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Locally Grown Produce as a Marketing Strategy: Producer Perceptions of State-Sponsored Marketing Programs

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Locally Grown Produce as a Marketing Strategy: Producer Perceptions of State-Sponsored
Marketing Programs

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Abstract

State programs promoting their own agricultural products have proliferated in response to increased consumer interest in locally grown foods (LGF). Tennessee, for example, currently has two state-funded programs promoting the consumption of Tennessee agricultural products: Pick Tennessee Products (PTP) and Tennessee Farm Fresh (TFF). The goal of this study is to examine the factors affecting producer awareness and participation in these state-sponsored marketing programs. This goal was achieved using survey data gathered from Tennessee's fruit and vegetable producers. These results should interest individuals attempting to increase producer awareness and participation in these types of programs.

This thesis examines both producer awareness and participation in state-sponsored marketing programs. The first essay of the thesis focuses on factors affecting Tennessee fruit and vegetable producer awareness of TFF and PTP. The second essay examines factors that affect Tennessee fruit and vegetable producer participation in TFF and PTP.

The factors affecting producer awareness of Tennessee's two state-sponsored marketing programs were evaluated using a bivariate probit model. Factors used in the analysis included observed producer, farm, and regions characteristics. Findings suggest that producer awareness was associated with education, percentage of income from farming, use of University/Extension publications, attendance at University/Extension education events, and operation location.

A bivariate probit model was used to examine the effect of observed producer, farm, and county characteristics on producer participation in TFF and PTP, given awareness of these

programs. Results suggest that farmer participation in these programs was associated with size of operation, education, use of Extension resources, and sale of fresh produce.

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Part 1: Introduction

Introduction

Sales of locally grown food (LGF) in the U.S. grossed to $4.8 billion in 2008 and is expected to grow to $7 billion by 2012 (Low and Vogel 2011; USDA/Agricultural Marketing Services). U.S. consumer preferences for these products are driven by demand for freshness, support of local economies, information about the source of the products, and reduction of the environmental impact of the food chain when buying LGF (Food Marketing Institute 2009). In particular, consumers perceive purchasing LGF as a way to reduce the environmental impact of foods being transported long distances (Food Marketing Institute 2009). Consumers may also associate sustainable methods of agricultural production with LGF and relate LGF with production practices that reduce or eliminate the use of chemicals, moderate the impact of agriculture on soil quality, water and air pollution (Thompson et al. 2008). Additionally, consumer interest in knowing who produces the food may be a contributing factor to the increase in popularity of LGF. The "story behind the food," or "provenance" is often comprised of factors such as who produced the food, the personality and ethics of the producer, and the attractiveness of the farm or surrounding area (Thompson et al. 2008).

Although consumer interest in LGF has grown in recent years, states' effort to promote agricultural products grown within their limits is not new. States have been promoting their products since about the 1930's (Patterson 2006). Nonetheless, due to recent increase in LGF popularity, state marketing programs have steadily increased (Onken and Bernard 2010). About 56% of all state marketing programs in the U.S. were established in 2000 or later (Onken and Bernard 2010). In Tennessee, there are currently two state-funded programs to support and develop markets for Tennessee-grown products. Pick Tennessee Products (PTP) was created by

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the Tennessee Department of Agriculture (TDA) in 1986. In 2008, the Tennessee Department of Agriculture, in cooperation with the Tennessee Farm Bureau, also created Tennessee Farm Fresh (TFF). The purpose of these programs is to help farmers market their local products and inform consumers about LGF markets.

Previous studies have looked at consumer awareness and preferences for products labeled with state program logos and the impact of state marketing program on premiums, sales, and local economies in general (Brooker and Eastwood 1989; Adelaja, Brumfield, and Lininger 1990; Govindasamy et al. 1998b; Patterson et al. 1999; Govindasamy et al. 2004; Carpio and Isengildina-Massa 2010; Onken and Bernard 2010; Onken, Bernard, and Pesek 2011). Although, these studies have evaluated the effectiveness of state marketing programs by measuring consumer awareness (e.g. Govindasamy et al. 1998b; Patterson et al. 1999; Onken and Bernard 2010; Onken, Bernard, and Pesek 2011) or evaluating the impact of state marketing programs on producer revenues or surplus (Brooker and Eastwood 1989; Govindasamy et al. 2004; Carpio and Isengildina-Massa 2010), none of them have evaluated producer awareness and participation in these programs. Little research exists of producer response to state-sponsored promotion programs (Govindasamy et al. 1998a).

Literature Review

Producers Perceptions of State Sponsored Marketing Program

Govindasamy et al. (1998a) evaluated farmer awareness, participation, perceptions and opinions about the Jersey Fresh logos (i.e., Jersey Fresh, quality grading, and premium logos) using a survey of New Jersey farmers. About 93% of producers were aware of the Jersey Fresh Program, and about 51% have used the Jersey Fresh logos. The majority of farmers (i.e., 91%)

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indicated they had used Jersey Fresh logos to add locally grown value to their produce. About 37 of respondents perceived their average gross sales have grown, while about 43% indicated they did not know whether the Jersey Fresh logos had any impact on sales. This study used logistic regressions to identify factors affecting farmer use, and willingness to use Jersey Fresh logos in the future. Results suggest that producers who perceived high consumer awareness of Jersey Fresh logos, who used other logos to identify fresh produce, with more farming experience, and located in the agricultural zone of New Jersey were more likely to use Jersey Fresh logos. In contrast, farmers with larger acreage and more than 75% of their production being wholesaled were less likely to use these logos. Additionally, results suggested that younger and more educated farmers were more likely to be willing to participate in the Jersey Fresh Program in the future. The profile of farmers who had the potential to use Jersey Fresh logos in the future was very similar to the one of farmers already using the logos.

Consumers Perceptions of State Sponsored Marketing Program

Brooker and Eastwood (1989) use a survey of consumers in Knox County, Tennessee to explore the impact of state sponsored logos on LGF sales in retail stores. They found that consumers in Knox County had positive attitudes towards state logos. Consumer perceives state logos as useful tools to identify LGF in metropolitan supermarkets, more for fresh products than for processed food. Nonetheless, a small proportion of consumers were willing to pay a premium for those products labeled with state sponsored logos.

Adelaja, Brumfield, and Lininger (1990) evaluated the potential success of the "Jersey Fresh" brand." A consumer survey was conducted at four stores in Northern New Jersey in 1988 to assess produce purchaser response to "Jersey Fresh" brand, specifically "Jersey Fresh"

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tomatoes. Econometric methods (i.e., GLS and Iterative Zellner's seemingly unrelated regression techniques) were used to estimate demand functions for tomatoes grown in New Jersey using survey cross-sectional data. They found that the Jersey fresh tomato seems to have a more inelastic demand with respect to price, a more elastic demand with respect to income, and fewer substitutes when compared to other products. Additionally, they concluded that consumer preferences for Jersey Fresh tomatoes were based on the tomatoes' quality and local origin. This study found that characteristics of the demand function as well as consumer preferences for high quality tomatoes grown in New Jersey represented a great opportunity for an increase in market share of products grown in New Jersey, and therefore a potential success of the "Jersey Fresh" brand promotion campaign.

Govindasamy, Italia, and Thatch (1998b) evaluated effectiveness of the Jersey Fresh program through consumer awareness. A survey was conducted between July and August of 1996 to collect information about New Jersey consumer opinions about locally grown produce, relative importance they place on price, quality and freshness when purchasing products, and awareness and opinions about the Jersey Fresh campaign. They used a logistic regression to identify factors affecting consumer awareness of the Jersey Fresh program. This study found high awareness of the Jersey Fresh program among consumers. They found that consumers who were more likely to be aware of this program shopped at direct marketing outlets, read food advertisements, shop at more than one place, have lived in New Jersey for more than five years, and own a farm garden.

Patterson et al. (1999) evaluated effectiveness of the Arizona Grown campaign. Using a survey of grocery shoppers they evaluated consumer awareness and preferences for Arizona

Grown products. A two stage probit estimation procedure was used to identify factors affecting consumer awareness and preferences for this program. They found limited awareness of the Arizona Grown program among grocery shoppers and that the campaign had a fairly small impact on consumer preferences for products grown in Arizona. Additionally, this study collected information of product sales from a sample of retail grocers to evaluate impact of the Arizona Grown program on sales. Using this information, this study estimated demand equations for ten fruits and vegetables products promoted by the state marketing program. Results suggested modest or no impact of the Arizona Grown campaign on in-store sales.

Govindasamy et al. (2004) evaluated the impact of the Jersey Fresh program on cash receipts of farmers and the local economy in general. They estimated a promotional response function to determine the impact of expenditures in the Jersey Fresh campaign on fruit and vegetables producer cash receipts using an ordinary least square model. They concluded that every dollar invested in the campaign increased New Jersey fruit and vegetable farmer revenues by $31.54 and related industry revenues by $22.95. Therefore it was estimated that the $1.16 million investment in the Jersey Fresh campaign in 2000 generated $36.6 million in revenues for New Jersey fruit and vegetable growers and $26.6 million in revenues for related industries for a total impact of $63.2 million.

Onken and Bernard (2010) examined effectiveness of state branding programs in five Mid-Atlantic States (New Jersey, Virginia, Maryland, Delaware, and Pennsylvania) though the evaluation of consumer awareness of these programs. Using information from a consumer survey conducted in the fall of 2009, they found that states with programs established in the 1980's, New Jersey and Virginia, had significantly higher awareness rates among survey respondents.

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They also observed that, with the exception of New Jersey, consumers purchased more food products labeled as "locally grown" as opposed to products labeled with the state program. They suggested two potential causes for this result: 1) consumers cannot find or are unaware of products advertised through state's program; 2) consumers are more concerned with the concept of "local" and they define this concept differently than the borders of the state. The lack of consumer awareness of and the inability to find products label with the state program may provide sales opportunities for state marketing programs (Onken and Bernard 2010).

Carpio and Isengildina-Massa (2010) provided a novel approach for an ex ante evaluation of regional promotion campaigns. They used an equilibrium displacement model to evaluate the impact of regional promotion campaign on quantities and prices. Additionally, they evaluated the shift in demand for branded products due to a regional campaign using a contingent valuation technique. This approach was applied to South Carolina's locally grown campaign to measure potential impact and effectiveness of this program. Using consumer surveys conducted in 2007 they evaluated consumer willingness to pay for produce and animal products grown in South Carolina versus products grown out of the state. They concluded that the South Carolina locally grown campaign increased consumers' willingness to pay for produce by 3.4%, it increased producer surplus by about three million dollars, and it represented a return to investment of about 618% for the state of South Carolina.

Onken, Bernard, and Pesek (2011) evaluated consumer preference and willingness to pay for attributes such as organic, natural, locally grown, and products labeled under state marketing programs. Using a choice experiment of five Mid-Atlantic States - New Jersey, Virginia, Maryland, Delaware, and Pennsylvania - they determine willingness to pay for attributes in

strawberry preserves as well as the influence of purchasing venue on willingness to pay. They found that consumers preferred local and state program preserves over non-local. Consumers from New Jersey were the only ones who expressed preferences for state program over local preserves. Consumers from larger states (i.e., Maryland, Pennsylvania, and Virginia) exhibit preferences of local preserves over state program preserves. They found higher price premiums for products labeled as local or state program promoted at farmers markets compared to grocery stores settings. They concluded that state marketing program will have to be evaluated for effectiveness by looking at consumers preferences for "local" compared to state program promoted labels. This information may help identify whether or not a program is worth continuing based on the potential premiums associated with state programs promoted brands.

Given the limited literature concerning marketing program awareness and participation from a producer stand point this study intends to add to the existing literature about this topic. A first step in evaluating effectiveness of these programs from producers' perspectives is to better understand awareness of the programs among those producers who would be most likely to benefit from the services offered by state marketing programs. A second step in gauging effectiveness of the programs is to look at actual participation in these programs. Information about factors affecting producer awareness and participation in state marketing programs may be of assistance to policy makers such as the Tennessee Department of Agriculture and organizations that operate similar programs in other states, as well as University/Extension personnel to expand the marketing potential of these programs. Additionally, this approach may give a different perspective about how producers have benefited from state marketing campaigns, and who else may have benefited from these programs. Finally, this information may

also help policy makers adjust limited funds to better promote state marketing programs and increase participation across the state given that financial support for these programs from state and private sources has been relatively modest and variable over time (Patterson 2006).

Objectives

The objectives of this research are: 1) to assess awareness of state marketing programs (i.e., TFF and PTP) among Tennessee's fruit and vegetable producers and to identify and evaluate the factors associated with producer awareness, and 2) to evaluate factors affecting Tennessee's produce farmer participation in TFF and PTP programs.

Thesis Outline

The objectives of this thesis will be addressed in two essays. In the first essay, the extent of awareness of TFF and PTP among Tennessee's fruit and vegetable producers will be evaluated. The factors affecting awareness of the two programs will then be examined using a bivariate probit model. Producer participation in TFF and PTP and factors affecting participation will be evaluated in the second essay using a similar approach.

The thesis will be organized as follows: part two presents description of data, empirical model, estimation methods, results and discussion, and conclusions for the first essay. Part three presents data and methodology, results and discussion, and conclusions for the second essay. Note that in parts two and three a general introduction to the problem and specific objectives are presented. Finally, in part four the two essays will be summarized and concluding comments provided.

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Part 2: Factors Affecting Producer Awareness of State Programs Promoting Locally Grown Foods: The Case of Fruit and Vegetable Growers in Tennessee

Abstract

Interest in locally grown foods has increased over the past few years. Tennessee currently has two state-funded programs promoting the consumption of Tennessee agricultural products by linking producers and consumers-Tennessee Farm Fresh and Pick Tennessee Products. Factors associated with fruit and vegetable producer awareness of each of these programs are analyzed using a bivariate probit model. Findings suggest that awareness was associated with education, percentage of income from farming, use of University/Extension publications, attendance at University/Extension education events, and operation location. These results should be of assistance to individuals attempting to increase producer awareness of programs promoting locally grown foods.

Introduction

Interest in locally grown foods (LGF) has dramatically increased over the past few years. In 2008, the U.S. market for LGF reached $5 billion (Tropp 2008). Big box retailers and grocery chains increasingly dedicate shelf space to differentiate "locally grown" from "conventional" produce as evidenced by Wal-mart, the top buyer of LGF at $400 million (Gambrell 2008). Interest in Community Supported Agriculture (CSA) programs is also growing (Brown and Miller 2008), and farmers markets are flourishing. Between 2000 and 2006, the number of farmers markets increased by 8.6% per year to 4,093 nationwide (Agricultural Marketing Service USDA). In Tennessee, the number of farmers participating in direct farm sales to consumers increased by 33% from 1997 to 2007. The number of farmers markets in Tennessee increased by 56% from 2006 to 2009.

There are several reasons for the increased interest in LGF (Onken, Bernard, and Pesek 2011). LGF may provide health and nutrition benefits because they may be fresher and their increased availability may encourage consumers to make healthier food choices (Martinez et al. 2010). LGF may also play a role in ameliorating a community's concerns over food security[1]. LGF provide a way for consumers to support local farmers and local economies (Gregoire and Strohbehn 2002; Peterson, Selfa, and Janke 2010; Starr et al. 2003). The sales retained within a region as consumers substitute LGF for imported products increases local farm revenue and regional income (Swenson 2009). Finally, consumption of LGF may have environmental benefits in reducing food miles to market, thereby moderating the use of fossil fuels in transportation (Anderson 2007; Gomez 2010)[2].

Because of these perceived benefits, federal and state governments have adopted a number of programs to support producers attempting to supply LGF (Martinez et al. 2010; Onken, Bernard, and Pesek 2011). Examples of federal programs include the Fresh Program, the Women and Infant Childcare (WIC) Farmers Market Nutrition Program (FMNP), and the Senior's Farmers Market Nutrition Program (SFMNP). The Fresh Program is a partnership of the U.S. Department of Defense and the U.S. Department of Agriculture (USDA) to promote the consumption of fresh, locally grown foods by schools and other institutions. The FMNP and SFMNP issue coupons to seniors and WIC participants that can be used at authorized farmers markets, roadside stands, and CSAs.

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[1] Food security has been defined as all people at all times having access to enough food for an active, healthy life (Nord and Andrews, 2002).
[2] The extent to which a shift toward LGF would actually engender environmental benefits is uncertain given that distance traveled is an imperfect measure of the environment impact of food transportation (Coley, Howard, and Winter 2009) and that the production of food typically has a larger impact on the environment than its transportation (Weber and Matthews 2008).

There are also a number of state-level programs designed to promote the consumption of LGF. For example, in Tennessee there are currently two state-funded programs to support and develop markets for Tennessee-grown products. Pick Tennessee Products (PTP) was created by the Tennessee Department of Agriculture in 1986. In 2008, the Tennessee Department of Agriculture - this time in cooperation with the Tennessee Farm Bureau - created Tennessee Farm Fresh (TFF). The purpose of both programs is to link producers with marketing channels for LGF and to inform consumers about opportunities to purchase LGF. The PTP program promotes all products available at Tennessee farms, farmers markets, and other retail outlets, while TFF focuses on the promotion of fresh products grown in Tennessee, including fruit and vegetables, nursery, dairy and some livestock products. The two programs offer an array of similar benefits, including: a listing on a web-site directory, the right to use the TFF and PTP logos, and advertising benefits. The two programs are differentiated by the following: the TFF program offers a banner with the TFF logo, TFF stickers, price cards, TFF reusable bags, and free access to workshops offered through the University of Tennessee Center for Profitable Agriculture to their members while the PTP program offers the right to participate in their on-line store but participation in this programs does not guarantee access to marketing tools (e.g. banner, price cards, stickers, workshops) (Howard 2012). Additionally, there are no fees required to participate in the PTP program, but the TFF program charges a $100 annual fee for participation.

A first step in gauging the effectiveness of these programs is to better understand awareness of the programs among those producers who would be most likely to benefit from the services offered by the two programs. Thus, the objectives of this study are to gauge awareness of the programs among Tennessee's fruit and vegetable producers and to identify and evaluate

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the factors associated with producer awareness. The study's focus is on fruit and vegetable producers because produce growers account for a large portion of direct agricultural sales (USDA 2007; Onken, Bernard, and Pesek 2011), which is one of the main marketing outlets for LGF (Martinez et al. 2010; Low and Vogel 2011). The information provided by this study should be of assistance to governmental agencies and other institutions that are interested in increasing producer awareness of programs or other efforts promoting LGF. Greater awareness of such programs or efforts may help producers increase profit margins through the adoption of new marketing strategies.

Description of Data

This study uses data from a 2011 survey of Tennessee's fruit and vegetable producers. The list frame for the survey was provided by USDA's National Agriculture Statistics Service (NASS) and included the entire population of fruit and vegetable producers in Tennessee. On February 2, 2011, the survey, a cover letter explaining the importance of the survey, and a postage paid return envelope were sent to Tennessee's 1,954 fruit and vegetable producers by first class mail. Approximately three weeks later, reminder postcards were sent. One month later, a second wave of surveys was mailed to those who had not returned the survey. Of the 1,954 questionnaires mailed, 587 were completed and returned, providing a response rate of approximately 30%. After eliminating observations with missing data, 316 responses were suitable for this analysis.

The survey included questions about: marketing outlets used to sell fruits and vegetables; barriers producers faced when participating in different markets; perceptions of the characteristics that define a "local" market; awareness of, and participation in, Tennessee's

programs promoting LGF (i.e., TFF and PTP); and general farm business and operator

characteristics. Secondary data concerning food marketing and other environmental factors or

community characteristics (e.g. metro/non-metro county, number of farmers markets in a county)

were collected from the Food Environmental Atlas (http://www.ers.usda.gov/foodatlas, USDA,

2011).

Empirical Model

Produce grower awareness of the TFF and PTP programs can be empirically specified as,

(1)
$$y_{i1} = \beta_1' x_{i1} + e_{i1}$$
$$y_{i2} = \beta_1' x_{i2} + e_{i2}$$
$$Corr(e_{i1}, e_{i2}) = \rho$$

where y_{i1}=1 if a producer is aware of TFF, and zero otherwise; y_{i2}=1 if a producer is aware of

PTP, and zero otherwise; β_1, and β_2 are parameters associated with each awareness equation; e_{i1},

and e_{i2}, are random disturbances for each equation; and $\mathbf{x}_{i1}$, and $\mathbf{x}_{i2}$ are vectors of observed

producer, farm, and county characteristics that may influence the likelihood that a producer is

aware of either program. Given the similarities in the two programs, there are unobserved

variables that are likely to similarly influence awareness of each of the programs and, thus, the

error terms for the two equations are likely to be correlated ($Corr(e_{i1}, e_{i2}) = \rho$). A description of

the variables used in this analysis is presented in Table 1.

Producer characteristics hypothesized to influence awareness of PTP and TFF are: age

(AGE); highest level of educational attainment, expressed in dichotomous variables for some

high school (SOMEHS), high school graduate (HSGRAD), some college (SOMECOLL),

associate's degree (ASSOCDEG), bachelor's degree (BACHDEG), and graduate degree

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(GRADDEG); the percentage of taxable household income coming from farming, expressed in a dichotomous variable for less than 25 percent (PF_INCOME); the number of University/Extension educational events or presentations related to produce marketing that the grower had attended in the past five years (EDUC_EVENTS); and whether the producer had used University/Extension publications to obtain information about how to better market produce in the last 5 years (PUBLICATIONS).

Age is expected to be negatively correlated with awareness as older producers tend to have shorter planning horizons and may be less likely to search for programs that offer alternatives to current marketing efforts. Education is expected to be positively correlated with awareness as marketing produce directly to consumers requires special skills and abilities, not all of which are likely to be directly related to agricultural operations (Uva 2002; Uematsu and Mishra 2011). Thus, given that direct marketing to consumers is one of the main marketing outlets for LGF (Martinez et al. 2010; Low and Vogel 2011), it is expected that more educated farmers may be more willing to experiment with LGF marketing strategies and more likely to be aware of programs promoting LGF. The percentage of household income from farming is hypothesized to be positively correlated with awareness of the programs, as producers with a high percentage of income from farming are more likely to be willing to invest the time and effort needed to improve their bottom line sales through novel marketing strategies and, therefore, more likely to be aware of programs designed to meet those needs. Attendance at University/Extension outreach events or presentations related to produce marketing strategies is expected to increase producer exposure to, and thus awareness of, the programs. Similarly, the

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use of University/Extension publications to obtain information about how to better market produce is also expected to increase producer awareness of these programs.

The characteristics of the producer's operation included in the analysis are: size of the producer's fruit and vegetable operation in acres (VEGSIZE); percentage of sales made directly to consumers (TDS), intermediaries (TIN), and retail outlets (TRE); percentage of direct sales to consumers in different geographic areas, expressed in dichotomous variables for in: the producer's county of operation (YOURCNTY); neighboring counties (NEXTCNTY); elsewhere in the state of Tennessee (INSTATE); elsewhere in the U.S. (INUS); and elsewhere in the world (OTHCNTRY).

It is hypothesized that the size of the producer's fruit and vegetable operation will be negatively correlated with awareness of the two programs. Producers managing larger operations may be more inclined to market products through wholesalers, whereas smaller operations might rely more on alternative marketing channels such as farmers markets and CSAs (Lockeretz 1986; Low and Vogel 2011; Watson and Gunderson 2010) where the services provided by the two programs would be of more use.

The percentage of sales made directly to consumers is likely to be positively correlated with producer awareness of the PTP and TFF programs as the services offered by these programs would seem to be more directly applicable to these types of sales. In addition, it could be that the concept of "local" is more important to the consumers who purchase produce directly from producers (Lockeretz 1986). Similarly, farmers who market produce directly to consumers through farmers markets and CSAs may have a greater chance of being exposed to programs

promoting LGF as other producers also selling through these outlets may be already participating in programs promoting LGF (Low and Vogel 2011). Producers who market a greater share of their produce through intermediaries (e.g. wholesalers, grower cooperatives) or retailers (e.g. groceries) are less likely to be aware of programs promoting LGF, because the services offered by these programs may be less relevant to these types of sales and because consumers who purchase their produce through these outlets might be more interested in price than other characteristics (Lockeretz 1986). The percentage of a producer's direct sales to consumers in Tennessee is likely to be positively correlated with awareness of the programs promoting LGF given that the goal of these programs is to promote Tennessee-grown products. Therefore it is hypothesized that producers with a larger percentage of sales elsewhere in the U.S. and other countries are less likely to be aware of these programs.

The characteristics of the county in which the producer operates that are included in this analysis are: whether the county is located in east (EASTTENN), middle (MIDTENN), or west (WESTTENN) Tennessee; whether the county is a metropolitan county (METRO); and the number of farmers markets operating in the county (FMRKT10). Geographic location could influence producer awareness in a number of ways. Direct-to-consumer sales drivers are affected by regional characteristics such as proximity to farmers markets and to farmland (Low and Vogel 2011). Therefore, geographic location may explain producer exposure to programs promoting LGF. It is hypothesized that producers located in regions producing more fruit and vegetables and other specialty crops, and closer to farmers markets and farmer-to-grocer's marketing channels are more likely to be aware of programs promoting LGF (Low and Vogel 2011). Thus, it is also expected that the number of farmers markets located in the producer's county will

positively influence the likelihood of program awareness. The greater the number of farmers markets in a county the more likely farmers would be to market fresh produce to this outlet. Given that farmers markets are one of the most popular direct to consumer outlets for LGF it is expected that the greater the number of farmers markets in a county the more likely farmers are to be exposed to programs promoting LGF (Low and Vogel 2011).

Estimation Methods

The error terms in the awareness equations presented in (1) are assumed to be normally distributed and correlated ($Cov(e_{i1}, e_{i2}) = \rho$). Therefore a bivariate probit model based on the join distribution of the error terms (e_{i1}, e_{i2}) is used for this analysis. To construct the likelihood function for this model let $q_{i1} = 2y_{i1} - 1$ and $q_{i2} = 2y_{i2} - 1$. Thus

(2)
$$q_{im} = \begin{cases} 1 & if \ \ y_{im} = 1 \\ -1 & if \ \ y_{im} = 0 \end{cases} \ \ m = 1,2$$

Additionally, let $z_{im} = \mathbf{x}'_{im}\boldsymbol{\beta}_m$, $w_{im} = q_{im}z_{im}$, and $\rho_i^* = q_{i1}q_{i2}\rho$.

The probabilities entering the likelihood function are (Green 2003):

(3)
$$\Pr ob(Y_1 = y_{i1}, Y_2 = y_{i2} \mid \mathbf{x}_{i1}, \mathbf{x}_{i2}) = \Phi_2(w_{i1}, w_{i2}, \rho_i^*),$$

where Φ_2 denotes the bivariate normal cumulative distribution function. Therefore, the log-likelihood function can be defined as:

(4)
$$\log L = \sum_{I=1}^{n} \ln \Phi_2(w_{i1}, w_{i2}, \rho_i^*)$$

The derivatives of the log-likelihood with respect to the parameters of interest (i.e., $\boldsymbol{\beta}_{im}$, ρ) are:

(5)
$$\frac{\partial \ln L}{\partial \boldsymbol{\beta}_m} = \sum_{i=1}^{n} \left(\frac{q_{im} g_{im}}{\Phi_2} \right) \mathbf{x}_{im} \quad for \quad m = 1,2$$

(6)
$$\frac{\partial \ln L}{\partial \rho} = \sum_{i=1}^{n} \frac{q_{i1} q_{i2} \phi_2}{\Phi_2} \quad for \quad m = 1,2$$

where ϕ_2 denotes the bivariate normal density function and

(7)
$$g_{i1} = \phi(w_{i1}) \Phi \left[\frac{w_{i2} - \rho_i^* w_{i1}}{\sqrt{1 - \rho_i^{*2}}} \right],$$

where ϕ represents the univariate standard normal density and Φ represents the univariate standard normal cumulative distribution function. The subscripts 1 and 2 are reverse in (7) to obtain g_{i2}. The maximum likelihood estimates are obtained by simultaneously setting (5) and (6) equal to zero. If $\rho = 0$ then $\rho_i^* = 0$ and therefore

(8)
$$g_{i1} = \phi(w_{i1}) \Phi [w_{i2}].$$

Replacing (8) in (5) reduces to the first order condition of a probit model.

Marginal effects are computed given the bivariate nature of the model (Greene 2003). The approach taken here was to first obtain the expected value of awareness of one of the programs (say, $y_{i1}=1$), conditional on the respondent being aware of the alternative program ($y_{i2}=1$):

(9)
$$E(y_{i1}|y_{i2}=1, \mathbf{x}) = Prob(y_{i1}=1 | y_{i2}=1, \mathbf{x}) = \frac{Prob(y_{i1}=1, y_{i2}=1 | \mathbf{x})}{Prob(y_{i2}=1 | \mathbf{x})}$$

$$= \frac{\Phi_2(\mathbf{x}'\boldsymbol{\gamma}_1, \mathbf{x}'\boldsymbol{\gamma}_2, \rho)}{\Phi(\mathbf{x}'\boldsymbol{\gamma}_2)},$$

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where $\mathbf{x} = \mathbf{x}_1 \cup \mathbf{x}_2$, $\mathbf{x}'\gamma_m = \mathbf{x}_1'\boldsymbol{\beta}_m$. Therefore γ_1 contains all the nonzero elements of $\boldsymbol{\beta}_1$ and possible some zeros in the positions of variables in $\mathbf{x}$ that appear only in equation 2 in (1). The derivative of (9) was taken with respect to the explanatory variables of interest to estimate the marginal effects:

$$(10) \quad \frac{\partial E(y_{i1}|y_{i2}=1,\mathbf{x})}{\partial \mathbf{x}} = \left(\frac{1}{\Phi(\mathbf{x}'\gamma_2)}\right)\left[g_1\gamma_1 + \left(g_2 - \Phi_2\frac{\phi(\mathbf{x}'\gamma_2)}{\Phi(\mathbf{x}'\gamma_2)}\right)\gamma_2\right],$$

where g_1 and g_2 are defined in (7).

Multicollinearity Tests

Multicollinearity may compromise inferences by inflating variance estimates (Greene 2003; Judge et al. 1988). A condition index was used to detect collinear relationships (Belsley, Kuh, and Welsch 1980). Condition indexes between 30 and 100 indicate that the explanatory variables have moderate to strong association with each other. A condition index accompanied by a proportion of variation above 0.5 indicates potential collinearity problems (Belsley, Kuh, and Welsch 1980).

Results and Discussion

Sample Overview and Descriptive Statistics

The average age of respondents included in this analysis (n=316) was 61 years, close to the average farmer age in Tennessee (58 years) according to the 2007 Census of Agriculture (USDA/NASS). The age distribution from respondents follows closely age distribution among vegetable and melon farmers, and fruit and nut farmers in Tennessee (Figure 1). The proportions of farmers in each age category are similar when comparing respondents age and age of

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vegetable and melon farmers in Tennessee. The sample used in this study had a larger proportion of farmers in the 35 to 44, 45 to 54 and 55 to 64 age categories when compared to Tennessee fruit and nut farmers. However, the proportion of Tennessee fruit and nut farmers in the 65 and over category was larger compared to the sample respondents. For about 26% of the respondents the highest level of educational attainment was a bachelor's degree, followed by 22% who earned a graduate degree and 22% who graduated from high school but did not attend college. About 69% of respondents earned less than 25% of their household income from farming. Respondents had attended an average of 1.2 University/Extension educational events or presentations related to marketing strategies over the past five years. About 30% of the respondents had used University/Extension publications to obtain information about improving their produce marketing within the past five years.

The average size of the fruit and vegetable operations was 10.8 acres. The majority (about 84%) of sales made by the respondents were direct sales to consumers. Most (about 69% on average) of the direct sales made by the respondents in 2010 took place in their home county. The average percentage of direct sales made in neighboring counties and elsewhere in the state were 24% and 5%, respectively. About 42% of the respondents were located in Middle Tennessee, 40% in East Tennessee, and the reminder in West Tennessee. About 47% of the respondents lived in metropolitan counties.

About 42% of the respondents included in this analysis were aware of the TFF program and 54% were aware of the PTP program. Greater awareness of the PTP program is probably not too surprising given that it has been in existence for about 22 years longer than the TFF program. Comparisons of the mean values for producer, producer operation and county characteristics, on

the basis of awareness of the TFF and PTP programs, are presented in Table 2. Differences in mean values between those who were aware and those who were not aware of each program were compared using *t*-tests. Significant differences for the variables associated with producer characteristics were evaluated. The proportion of producers with 25% or less of their household income from farming who were unaware of the TFF and PTP programs was larger (80% and 83%, respectively) than the proportion of producers with 25% or less of their income from farming who were aware of these programs (55% and 58%, respectively). As expected, producers with a higher percentage of income from farming are more likely to be aware of programs design to increase sales through alternative marketing strategies, given that they have a higher dependence on the economic viability of the farming operation. On average, respondents who were aware of TFF and PTP had attended more University/Extension educational events or presentations related to produce marketing over the last five years (2.1 and 1.9 events, respectively) compared to respondents who were not aware of the programs (0.5 and 0.3, respectively); as hypothesized, producers who attend these educational events may be more interested in alternative produce marketing strategies and more likely to be exposed to information about programs promoting LGF. Finally, about 48% of the respondents aware of TFF and 42% of those aware of PTP have used University/Extension publications to obtain information about how to better market their produce within the last five years, which is significantly higher than the 17% and 15% of producers not aware of TFF and PTP, respectively who used University/Extension publications for this purpose. University/Extension publications related to produce marketing strategies may include information about programs promoting LGF and therefore producers using these publications are more likely to be aware of TFF and PTP.

Significant differences for the variables associated with characteristics of the producer's operation were also considered. The average size of the fruit and vegetable operations was larger for respondents aware of TFF and those aware of PTP (17.1 and 14.3 acres, respectively) than those who were unaware of the programs (6.6 and 7.0 acres, respectively). Contrary to the hypothesis that local food marketing is more likely to occur on smaller operations (Martinez et al. 2010), for this sample, it seems that larger operations are more likely to be aware of programs promoting LGF in Tennessee. The average percentage of fruit and vegetable sales made in the county in which a producer's operation was located was significantly higher for producers unaware of TFF and PTP (75% and 78%, respectively) compared to producers who were aware of the two programs (60% for both). However, the average percentage of sales made in neighboring counties and elsewhere in the State was significantly higher for producers who were aware of TFF and PTP (29% and 30%, respectively for sales in neighboring counties, and 8% and 7%, respectively for sales elsewhere in the State) than for those who were unaware of the programs (20% and 17%, respectively for sales in neighboring counties and 3% for sales elsewhere in the State). As expected, producers with relatively more sales in Tennessee are more likely to be aware of programs promoting LGF given that the goal of these programs is to promote products grown in Tennessee. Nonetheless, respondents selling a higher percentage of their produce within their county of operation were less likely to be aware of TFF and PTP.

Finally, significant differences associated with the characteristics of the county in which the grower operates were identified. About 54% of the producers who were aware of TFF live in metropolitan counties while only 42% of the producers not aware of the program live in

metropolitan counties. This result is explained by the fact that marketing of LGF is more likely to take place in metropolitan counties (Martinez et al. 2010).

Bivariate Probit Marginal Effects

The results of the bivariate probit model can be seen in Table 4. The correlation coefficient between the residuals (ρ) was positive and statistically significant at the 1% level, supporting the hypothesis that the error terms in the TFF and PTP awareness equations were correlated, and also suggesting that the bivariate probit approach appears appropriate. A likelihood ratio test for the overall significance of the model indicated the model was significant at the 1% level.

The marginal effects of the bivariate probit model used to examine the factors affecting awareness of the TFF and PTP programs are presented in Table 3. Five of the explanatory variables had statistically significant marginal effects on awareness of the TFF program, given that the producer was aware of the PTP program. These five variables were whether the producer had some high school education (SOMEHS), whether the producer had used University/Extension publications to obtain information about marketing produce within the past five years (PUBLICATIONS), the size of the producer's fruit and vegetable operation in acres (VEGSIZE), the percentage of the producer's total sales made directly to consumers (TDS), and whether the producer's operation was located in a metropolitan county (METRO). Although these marginal effects were statistically significant some of them were very small in magnitude (i.e., VEGSIZE, TDS). The results suggest that producers located in a metropolitan county are 18% more likely to be aware of the TFF program, and producers who used University/Extension publication are 20% more likely to be aware of TFF, given that they are already aware of the

PTP program. The marginal effect associated with the education variable (SOMEHS) has a positive sign. This result suggests that producers with some high school education tended to be more likely to be aware of TFF than producers with bachelor degrees. This result runs counter the hypothesis that more educated farmers are more likely to be aware of programs promoting LGF. A possible explanation for this result is that more educated farmers may be more likely to be employed part time off the farm and therefore may have less time to look for alternative marketing opportunities such as LGF. Statistically significant conditional marginal effects for the PTP awareness equation were those associated with age (AGE), education (SOMEHS), percentage of total household income from farming activities (PF_INCOME), and the number of University/Extension educational events or presentations related to produce marketing strategies attended within the past five years (EDUC_EVENTS). Again, some of the statistically significant marginal effects were very small in magnitude (i.e., AGE). The results suggest that, given awareness of the TFF program, producers with some high school education are 35% less likely to be aware of PTP than producers with bachelor degrees, while producers with less than 25% of their income coming from farming are 7% less likely to be aware of the PTP program and, finally, attending an additional educational event increases the likelihood of being aware of PTP by 2.5%.

In summary, producers who are already aware of the PTP program and who have used University/Extension publications to obtain information about how to better market produce in the last 5 years, operate larger fruit and vegetable operations, derive a higher percentage of their sales from direct-to-consumer outlets, and are located in metropolitan counties are more likely to be aware of the TFF program. On the other hand, younger, more educated producers, with more

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than 25% of their household income from farming, who have attended more University/Extension educational events or presentations related to marketing strategies to sell produce in the past five years are more likely to be aware of the PTP program, given awareness of the TFF program.

Conclusions

The marketing of LGF continues to grow in popularity. The goal of this study is to evaluate fruit and vegetable producer awareness of the two Tennessee programs designed to enhance LGF marketing opportunities – TFF and PTP. A bivariate probit regression was used to measure the association between the characteristics of the producer, the producer's operation, and the county in which the producer's operation is located and producer awareness of these programs.

The factors affecting awareness of TFF and PTP programs differed between the two programs. Use of University/Extension publications, size of the fruit and vegetable operation, percentage of sales from direct-to-consumers outlets, and location in a metropolitan county all significantly affected awareness of the TFF program. On the other hand, attendance at University/Extension education events, age, education, and percentage of income from farming were factors significantly affecting producer awareness of the PTP program. Policymakers such as the Tennessee Department of Agriculture and organizations that operate similar programs in other states, as well as University/Extension personnel may benefit from this information to better market these programs. This information may also help policy makers adjust limited funds to better promote these programs by better targeting their clientele and increasing awareness of the programs across the state.

Attendance at University/Extension educational events or presentations related to produce marketing and the use of University/Extension publications to obtain information about how to better market their produce were significant factors affecting awareness of both the PTP and TFF programs. These results suggest that the partnership between policy makers and Extension may increase effectiveness in spreading the word about state programs promoting LGF. Therefore, it may be important for policymakers to continue working with Extension to increase producer awareness of state programs promoting LGF. Nonetheless, producers who are unaware of the TFF and PTP programs may not be attending University/Extension educational events or presentations related to marketing strategies to sell produce and/or using University/Extension publications. Therefore, reaching these producers will require alternative strategies**.**

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Appendix

Table 1. Definitions and Descriptive Statistics of Variables (n=316)

Variable	Description	Mean
A. Dependent Variables		
AWARE_TFF	=1 if farmer is aware of Tennessee Farm Fresh, zero otherwise	0.4114
AWARE_PTP	=1 if farmer is aware of Pick Tennessee Products, zero otherwise	0.5380
B. Independent Variables		
AGE	Age of producer in years	60.7089
SOMEHS	=1 if some high school is the highest level of education attained by the farmer, zero otherwise	0.0633
HSGRAD	=1 if high school diploma is the highest level of education attained by the farmer, zero otherwise	0.2152
SOMECOLL	=1 if some college is the highest level of education attained by the farmer, zero otherwise	0.1519
ASSOCDEG	=1 if an associate's degree is the highest level of education attained by the farmer, zero otherwise	0.0949
BACHDEG	=1 if a bachelor's degree is the highest level of education attained by the farmer, zero otherwise	0.2595
GRADDEG	=1 if a graduate degree is the highest level of education attained by the farmer, zero otherwise	0.2152
PF_INCOME	=1 if less than 25% of farmer household income comes from farming	0.6962
EDUC_EVENTS	The number of educational events the farmer has attended in the past 5 years	1.1416
PUBLICATIONS	=1 if the farmer has used University/Extension publications in the past 5 years	0.2975
YOURCNTY	Percent of direct sales to consumers in the county where the farmer operates	68.5158
NEXTCNTY	Percent of direct sales to consumers in neighboring counties of where the farmer operates	23.8070
INSTATE	Percent of direct sales to consumers elsewhere in the state	5.3212
INUS	Percent of direct sales to consumers elsewhere in the country	1.7547
OTHCNTRY	Percent of direct sales to consumers in other countries	0.6013
VEGSIZE	Size of fruit and vegetable operation in acres	10.8920
TDS	Percent of direct sales obtained from direct to consumer outlets	84.4842

Table 1. Continued

Variable	Description	Mean
TIN	Percent of direct sales obtained from direct to intermediary outlets	7.9114
TRE	Percent of direct sales obtained from direct to retail outlets	7.6044
EASTTENN	=1 if the farmer is located in East Tennessee, zero otherwise	0.3956
MIDTENN	=1 if the farmer is located in Middle Tennessee, zero otherwise	0.4241
WESTTENN	=1 if the farmer is located in West Tennessee, zero otherwise	0.1804
FMRKT10	The number of farmers markets in the county where the farmer operates	1.0475
METRO	=1 if farmer is located in a metropolitan county, zero otherwise	0.4684

Table 2. Variable Means for Respondents Aware of the Tennessee Farm Fresh and Pick Tennessee Products Programs and Those Not Aware of the Programs

Independent Variables[a]	Tennessee Farm Fresh		Pick Tennessee Products	
	Not Aware (n=186)	Aware (n=130)	Not Aware (n=146)	Aware (n=170)
AGE	61.6129	59.4154	63.5069***	58.3059
SOMEHS	0.0591	0.0692	0.0822	0.0471
HSGRAD	0.1989	0.2385	0.2192	0.2118
SOMECOLL	0.1613	0.1385	0.1644	0.1412
ASSOCDEG	0.1183*	0.0615	0.1164	0.0765
BACHDEG	0.2473	0.2769	0.2055**	0.3059
GRADDEG	0.2151	0.2154	0.2123	0.2176
PF_INCOME	0.7957***	0.5538	0.8288***	0.5824
EDUC_EVENTS	0.4839***	2.0827	0.2877***	1.8750
PUBLICATIONS	0.1720***	0.4769	0.1507***	0.4235
YOURCNTY	74.5699***	59.8539	78.4041***	60.0235
NEXTCNTY	20.1613**	29.0231	16.5411***	30.0471
INSTATE	3.2957**	8.2192	3.1370**	7.1971
INUS	1.3817	2.2885	1.8151	1.7029
OTHCNTRY	0.5914	0.6154	0.1027	1.0294
VEGSIZE	6.5880***	17.0500	6.9802**	14.2515
TDS	84.3172	84.7231	86.9726	82.3471
TIN	7.7527	8.1385	5.6233*	9.8765
TRE	7.9301	7.1385	7.4041	7.7765
EASTTENN	0.4032	0.3846	0.4178	0.3765
MIDTENN	0.3925	0.4692	0.3699**	0.4706
WESTTENN	0.2043	0.1462	0.2123	0.1529
FMRKT10	1.0645	1.0231	1.1370	0.9706
METRO	0.4194**	0.5385	0.4452	0.4882

*, **, *** denotes significance at the 10%, 5%, and 1% levels respectively based on t-tests.
[a] For variable definitions see Table 1.

Table 3. Parameter Estimates from the Bivariate Probit Models for Estimating Factors Affecting Awareness of Tennessee Farm Fresh and Pick Tennessee Products

Independent Variables[a]	Parameter Estimates for the Bivariate Probit Model	
	Awareness Equations	
	Tennessee Farm Fresh	Pick Tennessee Products
Constant	-1.2527**	1.1747*
	(0.6220)	(0.6022)
AGE	-0.0044	-0.0215***
	(0.0071)[b]	(0.0075)
SOMEHS	0.2262	-0.7067*
	(0.3655)	(0.3668)
HSGRAD	0.2113	-0.0934
	(0.2372)	(0.2359)
SOMECOLL	0.1382	-0.0937
	(0.2626)	(0.2657)
ASSOCDEG	-0.4827	-0.5676*
	(0.3179)	(0.3051)
GRADDEG	0.0799	-0.0011
	(0.2383)	(0.2410)
PF_INCOME	-0.4180	-0.6153
	(0.2012)	(0.2075)
NEXTCNTY	0.0036	0.0060**
	(0.0025)	(0.0026)
INSTATE	0.0115**	0.0092*
	(0.0051)	(0.0051)
INUS	-0.0001	-0.0102
	(0.0098)	(0.0096)
OTHCNTRY	0.0031	0.0198
	(0.0129)	(0.0172)
VEGSIZE	0.0143**	0.0039
	(0.0067)	(0.0042)
TOTDIRECTSALES	0.0094**	0.0039
	(0.0045)	(0.0041)
TOTINTERMSALES	0.0050	0.0081
	(0.0053)	(0.0051)
EASTTENN	-0.1037	-0.0727
	(0.1786)	(0.1842)
WESTTENN	-0.1574	-0.2122
	(0.2332)	(0.2298)
FMRKT10	-0.0729	-0.0870
	(0.0736)	(0.0733)

[a] For variable definitions see Table 1.
[b] Numbers in parenthesis are standard errors.
*, **, and *** represent statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3. Continued

Independent Variables[a]	Parameter Estimates for the Bivariate Probit Model	
	Awareness Equations	
	Tennessee Farm Fresh	Pick Tennessee Products
METRO	0.4121[**]	0.1227
	(0.1695)[b]	(0.1693)
EDUC_EVENTS	0.1440[***]	0.1995[***]
	(0.0464)	(0.0564)
PUBLICATIONS	0.6560[***]	0.4588[**]
	(0.1986)	(0.2060)
Likelihood value	-290.5575	
Likelihood ratio	147.4400[***]	
Correlation coefficient	0.8278[***]	
	(0.0496)	

[a] For variable definitions see Table 1.

[b] Numbers in parenthesis are standard errors.

*, **, and *** represent statistical significance at 10%, 5%, and 1% levels, respectively.

Table 4. Conditional Marginal Effects from the Bivariate Probit Model for Estimating Factors Affecting Awareness of Tennessee Farm Fresh and Pick Tennessee Products

Independent Variables	Marginal Effects of the Bivariate Probit Model	
	Prediction Conditions	
	AWARE_TFF=1 given AWARE_PTP=1	AWARE_PTP=1 given AWARE_TFF=1
AGE	0.0037	-0.0044**
	(0.0032)	(0.0018)
SOMEHS	0.2710***	-0.3469**
	(0.0858)	(0.1609)
HSGRAD	0.1280	-0.0636
	(0.0925)	(0.0620)
SOMECOLL	0.0934	-0.0505
	(0.1066)	(0.0713)
ASSOCDEG	-0.0812	-0.0698
	(0.1514)	(0.0967)
GRADDEG	0.0396	-0.0130
	(0.0999)	(0.0528)
PF_INCOME	-0.0452	-0.0704*
	(0.0834)	(0.0377)
EDUC_EVENTS	0.0172	0.0246*
	(0.0219)	(0.0130)
PUBLICATIONS	0.1920**	0.0059
	(0.0742)	(0.0407)
NEXTCNTY	0.0001	0.0009
	(0.0011)	(0.0006)
INSTATE	0.0032	0.0003
	(0.0023)	(0.0011)
INUS	0.0028	-0.0024
	(0.0043)	(0.0020)
OTHCNTRY	-0.0039	0.0043
	(0.0072)	(0.0042)
VEGSIZE	0.0062**	-0.0014
	(0.0031)	(0.0012)
TDS	0.0036*	-0.0006
	(0.0020)	(0.0009)
TIN	0.0003	0.0011
	(0.0024)	(0.0011)
EASTTENN	-0.0322	-0.0006
	(0.0776)	(0.0385)
WESTTENN	-0.0196	-0.0273
	(0.1025)	(0.0551)

*, **, and *** represent statistical significance at 10%, 5%, and 1% levels, respectively.

Table 4. Continued

Independent Variables	Marginal Effects of the Bivariate Probit Model	
	Prediction Conditions	
	AWARE_TFF=1 given AWARE_PTP=1	AWARE_PTP=1 given AWARE_TFF=1
FMRKT10	-0.0126	-0.0091
	(0.0323)	(0.0161)
METRO	0.1763**	-0.0417
	(0.0708)	(0.0361)

*, **, and *** represent statistical significance at 10%, 5%, and 1% levels, respectively.
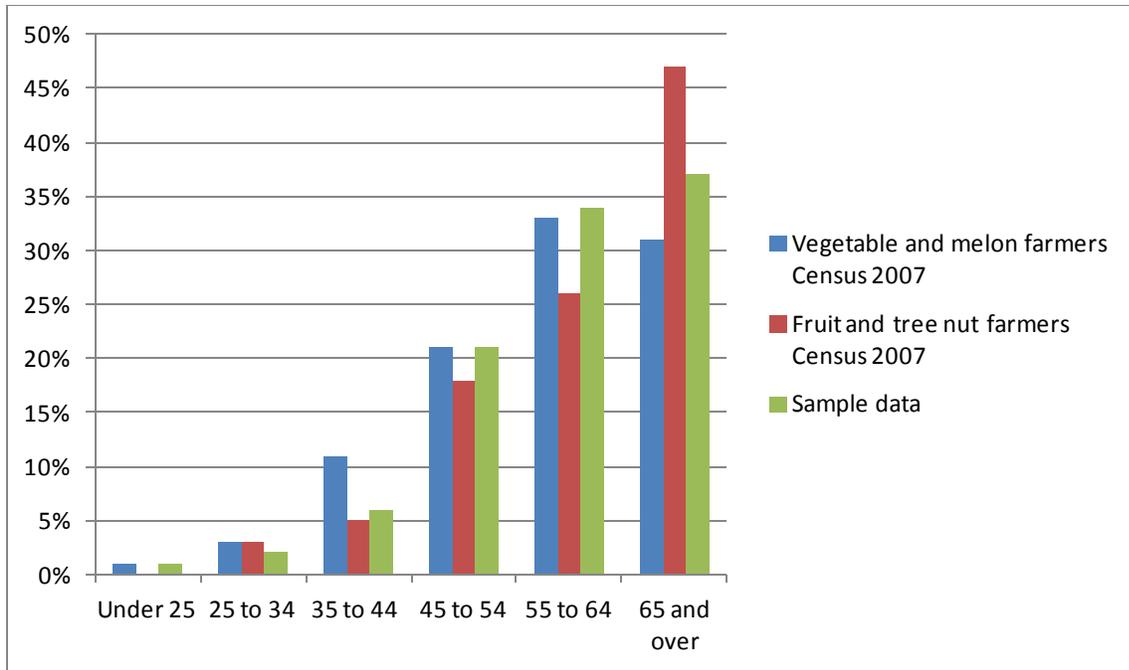
Figure 1. Age distribution of sample data compared with the 2007 Census of Agriculture

Part 3: Factors Affecting Producer Participation in State Programs Promoting Locally Grown Foods: The Case of Fruit and Vegetable Growers in Tennessee

Abstract

U.S. governmental agencies have implemented a variety of programs to increase the supply of Locally Grown Foods in response to growing popularity of these markets. Tennessee currently has two state-funded programs promoting the consumption of Tennessee agricultural products -Tennessee Farm Fresh and Pick Tennessee Products. Factors associated with produce farmer participation in each of these programs are analyzed using a bivariate probit model. Results suggest that participation in these programs was associated with use of Extension resources, education, and fresh produce marketing. These results should help agencies attempting to increase participation of producers in programs promoting locally grown foods.

Introduction

The sales of locally grown foods (LGF) in the U.S. reached$4.8 billion in 2008 and are expected to grow to $7 billion by 2012 (Low and Vogel 2011; USDA/Agricultural Marketing Services). While increased consumer interest in LGF may be new, the notion of states promoting their own agricultural products has been around since at least the 1930's (Patterson 2006) and a number of states currently have programs designed to promote products grown in that state and connecting producers with consumers seeking LGF. Previous studies have found that these programs can increase consumer interest in, and sales of, specific products. Brooker and Eastwood (1989) found that consumers in Knox County, Tennessee had positive attitudes towards state logos. They noticed that consumer perceived state logos as useful tools to identify LGF in metropolitan supermarkets. Govindasamy et al. (2004) evaluated the impact of the Jersey Fresh program on cash receipts of farmers and the local economy in general. They estimated that the $1.16 million investment in the Jersey Fresh campaign in 2000 generated $36.6 million in revenues for New Jersey fruit and vegetable growers. Carpio and Isengildina-Massa (2010)

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concluded that the South Carolina locally grown campaign increased consumers' willingness to pay for produce by 3.4%, it increased producer surplus by about three million dollars, and it represented a return to investment of about 618% for the state of South Carolina.

In Tennessee, there are currently two state-funded programs to support and develop markets for Tennessee-grown products. Pick Tennessee Products (PTP) was created by the Tennessee Department of Agriculture (TDA) in 1986. In 2008, the Tennessee Department of Agriculture, in cooperation with the Tennessee Farm Bureau, also created Tennessee Farm Fresh (TFF). The purpose of these programs is to help farmers market their local products and inform consumers about LGF markets.

Although previous studies have explored consumer awareness, perceptions and opinions about state-sponsored marketing programs (Brooker and Eastwood 1989; Adelaja, Brumfield, and Lininger 1990; Govindasamy et al. 1998b; Patterson et al. 1999; Govindasamy et al. 2004; Carpio and Isengildina-Massa 2010; Onken and Bernard 2010; Onken, Bernard, and Pesek 2011), little research exists of producer response to state-sponsored promotion programs (Govindasamy et al. 1998a). Govindasamy et al. (1998a) evaluated farmer awareness, participation, perceptions and opinions about the Jersey Fresh logos (i.e., Jersey Fresh, quality grading, and premium logos). About 93% of producers were aware of the Jersey Fresh Program, and about 51% have used the Jersey Fresh Logos. Results suggest that producers who perceived consumer high awareness of Jersey Fresh logos, who used other logos to identify fresh produce, with more farming experience, and located in the agricultural zone of New Jersey were more likely to use Jersey Fresh logos. In contrast, farmers with larger acreage and more than 75% of their production being wholesaled were less likely to use these logos. Additionally, results

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suggested that younger and more educated farmers were more likely to be willing to participate in the Jersey Fresh Program in the future. They identified that the profile of farmers who willing to use Jersey Fresh logos in the future was very similar to the one of farmers already using the logos.

The goal of this study is to evaluate factors affecting fruit and vegetable producer participation in TFF and PTP programs. The existence of two different programs within the same state allows us to examine how observable differences in the two programs affect producer participation. Information on the factors influencing producer participation in these programs can help policy makers design and market similar programs in other states. The next section of this second essay develops a theoretical model to explain producer participation in these programs. The discussion of the data and methodology includes data description; theoretical model; and methodology used to empirically analyze the factors influencing producer participation in state-sponsored marketing programs in Tennessee. The results of this analysis are discussed next and the final section concludes.

Data and Methodology

This study uses data from a survey of the entire population of fruit and vegetable producers in Tennessee, as determined by the United States Department of Agriculture's National Agricultural Statistics Survey (USDA/NASS). The survey, a cover letter explaining the importance of the survey, and a postage paid return envelope were mailed to Tennessee's 1,954 fruit and vegetable producers on February 2, 2011. Reminder post cards were sent on February 24th. On March 24th, a second wave of surveys was sent to the producers who had not responded

to the initial mailing. Of the 1,954 surveys mailed, 587 were completed and returned for a response rate of 30%.

The survey included an array of questions regarding outlets used to market produce, how producers define a "local" market, barriers producers face when marketing their products, and awareness and participation in the state-sponsored marketing programs. In addition, the survey gathered information about farmer/farm business characteristics. More specifically, producers were asked whether they were aware of each of Tennessee's two programs – TFF and PTP. Those responding that they were aware were then asked whether they participated in the program or not. In addition to the survey data, secondary data such as the number of farmers markets per county, and other county characteristics (e.g. metro/non-metro) that might be correlated with a producer's decision to participate in Tennessee's programs promoting local foods were collected from the United States Department of Agriculture's Food Environmental Atlas (http://www.ers.usda.gov/foodatlas, USDA 2011).

Theoretical Analysis

Fruit and vegetable producers are assumed to be rational decision makers who maximize the discounted expected benefits from farming. Producers' uncertainty about future income from fruit and vegetable production may induce them to look for alternative marketing strategies to improve benefits from farming. A producer decision to participate in a state-sponsored marketing program can be seen as an attempt to boost benefits from farming through the potential increase in sales, access to price premiums, and therefore contribution to local economies. Additionally, producers may perceive the participation in these programs as an opportunity to contribute to the wellness of their community, as they give access to local and maybe fresher foods (Govindasamy

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et al. 1998a). Producers participating in state programs may develop a pride in participating in these programs as they differentiate their produce using a logo that represents quality and freshness. The utility producer receives from participating in state program m can be represented by a random utility model such that:

(1) $$U_{im} = \alpha'_m r_{im} + \varepsilon_{im} \text{ for } m = 1, 2,$$

where r_{im} is a vector of observed producer, farm, and region characteristics, α_m is a vector of unknown parameters associated with these variables, and ε_{im} is the error term. In this study two programs will be evaluated: Tennessee Farm Fresh ($m=1$), and Pick Tennessee Produce ($m=2$).

A farmer will participate in a state-sponsored marketing program if the expected utility from participating is greater than zero ($U^*_{im} > 0$).

Note that U^*_{im} is an unobservable latent variable, but the decision to participate in a state program is observable such that:

(2) $$y_{im} = \begin{cases} 1 \text{ if } U^*_{im} > 0 \\ 0 \text{ if } U^*_{im} \leq 0 \end{cases} \text{ for } m = 1,2,$$

where $y_{im} = 1$ if the producer decides to participate in state program m and $y_{im} = 0$, otherwise. This identity provides an empirically tractable approach to estimate the factors influencing the participation in state-sponsored marketing programs.

Sample Selection

Since only those survey respondents who indicated that they were aware of TFF or PTP were asked to indicate whether they participated in that program, participation is assumed to be the result of a selection process that can be modeled as follows:

(3)
$$s_{i1} = \beta_1' x_{i1} + e_{i1}$$
$$s_{i2} = \beta_2' x_{i2} + e_{i2}$$

where $s_{i1} = 1$ if a producer is aware of TFF, and zero otherwise; $s_{i2} = 1$ if a producer is aware of PTP, and zero otherwise; β_1 and β_2 are parameters associated with each awareness equation; e_{i1}, and e_{i2}, are random disturbances for each equation; and x_{i1}, and x_{i2} are vectors of observed producer, farm, and area characteristics that may influence the likelihood that a producer is aware of the two programs.

A Heckman selection probit model is used to examine the factors affecting producer participation in TFF and PTP, subject to awareness to these programs. Assuming that the error terms in the selection equations presented in (3) are normally distributed with $\mu_m = 0$, and $Var(e_{im}) = \sigma_m^2$, it can be shown that:

(4)
$$P_{Am} = \Pr(s_{im} = 1) = 1 - \Phi(-(\beta_m' x_{im})) \quad m = 1,2,$$

where P_{Am} is the probability of a farmer being aware of a state-sponsored marketing program m, and Φ represents the standard normal cumulative distribution function. The symmetric qualities of the standard normal distribution function can be used to show that:

(5) $$1 - \Phi(-(\beta' x_i)) = \Phi(\beta' x_i).$$

Therefore, the probability of a farmer being aware of a state program can be represented as:

(6) $$P_{Am} = \Phi(\beta'_m x_{im}).$$

Given equations (4) and (6), the sample likelihood function can be written as:

(7) $$L = \prod_{s_{im}=1} \Phi(\beta'_m x_{im}) \prod_{s_{im}=0} \Phi(-(\beta'_m x_{im}))$$

Assuming the error term in equation (1) is distributed standard normal with $\mu_{ym} = 0$ and $Var(\varepsilon_i) = \sigma_{ym}^2$, then

$$P_{Pm} = \Pr(y_{im} = 1 \mid s_{im} = 1) = \Pr(U_m^* > 0 \mid s_{im} = 1)$$

(8) $$= \Pr(\varepsilon_{im} > -(\alpha'_m r_{im}) / \Phi(\beta'_m x_{im}))$$

$$= \Phi(\alpha'_m r_{im}) / \Phi(\beta'_m x_{im}),$$

where P_{Pm} is the probability of a producer participating in state program m given awareness of this program. The sample likelihood function can then be written as:

(9) $$L = \prod_{y_{mi}=1 \mid s_{mi}=1} \Phi((\alpha'_m r_{im}), \rho) \prod_{y_{mi}=0 \mid s_{mi}=1} \Phi((-\alpha'_m r_{im}), -\rho),$$

where ρ is the correlation between the error term in the selection equation, e_{im}, and the error term in the outcome equation, ε_{im}. This correlation measures the level of association between the unobserved determinants of awareness of TFF and PTP and the unobserved determinants of participation in these programs and it is a result of the non-random nature of the samples used to

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evaluate participation in TFF and PTP. If $\rho \neq 0$, the Heckman correction is appropriate to estimate the parameters in equation (1). If $\rho = 0$, the model has failed to identify any selection bias and a probit model can be used to estimate participation in each program.

However, there may be unobserved determinants of participation in TFF and PTP that are correlated. If so, the error terms of the participation equations will be correlated. The TFF and PTP programs are similar in nature. Both TFF and PTP were created in order to link producers of LGF with consumers seeking LGF. In addition, both programs offer many of the same services including listing on an on-line directory and the right to use program logos. Thus, it seems likely that many of the same factors that influence participation in one program will influence participation in the other. If the error terms of the participation equation are found to be correlated a bivariate probit model is appropriate to estimate the equations described in (1) (Greene 2003; Christofides, Stengos, and Swidinsky 1997).

Empirical Model

Awareness is a necessary condition for participation in TFF and PTP, therefore the equation for awareness is set to be the selection equation in the Heckman selection probit estimation. Descriptions of the variables used in the selection equations are presented in Tables 1 and 2.

Producer characteristics hypothesized to affect awareness are: age (AGE); educational attainment, represented by a set of dummy variables for some high school (SOMEHS), high school graduate (HSGRAD), some college (SOMECOLL), an associate's degree (ASSOCDEG), a bachelor's degree (BACHDEG), and a graduate degree (GRADDEG); the percentage of household income from farming, represented by a single dichotomous variable for less than 25

percent (PF_INCOME); the number of University/Extension educational events or presentations involving produce marketing strategies attended in the past five years (EDUC_EVENTS); and a dichotomous variable indicating whether respondent has used any University/Extension educational publications regarding produce marketing strategies in the past five years (PUBLICATIONS).

Farm enterprise characteristics included in the awareness equation are: size of the fruit and vegetable operation in acres (VEGSIZE); percentage of fruit and vegetable sales made directly to consumers (TDS), intermediaries (TIN), and retail outlets (TRE); and the percentage of direct to consumer sales made to consumers in the producer's own county (YOURCNTY), neighboring counties (NEXTYCNTY), elsewhere in the state of Tennessee (INSTATE), elsewhere in the U.S. (INUS), and elsewhere in other countries (OTHCNTRY).

The characteristics of the region in which the producer operates that are included in the awareness equation are: geographic location, represented by dichotomous variables for East Tennessee (EASTTENN), Middle Tennessee (MIDTENN), and West Tennessee (WESTTENN); a dichotomous variable for whether the producer operates in a metropolitan county (METRO); and the number of farmers markets located within the producer's county of operation (FMRKT). Hypotheses about the impact (positive or negative) of all the variables described above on the awareness of TFF and PTP are described in the first essay of this thesis.

Descriptions of the variables used in the participation equations are presented in Table 3. Producer characteristics hypothesized to affect participation are: age (AGE); whether the producer has attained a bachelor or graduate degree (BACH_GRAD); the percentage of

household income coming from farming, expressed by a dichotomous variable for less than 25 percent (PF_INCOME); extent to which the producer agrees that labeling his or her produce as locally grown will increase sales on a scale of one to five where one represents "strongly disagree" and five represents "strongly agree" (BENEFIT_SALES); number of University/Extension events related to produce marketing strategies attended in the past five years (EDUC_EVENTS); and whether the producer used University/Extension publications to obtain information on produce marketing strategies in the past five years (PUBLICATIONS).

Age has been found to have a negative influence on use of state-logo programs by farmers (Govindasamy et al. 1998a). Thus, younger farmers are expected to be more likely to participate in state-sponsored marketing programs. Education is expected to be positively correlated with participation in these programs. Prior research found that producers with more than college education were more likely to participate in state-sponsored marketing programs in the future (Govindasamy et al. 1998a). Additionally, previous studies found producers marketing their produce directly to consumers to be more educated than those not using these outlets, perhaps because these marketing outlets may require additional skills or abilities beyond those needed for the management of an agricultural operation (Uva 2002; Hunt 2007; Uematsu and Mishra 2011). Hence, given that producers participating in state-sponsored marketing programs are more likely to use direct-to-consumer outlets (Govindasamy et al. 1998), they are also expected to be more educated than those not participating in these programs.

The percentage of household income coming from farming is hypothesized to have a positive impact on participation as households with a greater percentage of income from farming are likely to be willing and able to devote more time to implementing new marketing strategies.

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Marketing local foods may be more time-intensive (e.g. more time to contact buyers) than other strategies, and therefore a larger percentage of income from farming may imply a higher probability to participate in programs promoting local foods (D'Souza, Cyphers, and Phipps 1993).Producer's believes that labeling produce as local will increase produce sales is expected to be positively correlated with participation. Given that state-sponsored marketing programs are meant to increase popularity of products grown in the state and potentially increase sales of these products, it is expected that producers perceiving the effectiveness of these programs in attaining this goal will increase producer likelihood to participate (Govindasamy et al. 1998a).

Attendance at University/Extension educational events and use of University/Extension publications are hypothesized to increase participation. Information plays a key role in the adoption of new management practices including marketing and Extension services can be an effective tool in delivering the information needed for farmers to make informed decisions about new marketing strategies (Nowak 1987; Knowler and Bradshaw 2007).

Characteristics of the producer's farming operation included in the outcome equation are: size of the producer's fruit and vegetable operation in acres (VEGSIZE); percentage of sales made directly to consumers (TDS); and whether the operation markets fresh fruits and vegetables (FRESH).

While some studies suggest that that the number of acres being farmed has a negative impact on participation in state-sponsored marketing programs (Govindasamy et al. 1998a), other results suggest that adoption of new marketing strategies does not seem to have a scale effect where the "cost" of adoption of a new marketing strategy is spread over the number of

acres farmed (D'Souza, Cyphers, and Phipps 1993). Thus, there is no *a priori* hypothesis with respect to participation and size of operation. On the other hand, the percentage of sales made directly to consumers is hypothesized to be positively correlated with participation. Previous research found that producers categorized as primary wholesalers (i.e., more than 75 percent of their production being sold in the wholesale market) were less likely to participate in these programs (Govindasamy et al. 1998a). Therefore, we expected that those who primary sell through direct-to-consumer outlets as oppose to wholesale markets may be more likely to participate in state-sponsored marketing programs. The marketing of fresh fruits and vegetables is hypothesized to increase participation solely in the TFF program as TFF focuses on the promotion of fresh products grown in Tennessee.

Characteristics of the area in which the producer operates included in the participation equations are: region of Tennessee producer is located in, expressed by dichotomous variables for East (EASTTENN), Middle (MIDTENN), and West (WESTTENN); and whether producer is located in a metropolitan county (METRO).

Producers located in metropolitan counties are expected to be more likely to participate in TFF and PTP. Producers living in metropolitan areas rely heavily on urban markets. More than half of the farms with local food sales are situated in metropolitan counties (Low and Vogel 2011).

Results and Discussion

Sample Overview and Descriptive Statistics

   After eliminating observations with missing data, 301 and 302 responses were suitable for the analysis of awareness of the TFF and PTP programs, respectively. For the joint analysis of participation in TFF and PTP 104 responses were suitable for analysis after eliminating observations with missing data. The survey design made individuals who were not aware of TFF or PTP not to answer the question of participation, and this explains in part why for the participation in TFF and PTP analysis only 104 observations were used. The average age of respondents included in the analysis of factors affecting participation in TFF and PTP (n=104) was 58 years which is the average age of farmers in Tennessee according to the 2007 Census of Agriculture (USDA/NASS). The age distribution from respondents follows closely age distribution among vegetable and melon farmers, and fruit and nut farmers in Tennessee (Figure 2). The proportions of farmers in each age category are similar when comparing respondents age and age of vegetable and melon farmers in Tennessee. The sample used in this study had a larger proportion of farmers in the 35 to 44, 45 to 54 and 55 to 64 age categories when compared to Tennessee fruit and nut farmers. However, the proportion of Tennessee fruit and nut farmers in the 65 and over category was larger compared to the sample respondents. About 54% of respondents have attained either a bachelor's degree or graduate degree. About 52% of respondents reported that less than 25% of their household income came from farming. On average, respondents somewhat agreed with the statement that labeling produce as "locally grown" would increase "the number of customers willing to buy my produce." Respondents attended an average of 2.2 University/Extension educational events relating to marketing strategies for selling produce in the past five years. About 52% of respondents have used

University/Extension publications to obtain information about how to better market their produce in the past five years.

The average size of respondents' fruit and vegetable operations is 12 acres. About 87% of respondent fruit and vegetable sales were made through direct-to-consumer outlets. About 92% of producers indicated that they sell fresh fruits and vegetables, which is very close to the percentage of producers selling fresh vegetables in Tennessee (91%) according to the 2007 Census of Agriculture (USDA/NASS). Approximately 37% of respondents were located in East, 52% in Middle, and 12% in West Tennessee. About 52% of the respondents' fruit and vegetable operations are located in metropolitan counties.

Approximately 23% of the respondents participate in the TFF program and 39% participate in the PTP program. The difference in the percentage of respondents participating in each program may be due to the fact that PTP was established in 1986 and TFF is still relatively new, having been established in 2008. The difference could also be attributed to the fact that participation in TFF entails an annual fee ($100.00) while PTP does not, although the TFF fee guarantees an array of marketing tools and benefits (i.e. TFF logo, TFF stickers, price cards, TFF reusable bags, and free access to workshops offered through the University of Tennessee Center for Profitable Agriculture).

Mean values of producer, operation, and area characteristics for respondents who participate in the programs and for those who do not are reported in Table 4. Differences in these mean values between those who participate and those who do not are evaluated using t-tests. On average, participants in both programs have larger fruit and vegetable operations, have attended more University/Extension educational events related to fruit and vegetable marketing in the last

five years, and were more likely to have used University/Extension publications to obtain information on how to better market their produce in the last five years. A larger proportion of respondents participating in PTP had attained a bachelor or graduate degree (66%) than those not participating in the program (46%). The proportion of respondents with 25% or less of their income coming from farming was significantly lower among PTP participants than among non-participants. This finding supports the hypothesis that respondents with higher percentages of income coming from farming are more likely to participate in these programs to improve marketing strategies because they rely more heavily on farm incomes (D'Souza, Cyphers, and Phipps 1993).

A greater proportion of respondents not participating in TFF sell fresh fruits and vegetables (95%) compared to respondents participating in this program (83%). A significantly higher proportion of respondents whose operation was located in East Tennessee were not participating in PTP than were participating, with 43% and 27%, respectively. Finally, a significantly larger proportion of respondents operating in metropolitan counties are participating in PTP (63%) than those who were not participating (44%). This result is consistent with the hypothesis that because urban markets are used by a large number of producers marketing their products as local foods producers located near to these markets are more likely to participate in state-sponsored marketing programs (Low and Vogel 2011).

Evaluation of Factors Affecting Conditional and Joint Probabilities of Participation in TFF and PTP: A Bivariate Probit Model

Heckman selection probit models were estimated to identify factors affecting participation in TFF and PTP. However, the correlation coefficients between the selection

equation and the outcome equation were not statistically significant for either the TFF or PTP models, indicating that probit models could be used for this analysis (Table 5). However, it is hypothesized that because of similarities in the TFF and PTP programs, there may be unobserved determinants that are likely to have an analogous influence on participation in these programs, and, as a result, the error terms of the two participation equations are likely to be correlated. Therefore, a bivariate probit model was used. The correlation coefficient between the residuals for the participation in TFF and PTP equations was positive and significant at the 1% level. This result indicates that the error terms of the TFF and PTP participation equations are correlated and therefore, the use of the bivariate probit model is appropriate. A likelihood ration test also indicated the model was overall significant at the 1% level. Results from the bivariate probit model can be seen in Table 5. As explained above, only respondents who reported to be aware of TFF or PTP were asked to answer the question whether they participate or not on these programs. Therefore, only individuals aware of both programs were considered in the bivariate probit model but no corrections were made for potential selection bias given the results obtained from the Heckman selection probit.

Marginal effects of the various explanatory variables considered on the conditional and joint probabilities of participation in these two programs are presented in Table 6. For this analysis we only present the marginal effects for one conditional probability and three joint probabilities because these were the ones considered relevant for this study[3]. Marginal effects were estimated for the probability of participating in TFF given participation in PTP, $\Pr(y_{i1} = 1 \mid y_{i2} = 1 \mid n_1, n_2)$, probability of jointly participating in both programs,

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[3] Other marginal effects are available from author upon request.

$\Pr(y_{i1}=1, y_{i2}=1 | n_1, n_2)$, and probability of participating in PTP but not in TFF,

$\Pr(y_{i1}=0, y_{i2}=1 | n_1, n_2)$. Conditional probabilities are related with the probability of an event

given prior information (e.g. probability of participation in TFF given prior information that the

respondent is participating in PTP). Joint probabilities deal with events that happened

simultaneously without any prior information. Given that information about the decision making

process behind participation in TFF and PTP is limited, both, conditional and joint probabilities

were considered. Estimation of marginal effects followed Christofides, Stengos, and Swidinsky

(1997) approach. The number of University/Extension educational events attended in the past

five years (EDUC_EVENTS) and whether the producer sold fresh fruits and vegetables

(FRESH) had a statistically significant effect on the probability of participating in TFF given that

the producer was already participating in PTP. Attendance at an additional University/Extension

educational event increased the likelihood of producer participation in TFF by 5%, given that the

producer was already participating in PTP. If the producer was selling fresh fruits and vegetables

(FRESH) he/she was 48% less likely to participate in TFF, given participation in PTP. This

result indicates that, even though a main focus of TFF is to promote locally grown fresh produce,

fruit and vegetable producers are less likely to participate in this program if they are already

participating in PTP. Contrary to the hypothesis that producers selling fresh produce are more

likely to participate in TFF given that the focus of this program is the promotion of fresh produce

grown in Tennessee, for this sample, it seems that a larger proportion of operations selling fresh

produce are not participating in TFF. These results may be explained by the fact that PTP

promotes all products grown in Tennessee not only fresh produce, and therefore given its

coverage it may be perceived by producers as a program having a larger impact on consumer

preferences. Therefore, a produce farmer may be less interested in participating in alternative programs focusing on fresh produce only. Additionally, the fact that PTP has been around for about twenty four years may increase producer confidence in the effectiveness of the campaign reducing the need for participation in any other program specializing in the type of products they are marketing (i.e. fresh produce).

Producers who have either a bachelor or graduate degree (BACH_GRAD) or who sell fresh fruits and vegetables (FRESH) are more likely to participate in PTP and not in TFF. Producers who have either a bachelor's or graduate degree are 21% more likely to participate in PTP and not participate in TFF, and producers who sell fresh fruits and vegetables are 19% more likely to participate in PTP and not in TFF. As hypothesized, producers who have attained higher levels of education are more likely to participate in program promoting local foods as the use of marketing outlets associated with LGF may require additional skills or abilities not related with the management of an agricultural operation (Uva 2002; Hunt 2007; Uematsu and Mishra 2011).

The size of fruit and vegetable operation (VEGSIZE), the number of University/Extension educational events attended in the past five years (EDUC_EVENTS), and the use of University/Extension publications in the past five years (PUBLICATIONS) had a positive impact on the joint probability of participating in both TFF and PTP. Although statistically significant, the effect of fruit and vegetable operation size on the likelihood of participation in both programs was very small in magnitude. Attendance to University/Extension events increase the likelihood of jointly participating in TFF and PTP by 4% and the use of University/Extension publications increased the likelihood of jointly participation in both programs by 14%. The correlation between use of University/Extension resources, such as

educational events and publications, and program participation is expected given that Extension services are an important source of information for farmers looking for new farming practices and marketing strategies (Nowak 1987; Knowler and Bradshaw 2007).Whether the producer sold fresh fruits and vegetables decreased the likelihood of participation in TFF and PTP by 19%.

Conclusions

Federal and state agencies have implemented a variety of programs to increase the supply of LGF in response to growing popularity of these markets among consumers. Tennessee currently has two state-funded programs in place to support and develop markets for Tennessee-grown products: Tennessee Farm Fresh (TFF) and Pick Tennessee Products (PTP). A bivariate probit regression was used to evaluate the impact of characteristics of the producer, the producer's operation, and the county in which the producer's operation is located on producer participation in TFF and PTP.

Different factors affected the likelihood of participating in one program given the participation in the alternative program, and the likelihood of jointly participating in both programs (i.e., TFF and PTP). Attendance to University/Extension educational events and whether the producer sold fresh fruits and vegetables significantly affected participation in TFF, given producer participation in PTP. On the other hand, higher levels of education (i.e. bachelor's or graduate degree) and whether the producer sold fresh fruits and vegetables significantly affected participation in PTP, given producer participation in TFF. Size of fruit and vegetable operation, attendance to University/Extension educational events, and the use of University/Extension publications had a significant effect on the joint probability of participation

in both TFF and PTP. It is important to notice that if a producers is selling fresh produce he/she is more likely to participate in PTP, given participation in TFF, while a producer selling fresh fruits and vegetables is less likely to participate in TFF, given he/she is already participating in PTP. This result is surprising given that the focus of TFF is promotion of fresh products grown in Tennessee. This result may suggest further exploration of the differences in the profile of producer who could potentially participate in TFF and PTP, as well as their needs, given that the marketing of fresh produce does not necessarily increase interest in participating in TFF if a producer is already participating in PTP. Additionally, it would be important to identify the profile of those producers who may benefit from participation in both programs simultaneously, so that policy makers can better satisfy the needs of this particular clientele.

Additionally, results point at the importance of Extension as a source of information for producers who may be interested in participating in programs promoting LGF. Attendance to University/Extension events and the use of University/Extension publications were significant factors affecting participation in TFF and PTP. Therefore, policy makers should continue collaborating with Extension services to increase participation in marketing programs but may also explored alternative information sources for those who do not use Extension as their main source of information when looking for alternative marketing strategies.

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Appendix

Table 5. Definitions and Descriptive Statistics of Variables Affecting Awareness of Tennessee Farm Fresh (n=301)

Variable	Description	Mean
C. Dependent Variables		
AWARE_TFF	=1 if farmer is aware of Tennessee Farm Fresh, zero otherwise	0.3787
D. Independent Variables		
AGE	Age of producer in years	60.6013
SOMEHS	=1 if some high school is the highest level of education attained by the farmer, zero otherwise	0.0631
HSGRAD	=1 if high school diploma is the highest level of education attained by the farmer, zero otherwise	0.2060
SOMECOLL	=1 if some college is the highest level of education attained by the farmer, zero otherwise	0.1462
ASSOCDEG	=1 if an associate's degree is the highest level of education attained by the farmer, zero otherwise	0.0963
BACHDEG	=1 if a bachelor's degree is the highest level of education attained by the farmer, zero otherwise	0.2658
GRADDEG	=1 if a graduate degree is the highest level of education attained by the farmer, zero otherwise	0.2226
PF_INCOME	=1 if less than 25% of farmer household income comes from farming	0.7043
EDUC_EVENTS	The number of educational events the farmer has attended in the past 5 years	1.1296
PUBLICATIONS	=1 if the farmer has used University/Extension publications in the past 5 years	0.2990
YOURCNTY	Percent of direct sales to consumers in the county where the farmer operates	68.8239
NEXTCNTY	Percent of direct sales to consumers in neighboring counties of where the farmer operates	23.6678
INSTATE	Percent of direct sales to consumers elsewhere in the state	5.0681
INUS	Percent of direct sales to consumers elsewhere in the country	1.8090
OTHCNTRY	Percent of direct sales to consumers in other countries	0.6312
VEGSIZE	Size of fruit and vegetable operation in acres	8.9132
TOTDIRECTSALES	Percent of direct sales obtained from direct to consumer outlets	85.1728

Table 5. Continued

Variable	Description	Mean
TOTINTERMSALES	Percent of direct sales obtained from direct to intermediary outlets	7.5914
TOTRETAILSALES	Percent of direct sales obtained from direct to retail outlets	7.2359
EASTTENN	=1 if the farmer is located in East Tennessee, zero otherwise	0.3987
MIDTENN	=1 if the farmer is located in Middle Tennessee, zero otherwise	0.4319
WESTTENN	=1 if the farmer is located in West Tennessee, zero otherwise	0.1694
FMRKT	The number of farmer's markets in the county where the farmer operates	1.0664
METRO	=1 if farmer is located in a metropolitan county, zero otherwise	0.4651

Table 6. Definitions and Descriptive Statistics of Variables Affecting Awareness of Pick Tennessee Products (n=302)

Variable	Description	Mean
E. Dependent Variables		
AWARE_PTP	=1 if farmer is aware of Pick Tennessee Products, zero otherwise	0.5099
F. Independent Variables		
AGE	Age of producer in years	60.5927
SOMEHS	=1 if some high school is the highest level of education attained by the farmer, zero otherwise	0.0662
HSGRAD	=1 if high school diploma is the highest level of education attained by the farmer, zero otherwise	0.2086
SOMECOLL	=1 if some college is the highest level of education attained by the farmer, zero otherwise	0.1457
ASSOCDEG	=1 if an associate's degree is the highest level of education attained by the farmer, zero otherwise	0.0960
BACHDEG	=1 if a bachelor's degree is the highest level of education attained by the farmer, zero otherwise	0.2550
GRADDEG	=1 if a graduate degree is the highest level of education attained by the farmer, zero otherwise	0.2285
PF_INCOME	=1 if less than 25% of farmer household income comes from farming	0.6921
EDUC_EVENTS	The number of educational events the farmer has attended in the past 5 years	1.0993
PUBLICATIONS	=1 if the farmer has used University/Extension publications in the past 5 years	0.2980
YOURCNTY	Percent of direct sales to consumers in the county where the farmer operates	69.0530
NEXTCNTY	Percent of direct sales to consumers in neighboring counties of where the farmer operates	23.5960
INSTATE	Percent of direct sales to consumers elsewhere in the state	5.0513
INUS	Percent of direct sales to consumers elsewhere in the country	1.6705
OTHCNTRY	Percent of direct sales to consumers in other countries	0.6291
VEGSIZE	Size of fruit and vegetable operation in acres	9.5111
TOTDIRECTSALES	Percent of direct sales obtained from direct to consumer outlets	85.3378
TOTINTERMSALES	Percent of direct sales obtained from direct to intermediary outlets	7.4338

Table 6. Continued

Variable	Description	Mean
TOTRETAILSALES	Percent of direct sales obtained from direct to retail outlets	7.2285
EASTTENN	=1 if the farmer is located in East Tennessee, zero otherwise	0.3974
MIDTENN	=1 if the farmer is located in Middle Tennessee, zero otherwise	0.4272
WESTTENN	=1 if the farmer is located in West Tennessee, zero otherwise	0.1755
FMRKT	The number of farmer's markets in the county where the farmer operates	1.0861
METRO	=1 if farmer is located in a metropolitan county, zero otherwise	0.4636

Table 7. Definitions and Descriptive Statistics of Variables Affecting Participation in TFF and PTP (n=104)

Variable	Description	Mean
G. Dependent Variables		
PART_TFF	=1 if farmer is participating in Tennessee Farm Fresh, zero otherwise	0.2308
PART_PTP	=1 if farmer is participating in Pick Tennessee Products, zero otherwise	0.3942
H. Independent Variables		
AGE	Age of producer in years	58.0481
BACH_GRAD	=1 if producer has attained a bachelor's or graduate degree	0.5385
PF_INCOME	=1 if less than 25% of farmer household income comes from farming	0.5192
VEGSIZE	Size of fruit and vegetable operation in acres	11.7740
TDS	Percent of direct sales obtained from direct to consumer outlets	87.2115
EASTTENN	=1 if the farmer is located in East Tennessee, zero otherwise	0.3654
MIDTENN	=1 if the farmer is located in Middle Tennessee, zero otherwise	0.5192
WESTTENN	=1 if the farmer is located in West Tennessee, zero otherwise	0.1154
BENEFIT_SALES[a]	=1,…,5 based on degree to which farmers believe labeling their produce as "locally grown" will increase sales	4.1250
METRO	=1 if farmer is located in a metropolitan county, zero otherwise	0.5192
EDUC_EVENTS	The number of educational events the farmer has attended in the past 5 years	2.2019
PUBLICATIONS	=1 if the farmer has used University/Extension publications in the past 5 years	0.5192
FRESH	=1 if the farmer sells fresh fruits and vegetables	0.9231

[a] Responses were 1= "strongly disagree", 2= "somewhat disagree", 3= "neither agree nor disagree", 4= "somewhat agree", and 5= "strongly agree."

Table 8. Variable Means for Respondents Participating in the Tennessee Farm Fresh, Pick Tennessee Products, and Both Programs and Those Not Participating

Independent Variables[a]	Tennessee Farm Fresh		Pick Tennessee Products		Both Programs	
	Do Not Participate (n=80)	Participate (n=24)	Do Not Participate (n=63)	Participate (n=41)	Do Not Participate (n=83)	Participate (n=21)
AGE	57.9375	58.4168	58.9206	56.70732	58.0602	58.0000
BACH_GRAD	0.5250	0.5833	0.4603	0.6585**	0.5181	0.6190
PF_INCOME	0.5625	0.3750	0.6032**	0.3902	0.5663*	0.3333
VEGSIZE	8.8250	21.6042***	8.6905	16.5122**	8.7530	23.7142***
TOTDIRECTSALES	89.0250	81.1667	88.9048	84.6098	89.0482	79.9524
EASTTENN	0.4000	0.2500	0.4286*	0.2683	0.3855	0.2857
MIDTENN	0.4875	0.6250	0.4921	0.5610	0.5060	0.5714
WESTTENN	0.1125	0.1250	0.0794	0.1707	0.1084	0.1429
BENEFIT_SALES	4.1000	4.2083	4.0000	4.3171	4.0843	4.2857
METRO	0.5000	0.5833	0.4444	0.6341*	0.4940	0.6190
EDUC_EVENTS	1.4375	4.7500***	1.2540	3.6585***	1.5181	4.9048***
PUBLICATIONS	0.4250	0.8333***	0.3968	0.7073***	0.4337	0.8571***
FRESH	0.9500*	0.8333	0.9365	0.9024	0.9277	0.9048

*, **, *** denotes significance at the 10%, 5%, and 1% levels respectively based on t-tests.

[a] For variable definitions see Table 1.

Table 9. Heckman Sample Selection Model Estimation of Participation in the Tennessee Farm Fresh and Pick Tennessee Products Program Given Awareness of These Programs

Independent Variables	Dependent Variable			
	Aware of TFF (n=114)	Participating in TFF (n=28)	Aware of PTP (n=154)	Participating in PTP (n=58)
	Coefficient		Coefficient	
Constant	-2.0040***	-2.7362**	0.9923	-1.6973**
	(0.7502)	(1.2595)	(0.6387)	(0.8108)
AGE	-0.0019	0.0115	-0.0200***	0.0026
	(0.0074)[a]	(0.0150)	(0.0075)	(0.0108)
SOMEHS	0.2836		-0.6259*	
	(0.3796)		(0.3728)	
HSGRAD	-0.0021		-0.1674	
	(0.2577)		(0.2570)	
SOMECOLL	0.0410		-0.1871	
	(0.2755)		(0.2780)	
ASSOCDEG	-0.5343		-0.5821*	
	(0.3320)		(0.3153)	
GRADDEG	0.1372		0.0175	
	(0.2427)		(0.2446)	
BACH_GRAD		-0.0468		0.3677
		(0.3095)		(0.2493)
PF_INCOME	-0.4038*	-0.0813	-0.6468***	-0.4615
	(0.2196)	(0.3191)	(0.2150)	(0.2850)
NEXTCNTY	0.0054**		0.0073**	
	(0.0027)		(0.0028)	
INSTATE	0.0127**		0.0089	
	(0.0056)		(0.0055)	
INUS	0.0002		-0.0109	
	(0.0112)		(0.0108)	
OTHCNTRY	0.0023		0.0252	
	(0.0139)		(0.0243)	
VEGSIZE	0.0201**	0.0295***	0.0040	0.0097
	(0.0082)	(0.0093)	(0.0068)	(0.0076)
TDS	0.0145**	-0.0047	0.0048	-0.0008
	(0.0057)	(0.0065)	(0.0045)	(0.0039)
TIN	0.0072		0.0089	
	(0.0064)		(0.0057)	
BENEFIT_SALES		0.1069		0.1205
		(0.1615)		(0.1069)
FRESH		-0.7970**		
		(0.4446)		

*, **, *** denotes significance at the 10%, 5%, and 1% levels respectively.

[a] Standard errors are in parenthesis.

Table 9. Continued

Independent Variables	Dependent Variable			
	Aware of TFF (n=114)	Participating in TFF (n=28)	Aware of PTP (n=154)	Participating in PTP (n=58)
	Coefficient		Coefficient	
EASTTENN	-0.1041 (0.1849)[a]	0.0375 (0.3399)	-0.1348 (0.1872)	-0.1335 (0.2551)
WESTTENN	-0.4444* (0.2651)	0.0101 (0.4516)	-0.3623 (0.2408)	0.7097* (0.4042)
FMRKT	-0.0275 (0.0765)		-0.0777 (0.0741)	
METRO	0.3869** 0.1757)	0.1928 (0.2971)	0.0836 (0.1753)	0.1876 (0.2504)
EDUC_EVENTS	0.1279*** 0.0460)	0.1950*** (0.0533)	0.2009*** (0.0615)	0.1496*** (0.0546)
PUBLICATIONS	0.6843*** 0.2099)	1.0208*** (0.3712)	0.4880*** (0.2149)	0.3636 (0.2715)
ρ	0.9989		0.2806	
χ^2 statistic ($H_0 : \rho = 0$)	0.3204		0.6065	
Log likelihood value	-191.4954		-238.4091	

*, **, *** denotes significance at the 10%, 5%, and 1% levels respectively.
[a] Standard errors are in parenthesis.

Table 10. Parameter Estimates from the Bivariate Probit Models for Estimating Factors Affecting Participation in Tennessee Farm Fresh and Pick Tennessee Products

Independent Variables[a]	Parameter Estimates for the Bivariate Probit Model	
	Participation Equations	
	Tennessee Farm Fresh	Pick Tennessee Products
Constant	-1.4138	-1.2286
	(1.5797)	(1.1598)
AGE	0.0072	-0.0056
	(0.0180)[b]	(0.0123)
BACH_GRAD	-0.1354	0.5639*
	(0.3725)	(0.3178)
PF_INCOME	0.2490	-0.3815
	(0.4255)	(0.3365)
VEGSIZE	0.0309**	0.0167
	(0.0146)	(0.0112)
TDS	-0.0071	-0.0022
	(0.0074)	(0.0065)
EASTTENN	-0.0238	-0.1986
	(0.4187)	(0.3344)
WESTTENN	0.2426	0.7825
	(0.5254)	(0.5024)
BENEFIT_SALES	0.0705	0.1285
	(0.1943)	(0.1434)
METRO	0.0483	0.3013
	(0.3467)	(0.3038)
EDUC_EVENTS	0.1841***	0.1485**
	(0.0612)	(0.0589)
PUBLICATIONS	0.7145*	0.2200
	(0.4217)	(0.3529)
FRESH	-0.9879**	
	(0.4851)	
Likelihood value	-81.3887	
Likelihood ratio	57.6400***	
Correlation coefficient	0.7826***	

[a] For variable definitions see Table 6.
[b] Numbers in parenthesis are standard errors.
*, **, and *** represent statistical significance at 10%, 5%, and 1% levels, respectively.

Table 11. Effect of the Independent Variables on the Conditional Probability of Participation in Tennessee Farm Fresh and Pick Tennessee Products

Independent Variables	Marginal Effects of the Bivariate Probit Model [a]		
	PART_TFF=1/ PART_PTP=1	PART_TFF=0, PART_PTP=1	PART_TFF=1, PART_PTP=1
AGE	0.0050	-0.0033	0.0011
	(0.0084)[a]	(0.0045)	(0.0036)
BACH_GRAD	-0.2170	0.2107**	0.0008
	(0.1938)	(0.1011)	(0.0774)
PF_INCOME	0.2197	-0.1756	0.0303
	(0.2024)	(0.1140)	(0.0857)
VEGSIZE	0.0109	-0.0002	0.0066**
	(0.0070)	(0.0041)	(0.0032)
TDS	-0.0029	0.0006	-0.0014
	(0.0033)	(0.0021)	(0.0015)
EASTTENN	0.0413	-0.0620	-0.0131
	(0.1978)	(0.1101)	(0.0827)
WESTTENN	-0.0581	0.2255	0.0789
	(0.2178)	(0.1821)	(0.1446)
BENEFIT_SALES	0.0011	0.0303	0.0188
	(0.0910)	(0.0495)	(0.0393)
METRO	-0.0555	0.0927	0.0219
	(0.1593)	(0.0955)	(0.0715)
EDUC_EVENTS	0.0521*	0.0155	0.0412***
	(0.0271)	(0.0195)	(0.0146)
PUBLICATIONS	0.2877	-0.0583	0.1421*
	(0.1756)	(0.1127)	(0.0832)
FRESH	-0.4841**	0.1861**	-0.1861**
	(0.1888)	(0.0769)	(0.0769)

*, **, *** denotes significance at the 10%, 5%, and 1% levels respectively.
[a] Standard errors are in parenthesis.
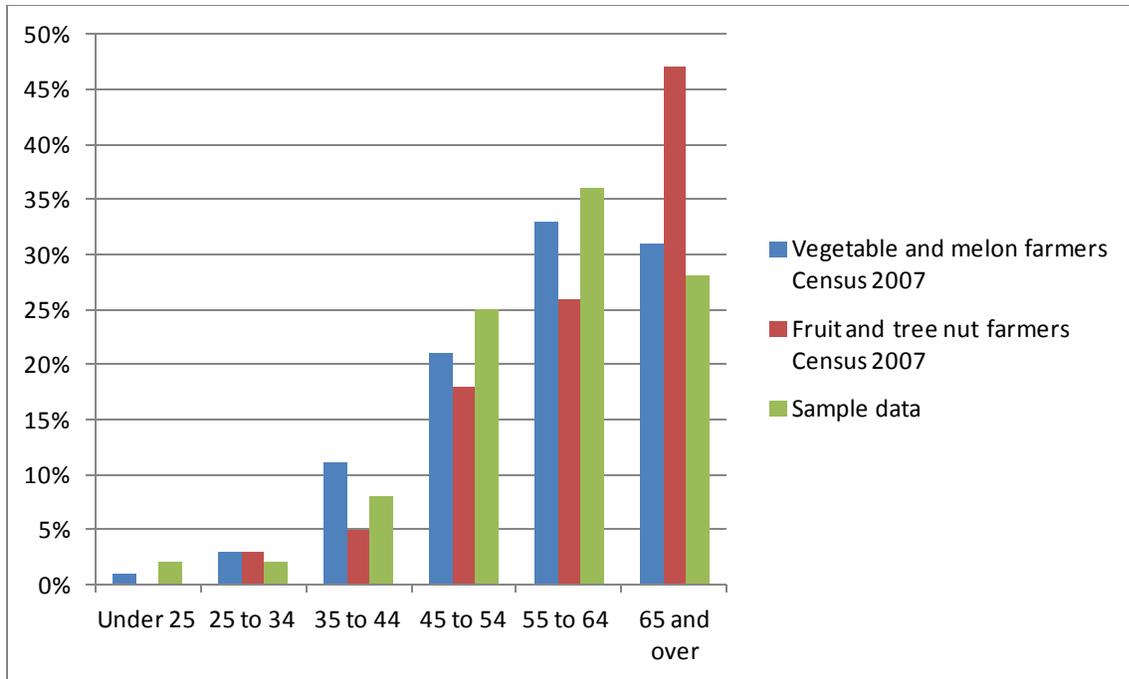
Figure 2. Age distribution of sample data compared with the 2007 Census of Agriculture

Part 4: Summary

Summary

This study evaluates the factors affecting fruit and vegetable producer awareness and participation in Tennessee's state-sponsored marketing programs, Pick Tennessee Products (PTP) and Tennessee Farm Fresh (TFF). The first essay of the thesis focuses on the factors affecting producer awareness of these programs. Univariate t-tests were used to examine differences among producers who were aware of these programs and those not aware. Producers aware of TFF and PTP tended to have a higher percentage of household income coming from farming, used more University/Extension educational tools to obtain information on how to better market produce (e.g. educational meetings, publications), sold more products in neighboring counties and elsewhere in the state, and had more acres in fruit and vegetable production than producers unaware of the programs.

A bivariate probit model was used to evaluate the impact of producer, farm, and county characteristics on awareness of TFF and PTP. It was hypothesized that the error terms between the awareness equation for TFF and PTP were correlated. The correlation coefficient between the two equations was positive and significant, therefore, the bivariate probit approach was deemed appropriate. The results from this analysis showed that the use of University/Extension publications, size of the fruit and vegetable operation, percentage of sales from direct-to-consumers outlets, and location in a metropolitan county all significantly affected awareness of the TFF program. Attendance at University/Extension education events, age, education, and percentage of income from farming were factors significantly affecting producer awareness of the PTP program.

The second essay examines factors affecting Tennessee fruit and vegetable producer participation in TFF and PTP. The first essay provided a starting point for selecting variables hypothesized to affect participation. Univariate t-tests were performed on the selected producer, farm, and county characteristics in order to examine differences between producers participating in the state marketing programs and non-participants. TFF participants tended to have larger fruit and vegetable operations, attended more University/Extension educational events and used more University/Extension publications to obtain information on how to better market their produce when compared with TFF non-participants. Producers participating in PTP tended to be more educated, have higher percentages of household income coming from farming, attended more University/Extension educational events, and used more University/Extension publications.

A bivariate probit model was used to evaluate the producer, farm, and county characteristics that affect participation in TFF and PTP. It was hypothesized that correlation existed between the error terms in the participation equations for TFF and PTP. The correlation coefficient for the two equations was positive and statistically significant which supported the hypothesis that unobserved factors affecting participation in TFF and PTP are correlated in some way, and a bivariate probit model was appropriate for this analysis. University/Extension educational events and whether the producer sold fresh fruits and vegetables had significant impact on participation in TFF, given producer participation in PTP. Factors that significantly affected the probability of participating in PTP, when not participating in TFF, were whether the producer had a bachelor's or graduate degree and whether the producer sold fresh fruits and vegetables. Size of fruit and vegetable operation, University/Extension educational events, the use of University/Extension publications, and whether the producer sold fresh fruits and

vegetables were significant factors affecting the probability of jointly participating in TFF and PTP. It is interesting to note that producers who sell fresh fruits and vegetables and participate in PTP are less likely to also participate in TFF, regardless of the fact that TFF specializes in fresh produce.

The information gained in this study makes a significant contribution to the body of literature concerning producer awareness and participation in state-sponsored marketing programs given the limited number of studies currently available (Govindasamy et al. 1998a). This information can benefit policy makers in the state of Tennessee, such as the Tennessee Department of Agriculture, as well as policy makers in other states. By identifying the profile of farmers who are aware of and are participating in these types of programs policy makers can modify programs in a way that they can increase awareness and participation, better address clientele needs, and adjust limited funding.

The findings contained in this research may also benefit University/Extension programs. The attendance of University/Extension educational events and the use of University/Extension publications to obtain information on how to better market produce were significant factors affecting both awareness and participation in TFF and PTP. These results highlight the importance of continued partnership between policy makers and University/Extension personnel in order to increase producer awareness and participation.

Further research is needed regarding consumer perceptions and preferences for produce labeled with TFF and PTP marketing logos, as well as consumer willingness to pay for products marketed through these programs to evaluate effectiveness of the programs from the consumer

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stand point. With a more complete picture of effectiveness of state-sponsored marketing

programs in Tennessee policymakers may be able to make informed decisions regarding

improvements or discontinuation of state-sponsored marketing programs.

Vita

James Andrew Davis was born in Cookeville, Tennessee on September 7, 1984, to Wayne and Tana Davis. He graduated from White County High School in Sparta, Tennessee in 2002. He attended Tennessee Technological University and received a B.S. degree in Agriculture with an area in Agribusiness Management in December, 2009. He later attended the University of Tennessee, Knoxville, where he earned a M.S. degree in Agricultural Economics in May, 2012.