-squared significant at p<.10

N=106 (due to missing values in 3 surveys)

Ordered Logit Results

Table 6 lists the model's estimated coefficients and odds ratios. A one-unit increase in *Production* leads to a .589 increase in log odds of a higher level of local sourcing. For a one-unit increase in *Production*, odds of the highest level of local sourcing vs. lower levels are 1.8 times greater. Due to the proportional odds assumption, the same increase is found between all levels of local sourcing. Threshold parameters (cut points) indicate where the latent variable is cut to make the five groups found in the data (i.e. constants are set to zero and cut points estimated for separating the five levels of local sourcing. With five possible values for Y, threshold parameter values are: $Y_i = 1$ if Y_i^* is ≤ 3.088; $Y_i = 2$ if $3.088 \leq Y_i^* \leq 4.161$; $Y_i = 3$ if $4.161 \leq Y_i^* \leq 5.900$; $Y_i = 4$ if $5.900 \leq Y_i^* \leq 7.423$; $Y_i = 5$ if $Y_i^* \geq 7.423$. According to results, threshold parameters do not differ statistically so they should be collapsed into fewer categories.

   The probability of sourcing 0-20% from local sources increases by 15% per one-unit increase in the composite score of *Production* (Table 7), with diminishing effects for higher values of *Production*. For *Autonomy Length*, probability of 0-20% local sourcing is 33% more likely for restaurants that have been making purchasing decisions 5-7 years than restaurants with less than two years of purchasing decisions; the probability of 41-60% local sourcing decreases by 16.9% for restaurants that have been making purchasing decisions for 5-7 years than restaurants with less than two years of purchasing. Results suggest small-midsized restaurants are less likely to purchase local. A closer look at the data, however, revealed that 74% of buyers serving less than 750 meals/week sourced at least 11% of food products from local sources. The probability of 0-20% local sourcing is 32% higher for independent restaurants, but 19% lower for probability of 41-60% local sourcing. Buyers identifying as *mostly autonomous* were 38% more likely to buy local than those with minimal autonomy. This suggests those looking for new buyers might focus on restaurants with more purchasing flexibility, such as independent restaurants. Independent restaurants are more likely to increase local purchases up to 40%. Results imply respondents making purchasing decisions more than two years are less likely to purchase locally, perhaps due to supplier agreements or aversion to change. Restaurants making purchasing decisions less than five years are more likely to purchase locally up to 20%. Beyond 20%, propensity of crossing to higher thresholds becomes negative. For farmers or suppliers, it may be in their interests to contact newly established and independent restaurants to promote higher levels of local sourcing.

   Impacts and *Production* tell an interesting story. A buyer who values local food's broader impacts is 56.4% more likely to buy local; if they value local production methods, they are 52.8% more likely. The impact of *Production* diminishes with higher

levels of local sourcing. Moreover, results imply room for market expansion through advertising, especially increasing intermediate purchases of local foods between 0 - 20%. Overall, buyers are more likely to purchase local if they feel they are socially or economically benefiting their community.

Table 7. Marginal Effects for Statistically Significant Variables at Each Sourcing Level.

	ME for 0-20%	P Value	ME for 21-40%	P Value	ME for 41-60%	P Value	ME for 61-80%	P Value	ME for 81-100%	P Value
Production	**0.146**	**.000***	0.023	0.153	**0.084**	**.001***	0.028	**.007***	0.009	**.066***
Auto Length-3 **(5 to 7 years)**	**0.328**	**.084***	-0.093	0.981	**-0.169**	**.100***	-0.049	0.186	-0.015	0.787
Bus Type-2 **(Independent)**	**0.322**	**.068***	0.074	0.6	**-0.186**	**.002****	-0.148	0.427	-0.016	0.787
Bus Type-4 **(Other)**	0.364	0.172	0.066	0.656	**-0.21**	**.085***	-0.155	0.414	-0.064	0.539

Discussion of Results and Solutions

When buyers were asked where they would *prefer* to purchase their food, 44% said directly from farmers. Farmer cooperatives or regional distributors were preferred second (14%). Indirect buyers would rather purchase from farmers despite opportunity costs, possibly because they can pass on additional costs to customers. Local sourcing in restaurants may be effective in meeting demand for local foods and for reducing purchasing restraints for direct consumers. In fact, 68% of buyers agreed or strongly agreed on expanding preferences for local menu options.

  Selling points for local sourcing included quality and supporting local businesses and local farmers. Challenges included price and seasonal availability of produce. A frequently cited solution by buyers was to set up better networking environments to help connect with farmers. Introducing a program similar to Utah's Farm-Chef-Fork in New Hampshire may facilitate a better-connected food network. Research has found that holding workshops is effective in providing information to strengthen farmer-restaurant relationships. Restaurants found it difficult to deal with multiple purchase and delivery sources—they can't "keep their refrigerator open 7 days a week for multiple deliveries." Many felt erratic deliveries hurt local purchasing (Inwood et al., 2008; FPC, 2003); consolidating deliveries could lower costs and affect ability to purchase locally. While many cited availability and distribution as obstacles, there was little interest in buying from food hubs (1.8%) or regional distributors (13.7%). There are few hubs in the region which may be why there is a lack of interest.

Conclusion

We investigated New Hampshire restaurants' potential to increase intermediate purchases of locally grown food. Using survey data, we estimated binary and ordered logistic models to study major factors influencing purchasing decisions. The model expanded on previous literature using a threshold parameter to define major local buyers in the market and investigate sourcing levels. Results revealed a negative propensity to purchase local for restaurants serving less than 750 meals/week. Owners and chefs making purchasing decisions longer than two years are less likely to buy local. *Impacts* and *Production* had significant and positive effects on buying local. *Impacts* may be capturing moral obligations to purchase locally; the coefficient on *Production* may be capturing similar awareness. Emphasizing knowing where their food comes from may increase intermediate purchases of locally grown food. There is little interest in purchasing from food hubs, but considerable interest in purchasing from farms. Respondents noted purchasing from multiple suppliers costs time and impedes ability to source locally. Lack of knowledge of local suppliers may explain the information gap between restaurants and local producers.

The survey response rate in the study was problematic; a longer data collection period/repeated sampling may help. Some addresses were inactive; specific contacts were unavailable, so it was hard to conclude who was reached. Other problems may stem from self-selection bias. Clearly, larger sample sizes across regions will be needed to draw broader generalizations, and a longitudinal investigation would help with investigating seasonal challenges in local purchasing in future studies. Further research is needed to explore effects of workshops with distributors and food hubs. Information distribution on local food availability may increase use of intermediate channels, thus lowering costs of buying.

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