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Factors Affecting Producer Participation in State-sponsored Marketing Programs: The Case of Fruit and Vegetable Growers in Tennessee

Margarita Velandia, Christopher D. Clark, Dayton M. Lambert, James A. Davis, Kimberly Jensen, Annette Wszelaki, and Michael D. Wilcox Jr.

State programs promoting their agricultural products have proliferated in response to increased consumer interest in locally grown foods. Tennessee, for example, currently has two state-funded programs promoting its agricultural products. This study examines the factors associated with participation by Tennessee fruit and vegetable farmers in those programs. The results suggest that farmer participation is associated with farm income, use of extension resources, and fresh produce sales. These results should be of interest to anyone attempting to increase producer participation in such programs.

Key Words: fruit and vegetable marketing, state-sponsored marketing program, Tennessee producer participation

Sales of locally grown foods in the United States amounted to \$4.8 billion in 2008 (Low and Vogel 2011, U.S. Department of Agriculture (USDA) 2012). Consumer demand for locally grown foods is driven by preferences for freshness, support of local economies, information about product origin, and reduced environmental impacts (Food Marketing Institute 2009).

While consumer demand for locally grown foods has increased interest in state-sponsored marketing programs, state promotion of local products actually began in the 1930s (Patterson 2006). States such as California, Maine, Florida, and Washington were first to promote state-grown farm products. Relocation of various federal programs to the states through block grants in the 1980s provided states with additional resources to create state-sponsored marketing programs promoting agricultural products grown within the state (Halloran and Martin 1989). Before 2000, less than half of U.S. states had such programs. By 2010, 46 states had established programs designed to promote their products and/or connect producers with consumers seeking local foods (Onken and Bernard 2010). Although there are differences in the approaches taken by various states, all of the programs strive to capture local consumers

Margarita Velandia, Christopher Clark, and Dayton Lambert are associate professors and Kimberly Jensen is a professor in the Department of Agricultural and Resource Economics at University of Tennessee, Knoxville. James Davis is a farm management specialist at the University of Tennessee. Annette Wszelaki is an associate professor in the Department of Plant Sciences at University of Tennessee, Knoxville, and Michael Wilcox is an assistant program leader at the Economic and Community Development Center at Purdue University. Correspondence: *Margarita Velandia* - Department of Agricultural and Resource Economics - University of Tennessee - 2621 Morgan Circle, 314C Morgan Hall - Knoxville TN 37996 - Phone 865.974.7409 - Email mvelandia@utk.edu.

The views expressed are the authors' and do not necessarily represent the policies or views of any sponsoring agencies.

and have contributed to ongoing efforts to arrive at a mutually agreeable definition of “local” foods (Hand and Stephen 2010, Nganje, Hughner, and Lee 2011).

Recently, declines in state funding for such programs have threatened their survival (Nganje, Hughner, and Lee 2011). Additionally, synergies between state-sponsored marketing program logos and national promotions of local food logos (e.g., Buy Local Buy Fresh) may affect the importance of state-sponsored marketing programs in attracting local consumers (Onken and Bernard 2010). Certification and regulation of products bearing program logos varies by state. The rigor of the certification process may determine consumers’ perceptions of locally grown food products and their willingness to purchase products identified by state-sponsored marketing program logos (Nganje, Hughner, and Lee 2011).

Previous studies have explored the effect of state-sponsored marketing programs on consumer interest in and sales of locally grown foods. Brooker and Eastwood (1989) found that consumers had positive attitudes toward state logos associated with fresh products and concluded that consumers perceived state logos as useful for identifying locally grown foods in metropolitan supermarkets. However, their study showed that only a small proportion of consumers were willing to pay a premium for products identified with the logos. Govindasamy, Italia, and Thatch (1998) evaluated consumer awareness of New Jersey’s Jersey Fresh program and found that consumers who shopped more frequently at direct marketing outlets, read food advertisements, shopped at more than one place, or had lived in New Jersey for more than five years were more likely to be aware of the program. Onken and Bernard (2010) examined consumer awareness of state branding programs. Using information from a consumer survey conducted in 2009, they found significantly higher rates of awareness among respondents in states that had established programs in the 1980s. They also observed that consumers purchased more food products labeled as “locally grown” than products labeled with the state program’s logo.

A number of studies have explored consumers’ awareness, perceptions, and opinions of state-sponsored marketing programs (e.g., Brooker and Eastwood 1989, Adelaja, Brumfield, and Lininger 1990, Govindasamy, Italia, and Thatch 1998, Patterson et al. 1999, Govindasamy et al. 2004, Carpio and Isengildina-Massa 2010, Onken and Bernard 2010, Nganje, Hughner, and Lee 2011, Onken, Bernard, and Pesek 2011). The analysis of producer participation in these programs is less extensive. Govindasamy et al. (1998) evaluated farmers’ awareness and use of Jersey Fresh logos (i.e., logos for the Jersey Fresh, Jersey Fresh Quality Grading, and Jersey Fresh Premium programs) and found that 93 percent of the survey respondents were aware of the Jersey Fresh programs while only 51 percent had used program logos. Respondents who had participated in the programs indicated that the main reason for using the logos was to differentiate locally grown products from nonlocal products.

State-sponsored Marketing Programs in Tennessee

Two state-funded programs support market development 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, in cooperation with the Tennessee Farm Bureau, created a second

program, Tennessee Farm Fresh (TFF). Both programs attempt to link producers with marketing channels for locally grown foods and educate consumers about opportunities to purchase such foods. PTP promotes all products available from Tennessee farms, farmers' markets, and other retail outlets. TFF focuses on promotion of fresh farm products grown in Tennessee, including fruit, vegetable, nursery, dairy, and some livestock products. In general, any farmer in the state can participate in PTP so long as they provide high-quality agricultural products produced in Tennessee (Tennessee Department of Agriculture 2012). Products labeled with the PTP logo must also meet or exceed U.S. government and/or Tennessee standards and regulations (Tennessee Department of Agriculture 2012). Participation in TFF is determined by the program's coordinator and a review committee. Farmers participating in the TFF program are required to produce and sell their agricultural products in Tennessee, offer consumers high-quality products at reasonable prices, and follow local regulations and best management practices in their production, processing, and marketing (Tennessee Farm Bureau 2012). The programs offer a number of similar benefits that include listing in a website directory, free marketing tools (e.g., banners, logos, price cards, and reusable bags), the right to use program logos, and advertising. They differ in two ways. TFF provides its members with free access to workshops offered through the University of Tennessee Center for Profitable Agriculture while PTP members have to pay to participate in the workshops. Additionally, there is no fee for participation in PTP, but TFF charges an annual participation fee of \$100 per farm.

Expanding markets for locally grown foods is a primary objective of many state-sponsored agricultural marketing programs. The existence of two programs in Tennessee allows us to examine how observable differences in programs relate to producer participation. For example, given that TFF was established just six years ago and PTP has been in place for 28 years, it is useful to determine if the level of farmer participation and factors that influence participation vary with program longevity. Information about the factors that influence producer participation in these programs could aid the design and dissemination of similar programs in other states and may help policymakers adjust their use of always limited and often uncertain funding to maximize interest in the programs (Patterson 2006).

Data and Methods

This study evaluates factors that influence participation in TFF and PTP by Tennessee fruit and vegetable producers who are aware of the programs to isolate factors that influence the participation decision from factors that influence awareness of the programs. Producers who are not aware of the program may decide not to participate based on the lack of information rather than an actual evaluation of the program. A recent study analyzed factors that influence awareness of the state's promotion programs among Tennessee fruit and vegetable growers (Velandia et al. 2012). The present study focuses on the participation decision because of its importance in both targeting efforts to increase producer awareness of the programs and projecting how such efforts might actually influence producer participation. Additionally, the study is focused on fruit and vegetable producers because local food farms in the United States primarily produce fresh fruits, vegetables, and nuts. According to the 2008 Agricultural Resource Management Survey conducted by the USDA

Economic Research Service (ERS), about 40 percent of vegetable, fruit, and nut farms sell their produce through local food channels while only 5 percent of all U.S. farms engage in local food sales (Low and Vogel 2011).

Data from a survey of all fruit and vegetable producers in Tennessee (1,954) identified by USDA's National Agricultural Statistics Service (NASS) in 2010 were used in this study. The survey, a cover letter explaining the importance and intentions of the survey, and a postage-paid return envelope were mailed to the producers on February 2, 2011, and reminder postcards were sent two weeks later. On March 24, a second wave of surveys was mailed to producers who had not yet responded. Of the 1,954 surveys mailed, 587 were completed and returned, resulting in a response rate of 30 percent. After respondents who, by the time of the survey, were not producing or selling fruits and vegetables (78) and producers who were not aware of at least one of the state-sponsored marketing programs (343) were eliminated, 166 observations were available for analysis. An additional 41 observations were eliminated due to missing records, leaving a sample of 125 respondents. Although the sample represented only 25 percent of the total sample of producers currently growing fruits and vegetables for sale (509), it is important to emphasize that the target population of this study is only Tennessee fruit and vegetable producers who were aware of both programs.

Since the analysis focuses only on producers who were aware of both programs, respondent self-selection is a potential concern. However, sample selection bias is only of concern once the target population is identified (Wooldridge 2002). Since the target population of this study is a subset of fruit and vegetable producers, we specify a model for that subset of the population (Wooldridge 2002). No information was available on the number of fruit and vegetable producers who were aware of both programs so we estimated the number using survey responses. Of the 485 respondents who answered both questions concerning awareness of PTP and TFF, 166 (34 percent) indicated that they were aware of both programs. Using a proportion estimator suggested by Lohr (1999), we could thus estimate a confidence interval of the number of Tennessee fruit and vegetable producers aware of both PTP and TFF. The actual percentage is bounded between 30 percent and 39 percent (between 586 and 762 producers) with a 95 percent probability. Consequently, the data set used in this analysis represents between 16 percent and 21 percent of the target population.

The survey included questions about marketing outlets for fruits and vegetables, how producers defined "local" markets, marketing barriers they faced, farmer and farm business characteristics, and their awareness of and participation in Tennessee's state-sponsored marketing programs. A metropolitan county indicator from USDA's Food Environmental Atlas (ERS 2011) was merged into the survey data and included in the analysis. The metropolitan county indicators are based on definitions of metropolitan and nonmetropolitan areas by the U.S. Census Bureau Office of Management and Budget (2010).

Producers who indicated that they were aware of either the TFF or PTP program were asked if they participated in that program. Of the 125 respondents who were aware of both programs, 25 (20 percent) participated in the TFF program, representing about 36 percent of the 69 fruit and vegetable growers participating in the program (Tennessee Farm Bureau 2012). Forty-five producers (36 percent) participated in the PTP program, representing

about 11 percent of the 398 fruit and vegetable growers participating in the program (Tennessee Department of Agriculture 2012). Finally, 22 respondents (18 percent) participated in both programs, representing about 46 percent of the 48 fruit and vegetable producers participating in both programs (Tennessee Farm Bureau 2012, Tennessee Department of Agriculture 2012).

Conceptual Model for Understanding Participation in the TFF and PTP Programs

Fruit and vegetable producers are assumed to be rational decision-makers who maximize discounted expected profits from farming. Uncertainty about future income from fruit and vegetable production may encourage producers to consider alternative marketing strategies, such as participation in state-sponsored marketing programs. Thus, choosing to participate in such programs may represent an effort to boost profits through increased farm sales and gain access to price premiums. Producers may also perceive participation in these programs as an opportunity to contribute to their communities by providing consumers with access to locally grown foods (Govindasamy et al. 1998).

Let $E[U(\pi_m)](E[U(\pi_0)])$ be the expected utility of profit (π) from participating (not participating) in state-sponsored marketing program m . Defining $U_m^* = E[U(\pi_m)] - E[U(\pi_0)]$, utility-maximizing producer i participates in program m if U_m^* is greater than zero. The unobserved latent variable U_m^* is hypothesized to be a random function of observable exogenous variables (\mathbf{x}_{im}) such that

$$(1) \quad U_{im}^* = \beta'_m \mathbf{x}_{im} + \varepsilon_{im} \quad \text{for } m = \text{TFF, PTP}$$

where \mathbf{x}_{im} is a vector of observed producer, farm, and region characteristics; β_m is a vector of unknown parameters associated with these variables; and ε_{im} is an error term.

While U_m^* is an unobservable latent variable, the decision to participate in a state program is observable:

$$(2) \quad y_{im} = \begin{cases} 1 & \text{if } U_{im}^* > 0 \\ 0 & \text{if } U_{im}^* \leq 0 \end{cases} \quad \text{for } m = \text{TFF, PTP}$$

where y_{im} equals one if producer i participates in state program m and equals zero otherwise. This identity provides an empirically tractable approach to estimating factors that influence participation in TFF and PTP.

Estimation Methods

Participation in state-sponsored marketing programs is hypothesized to be a function of the observable exogenous variables represented in equation 1. The error terms in the participation equations are assumed to be normally distributed with a constant variance. Correlation between the disturbances would imply that there are unobservable factors jointly determining participation in TFF and PTP. The two programs are similar in that both were created to link producers with consumers who are interested in locally grown foods and provide many of the same services. Thus, it seems likely that many of the unobserved factors influencing participation in one program will influence participation in the other. If unobserved variables influencing participation in

both programs are correlated, individual probit regressions evaluating factors that affect participation in TFF and PTP could produce biased estimates of the participation probabilities and imprecise estimates of the parameter standard errors (Kiefer 1982). We thus use a bivariate probit regression estimated using a quasi-maximum likelihood procedure (Cameron and Trivedi 2005) to model this relationship. Heteroskedastic robust standard errors are estimated using the sandwich covariance estimator proposed by Huber (1967) and White (1980).

The joint probability of participating in both programs ($y_{itff} = 1$ and $y_{iptp} = 1$) is

$$(3) \quad \Phi_{y_{itff}=1, y_{iptp}=1} = \text{Prob}(y_{itff} = 1, y_{iptp} = 1 \mid \mathbf{x}_{itff}, \mathbf{x}_{iptp}) = \Phi(\beta'_{itff} \mathbf{x}_{itff}, \beta'_{iptp} \mathbf{x}_{iptp}, \rho),$$

and the joint probability of not participating in either program is

$$(4) \quad \Phi_{y_{itff}=0, y_{iptp}=0} = \text{Prob}(y_{itff} = 0, y_{iptp} = 0 \mid \mathbf{x}_{itff}, \mathbf{x}_{iptp}) = \Phi(-\beta'_{itff} \mathbf{x}_{itff}, -\beta'_{iptp} \mathbf{x}_{iptp}, \rho).$$

In the model, ρ represents correlation between the disturbances of the participation equations (1) and Φ is the standard normal cumulative distribution function. The marginal probability of participating in either TFF or PTP is

$$(5) \quad \Phi_{y_{im}=1} = \text{Prob}(y_{im} = 1 \mid \mathbf{x}_{im}) = \Phi(\mathbf{x}'_{im} \beta_m) \quad \text{for } m = \text{TFF, PTP}.$$

Marginal effects are estimated according to the bivariate structure of the model (Christofides, Stengos, and Swidinsky 1997). The marginal effects of continuous variables can be evaluated for any of the probabilities previously defined and are calculated for the joint probability of participation as

$$(6) \quad \frac{\partial \Phi_{y_{itff}=1, y_{iptp}=1}}{\partial x_k} = \frac{\partial \Phi(\beta'_{itff} \mathbf{x}_{itff}, \beta'_{iptp} \mathbf{x}_{iptp}, \rho)}{\partial x_k} \\ = \Phi_{y_{iptp}=1 \mid y_{itff}=1} \phi_{y_{itff}=1} \beta_{itffk} + \Phi_{y_{itff}=1 \mid y_{iptp}=1} \phi_{y_{iptp}=1} \beta_{iptpk}$$

where the first term in equation 6 is the effect of a one-unit increase in the variable x_k on the probability of participating in TFF weighted by the probability of participating in PTP given participation in TFF. The second term is the effect of an increase in the variable x_k on the probability of participating in PTP weighted by the probability of participating in TFF given participation in PTP (Christofides, Stengos, and Swidinsky 1997).

Similar to the univariate probit model, the effect of x_k on the marginal probability of participating in TFF or PTP is

$$(7) \quad \frac{\partial \Phi_{y_{im}=1}}{\partial x_k} = \phi(\beta'_m \mathbf{x}_{im}) \beta_{mk} \quad \text{for } m = \text{TFF, PTP}.$$

Equality between Coefficients and Marginal Effects of Participation Equations

Potential differences in characteristics of farmers attracted by the PTP program and farmers attracted by the TFF program are evaluated. No differences identified between the two farmer groups suggest that there is potential for coordination of the programs' efforts to attract fruit and vegetable producers. Wald tests were used in this study to determine whether the parameters and marginal effects in each equation are not different (Wooldridge 2002).

Empirical Model

Descriptions of the variables included in the participation equations are presented in Table 1. Producer characteristics hypothesized to affect participation are respondent age (*AGE*), whether the respondents attained a bachelor's or graduate degree (*BACH_GRAD*), whether the respondents earned less than 25 percent of their incomes from farming (*PF_INCOME*), and the number of University Extension events related to produce marketing strategies attended in the preceding five years (*EDUC_EVENTS*).

Age is hypothesized to be negatively associated with use of state logo programs. Older producers tend to have shorter planning horizons (Govindasamy et al. 1998, Govindasamy, Italia, and Thatch 2000) and thus may be less likely to participate in programs that offer alternatives to their current marketing efforts. We therefore expect that younger farmers are more likely to participate in state-sponsored marketing programs. Education is expected to be positively correlated with participation in marketing programs. Prior research has found that producers who have more than a high school education were more likely to participate in state-sponsored marketing programs (Govindasamy et al. 1998, Govindasamy, Italia, and Thatch 2000). Other studies suggested that farmers who marketed produce directly to consumers generally had more years of formal education than farmers who did not, perhaps because those marketing channels require additional skills and abilities beyond what is needed for management of an agricultural operation (Uva 2002, Hunt 2007, Uematsu and Mishra 2011). Given that producers who were participating in state-sponsored

Table 1. Definitions and Descriptive Statistics of the Variables

| Variable | Description | Mean | Std. Dev. |
|-----------------------|--|---------|-----------|
| Dependent Variables | | | |
| <i>PART_TFF</i> | Equals 1 if participating in Tennessee Farm Fresh and 0 otherwise | 0.2000 | 0.4016 |
| <i>PART_PTP</i> | Equals 1 if participating in Pick Tennessee Products and 0 otherwise | 0.3600 | 0.4819 |
| Independent Variables | | | |
| <i>AGE</i> | Age in years | 59.5760 | 11.9489 |
| <i>BACH_GRAD</i> | Equals 1 if attained bachelor's or graduate degree | 0.5680 | 0.4973 |
| <i>PF_INCOME</i> | Equals 1 if less than 25 percent of household income comes from farming | 0.5520 | 0.4993 |
| <i>VEGSIZE</i> | Size of fruit and vegetable operation in acres | 19.5760 | 53.7615 |
| <i>PERCFRESH</i> | Percent of 2010 gross annual sales from fresh fruits and vegetables | 0.5224 | 0.4112 |
| <i>METRO</i> | Equals 1 if primary farming operation is located in a metropolitan county and 0 otherwise | 0.5200 | 0.5016 |
| <i>EDUC_EVENTS</i> | Number of educational events related to fruit and vegetable marketing attended in preceding five years | 2.2320 | 2.9379 |

Note: n = 125

marketing programs were more likely to use direct-to-consumer outlets (Govindasamy et al. 1998), they are expected to be relatively more educated than those not participating in the programs.

The percentage of household income from farming is hypothesized to be positively correlated with participation in both programs because households that depend more on income from farming are likely to be willing and able to devote more time to implementing new marketing strategies (Velandia et al. 2012). Marketing local foods may be more time-intensive than other sales strategies. Also, a larger percentage of income from farming may be related to a higher probability of participating in programs promoting local foods (D'Souza, Cyphers, and Phipps 1993). Velandia et al. (2012) found that fruit and vegetable producers who earned 25 percent or less of their incomes from farming were less likely to be aware of Tennessee's marketing programs. We expect these producers may also be less likely to participate in the programs even when they are aware of them.

Attendance at extension educational events is hypothesized to affect the likelihood of a farmer participating in TFF and PTP. Information plays a key role in adoption of new management practices, including marketing. Extension services can also be an effective tool for delivering information needed by farmers to make informed decisions about new marketing strategies (Nowak 1987, Knowler and Bradshaw 2007). Velandia et al. (2012) found that fruit and vegetable producers who had attended a relatively large number of such educational events were more likely to be aware of TFF and PTP. Therefore, it is expected that farmer attendance may be correlated with participation in the programs. Nonetheless, there is no *a priori* hypothesis regarding the relationship between participation and attendance at such events because participation and nonparticipation are both potentially informed decisions.

Characteristics of producers' farming operations included in the analysis are size of the fruit and vegetable operation in acres (*VEGFSIZE*) and the percentage of the farms' annual gross sales from fresh fruits and vegetables (*PERCFRESH*). Some studies have suggested that the number of acres farmed is negatively correlated with participation in state-sponsored marketing programs (Govindasamy et al. 1998) while others found that adoption of new marketing strategies was not influenced by operation scale (D'Souza, Cyphers, and Phipps 1993). Thus, there is no *a priori* hypothesis regarding the association between participation and size of the fruit and vegetable operation. The percentage of annual gross sales from fresh fruits and vegetables is hypothesized to be positively correlated with participation in TFF and PTP. Previous research has suggested that farms that market locally grown foods mainly sell fresh fruits and vegetables (Low and Vogel 2011). Given that the main objectives of TFF and PTP are to link producers to marketing channels for locally grown foods and to inform consumers about opportunities to purchase such foods, it is expected that farms with a larger percentage of sales from fresh fruits and vegetables are more likely to participate in Tennessee's state-sponsored marketing programs.

Location differences are identified by a binary variable that indicates whether the primary farming operation was located in a metropolitan county (*METRO*). Producers who have farming operations located primarily in metropolitan counties are expected to be more likely to participate in TFF and PTP. They are hypothesized to be more likely to rely on urban markets, where price premiums may be higher. Urban consumers may also be more likely to look for the freshness and quality aspects of foods highlighted by the state-sponsored

programs (Govindasamy, Italia, and Thatch 2000). Previous research also has suggested that more than half of the farms that sold local foods were located in metropolitan counties (Low and Vogel 2011). Finally, in some cases, the impact of participation in educational events associated with state-sponsored marketing programs and the impact of use of program logos on producer sales were different for rural and urban businesses (Malaga, Xu, and Martinez-Mejia 2011).

Results and Discussion

Sample Overview and Descriptive Statistics

The average age of respondents in the analysis was 60 years, which is similar to the average age of farmers in Tennessee according to the *2007 Census of Agriculture* (NASS 2007). Approximately 57 percent of the respondents had attained either a bachelor's or a graduate degree and 55 percent reported that less than 25 percent of their household incomes came from farming. Over the preceding five years, respondents had attended an average of 2.2 extension educational events related to marketing strategies for produce. The average size of fruit and vegetable operations was about 20 acres. Approximately 52 percent of the average farm annual sales came from fresh fruits and vegetables, and 52 percent of the respondents had fruit and vegetable operations located in metropolitan counties.

Among respondents who were aware of the programs, 36 percent participated in PTP and 20 percent participated in TFF. Respondents who were aware of the programs but had chosen not to participate were asked to provide the primary reason for not participating. A summary of the responses to this open-ended question, grouped into five categories, is presented in Table 2. The three most common responses were (i) not having enough information about the programs, (ii) having a small farm or not producing enough volume to benefit from the programs, and (iii) not perceiving any benefits from participation. About 18 percent of the farmers who chose not to participate in TFF felt that the participation fee of \$100 was too high.

Respondents participating in at least one of the programs were asked whether participation had led to increased sales, a price premium, and/or access to new markets (Table 3). A larger percentage of TFF participants (80 percent) than PTP participants (60 percent) believed that participation had led to increased sales. About half of the participants in each program believed that they had

Table 2. Respondent Reasons for Not Participating in PTP and TFF

| Reason | Percent of Farmers Per Program | |
|--|--------------------------------|-----|
| | TFF | PTP |
| Not enough information about the program | 20 | 29 |
| Lack of time to sign up | 17 | 22 |
| Too small / do not produce enough | 22 | 24 |
| Do not think it provides any benefits | 23 | 24 |
| Participation fee | 18 | — |

Note: The number of farmers who were aware of both programs was 125.

Table 3. Benefits Received from Participating in PTP and TFF

| Benefit | Percent of Farmers Per Program | |
|---|--------------------------------|---------------|
| | TFF n = 25 | PTP n = 45 |
| Increased sales | 80 | 60** |
| A premium over usual prices | 16 | 13 |
| Access to new markets | 48 | 49 |
| I do not think I have received any benefits | 12 | 18 |

Notes: Percentages do not add to 100 percent since each respondent could select more than one option. *, **, and *** denote significance at a 10 percent, 5 percent, and 1 percent level respectively based on proportion difference tests.

gained access to new markets. Less than one in five participants believed that participation had resulted in a price premium. Slightly more TFF participants (16 percent) believed that they had received this benefit than PTP participants (13 percent), but the difference was not statistically significant at a 10 percent level. Eighteen percent of PTP participants and 12 percent of TFF participants felt that they had received no benefit from participation in the programs.

The higher level of participation in PTP may be related to its longer tenure; it was established in 1986 while TFF was established less than ten years ago (in 2008). This result is consistent with Onken and Bernard (2010), which found that there was significantly greater awareness among consumers of programs established in the 1980s and possibly greater rates of participation among producers. The annual fee charged by TFF may also play a role.

We partitioned means for responses for the variables representing operator, farm, and regional characteristics of respondents who were aware of both programs by program participation and report those results in Table 4. Means were compared using t-tests for continuous variables and proportional difference tests for binary variables. On average, respondents who participated

Table 4. Means of Responses for Farmers Who Were Aware of Both Programs by Program Participation

| Independent Variable | TFF | | PTP | | Both Programs | |
|----------------------|-------------------------------|--------------------------|------------------------------|--------------------------|-------------------------------|--------------------------|
| | Do Not Participate n = 100 | Do Participate n = 25 | Do Not Participate n = 80 | Do Participate n = 45 | Do Not Participate n = 103 | Do Participate n = 22 |
| AGE | 59.78 | 58.76 | 60.49 | 57.96 | 59.71 | 58.95 |
| BACH_GRAD | 0.56 | 0.60 | 0.55 | 0.60 | 0.56 | 0.59 |
| PF_INCOME | 0.59 | 0.40** | 0.68 | 0.33*** | 0.60 | 0.32*** |
| VEG_SIZE | 17.57 | 27.62 | 15.64 | 26.57 | 17.17 | 30.82 |
| PERCFRESH | 0.49 | 0.66** | 0.44 | 0.67*** | 0.48 | 0.70** |
| METRO | 0.51 | 0.56 | 0.46 | 0.62** | 0.50 | 0.59 |
| EDUC_EVENTS | 1.54 | 5.00*** | 1.41 | 3.69*** | 1.60 | 5.18*** |

Notes: For variable definitions, see Table 1. *, **, and *** denote significance at a 10 percent, 5 percent, and 1 percent level respectively based on t-tests and proportional difference tests.

in one or both programs were (i) less likely to have obtained less than 25 percent of household income from farming, (ii) had a larger percentage of average annual farm sales originating from fresh fruits and vegetables, and (iii) attended more extension events related to fruit and vegetable marketing in the preceding five years. This finding supports the hypothesis that respondents with more income from farming, a larger stake in fresh fruits and vegetables, and greater attendance at educational events are more likely to participate in TFF and PTP to improve their marketing strategies. Respondents who participated in PTP were more likely to live in a metropolitan county than nonparticipants. Similar to producers who were likely to participate, those who were aware of the programs tended to earn more than 25 percent of their household incomes from farming, live in a metropolitan county, and attend more educational events.

Bivariate Probit Estimation

The results of the bivariate probit regression are presented in Table 5. The correlation coefficient between the residuals for the TFF and PTP equations was positive and significant at the 1 percent level, suggesting that the error terms

Table 5. Bivariate Probit Parameter Estimates

| Independent Variable | Parameter Estimates for the Bivariate Probit Model Participation Equations | |
|-------------------------|---|--------------------------|
| | Tennessee Farm Fresh | Pick Tennessee Products |
| Constant | -1.9386* (1.096) | -0.8812 (0.6638) |
| AGE | -0.0032 (0.0145) | -0.0081 (0.0088) |
| BACH_GRAD | 0.2489 (0.3041) | 0.5015* (0.2906) |
| PF_INCOME | 0.0253 (0.3090) | -0.7724***** (0.2831) |
| VEG_SIZE | 0.0026 (0.0019) | 0.0019 (0.0022) |
| PERCFRESH | 0.0080** (0.0038) | 0.0107*** (0.0034) |
| METRO | -0.0919 (0.2894) | 0.2109 (0.2618) |
| EDUC_EVENTS | 0.2301*** (0.0522) | 0.1610*** (0.0412) |
| Number of observations | 125 | |
| Likelihood value | -98.0974 | |
| Wald χ^2 (14) | 62.8400*** | |
| Correlation coefficient | 0.8010*** | |

Notes: Numbers in parentheses are robust standard errors. *, **, and *** represent statistical significance at a 10 percent, 5 percent, and 1 percent level, respectively. †, ††, and ††† represent parameters from the PTP participation equation that are statistically significantly different from the parameters of the TFF participation equation at a 10 percent, 5 percent, and 1 percent level, respectively.

in the equations are correlated (Table 5). A likelihood ratio test to evaluate the null hypothesis that all of the estimated parameters equal zero was rejected at the 1 percent level.

Table 6 presents results for the marginal effects for the joint probability of participating in both programs, the joint probability of not participating in either program, and the marginal probability of participating in either PTP or TFF. Other marginal effects, such as the probability of participating in TFF but not PTP ($\Pr(y_{itff} = 1, y_{iptp} = 0 \mid x_{i1}, x_{i2})$), are not discussed because of the absence of significant marginal effects due to lack of variation in the sample. The joint probability of not participating in either program is reported because about 62 percent of the sample (77 of 125 observations) did not participate in either program. The percentage of annual gross farm sales from fresh fruits and vegetables (*PERCFRESH*) and the number of extension events related to fruit and vegetable marketing attended (*EDUC_EVENTS*) were positively correlated with the joint probability of participating in TFF and PTP. A 1 percent increase in the percentage of farm sales from fresh fruits and vegetables increased the likelihood of participating in both programs by about 0.2 percent. Attendance at an additional educational event increased the likelihood of participating in both TFF and PTP by 5 percent. The correlation between use of University Extension resources such as educational events and program participation was expected given that those services are an important source of information

Table 6. Marginal Effects on Participation Probabilities from the Bivariate Probit Model

| | Both Programs | Neither Program | PTP Only | TFF Only |
|-----------------------|-----------------------|------------------------|------------------------|-----------------------|
| <i>AGE</i> | -0.0009 (0.0027) | 0.0027 (0.0032) | -0.0029 (0.0032) | -0.0008 (0.0034) |
| <i>BACH_GRAD</i> | 0.0658 (0.0603) | -0.1735* (0.0999) | 0.1815* (0.1045) | 0.0578 (0.0711) |
| <i>PF_INCOME</i> | -0.0308 (0.0610) | 0.2428** (0.1008) | -0.2795*** (0.1028) | 0.0059** (0.0718) |
| <i>VEG_SIZE</i> | 0.0005 (0.0004) | -0.0008 (0.0008) | 0.0007 (0.0008) | 0.0006 (0.0005) |
| <i>PERCFRESH</i> | 0.0019*** (0.0007) | -0.0039*** (0.0012) | 0.0039*** (0.0012) | 0.0019** (0.0008) |
| <i>METRO</i> | -0.0063 (0.0563) | -0.0612 (0.0930) | 0.0763 (0.0949) | -0.0214 (0.0676) |
| <i>EDUC_EVENTS</i> | 0.0471*** (0.0119) | -0.0646*** (0.0151) | 0.0583*** (0.0148) | 0.0535*** (0.0136) |
| Predicted Probability | 0.1314 | 0.6528 | 0.3294 | 0.1492 |

Notes: Numbers in parentheses are robust standard errors. *, **, and *** represent statistical significance at a 10 percent, 5 percent, and 1 percent level, respectively. +, **, and *** represent marginal effects from the PTP marginal probability equation that are statistically significantly different from the marginal effects of the TFF participation marginal probability equation at a 10 percent, 5 percent, and 1 percent level, respectively.

for farmers seeking new marketing opportunities (Nowak 1987, Knowler and Bradshaw 2007). Consistent with these results, the percentage of farm sales from fresh fruits and vegetables and the number of extension events attended were negatively correlated with the likelihood of not participating in either program. Additionally, producers who earned 25 percent or less of their incomes from farming were 24 percent more likely to not participate in either program while those with at least a bachelor's degree were 17 percent less likely to forgo participation in both programs.

The marginal effects associated with the likelihood of participating in only one program were also evaluated. Producers who had a bachelor's or graduate degree, a larger percentage of farm sales from fresh fruits and vegetables, or attended more educational events were more likely to participate in the PTP program. In contrast, producers who earned 25 percent or less of their incomes from farming were 28 percent less likely to participate in PTP. These results support the hypothesis that marketing produce as local is more time-intensive than other sales strategies, and, as a result, producers who earn a relatively smaller percentage of their incomes from farming are less likely to participate in programs promoting local foods. Producer attendance at one additional extension educational event increased the probability of participating in PTP by 6 percent. Finally, producers who had bachelor's or graduate degrees were 18 percent more likely to participate in PTP. A 1 percent increase in the percentage of farm sales from fresh fruits and vegetables increased the likelihood of participation in TFF by 0.2 percent, while attendance at an additional extension event increased the likelihood by 5 percent.

Equality between coefficients of the two participation equations and their relevant marginal effects was tested using Wald tests. The null hypothesis that the parameters of the PTP and TFF equations were equal was not rejected. Wald tests for the individual parameters indicated that the parameter associated with percentage of income from farming for the TFF participation equation was significantly different from the parameter for the same variable for the PTP participation equation at the 1 percent level. However, this result is not relevant since the marginal effect of the percentage of income from farming on the probability of participating in TFF was not statistically significant.

Since the marginal effects for attendance at educational events were highly significant in all cases, we estimated changes in predicted probabilities for different levels of attendance at educational events (Table 7). Given a baseline of attending no events, attending a single educational event increases the probability of participating in both programs and the probability of participating in PTP by 3 percent; attending three events instead of two increases the probability of participation in both programs and the probability of participating in PTP by about 4 percent. The marginal effect of attending one more educational event does not appear to diminish through attendance at three or four events, which suggests that some producers initially may doubt the value of participating in both programs or of participating in PTP only and need to accumulate information over time before they choose to participate. For the TFF program, on the other hand, attendance at educational events results in no change in participation, suggesting that, for the TFF program, additional information obtained through attendance at educational events may not change the likelihood of participation.

Table 7. Predicted Probabilities from the Bivariate Probit Model at Different Levels of Attendance at Educational Events

| | Both Programs | Neither Program | PTP Only | TFF Only |
|-------------------------|-----------------------|------------------------|-----------------------|-----------------------|
| Predicted Probabilities | | | | |
| <i>EDUC_EVENTS</i> = 0 | 0.0629*** (0.0219) | 0.7365*** (0.0458) | 0.2544*** (0.0454) | 0.0719*** (0.0248) |
| <i>EDUC_EVENTS</i> = 1 | 0.0927*** (0.0251) | 0.6871*** (0.0427) | 0.2989*** (0.0419) | 0.1065*** (0.0279) |
| <i>EDUC_EVENTS</i> = 2 | 0.1314*** (0.0289) | 0.6329** (0.0412) | 0.3467*** (0.0397) | 0.1518*** (0.0316) |
| <i>EDUC_EVENTS</i> = 3 | 0.1797*** (0.0349) | 0.5746*** (0.0432) | 0.3969*** (0.0406) | 0.2082*** (0.0384) |
| <i>EDUC_EVENTS</i> = 4 | 0.2371*** (0.0445) | 0.5129*** (0.0491) | 0.4488*** (0.0452) | 0.2755*** (0.0499) |
| <i>EDUC_EVENTS</i> = 5 | 0.3026*** (0.0575) | 0.4491*** (0.0574) | 0.5016*** (0.0527) | 0.3519*** (0.0659) |

Notes: Numbers in parentheses are robust standard errors. *, **, and *** represent statistical significance at a 10 percent, 5 percent, and 1 percent level, respectively.

Conclusions

Federal and state agencies have implemented a variety of programs to increase the supply of locally grown foods as they have become increasingly popular among consumers. Tennessee currently has two state-funded programs to support and develop markets for Tennessee-grown products: Tennessee Farm Fresh (TFF) and Pick Tennessee Products (PTP). This study used a bivariate probit regression to analyze the effect of producer and farm characteristics on participation in TFF and PTP by farmers who were aware of the programs.

The percentage of farm sales from fresh fruits and vegetables and attendance at extension educational events were correlated with the decision to participate in both programs. Some producers who chose not to participate in either program perceived the programs as relevant primarily for larger operations. This perception may be based on limited knowledge of the programs' purpose. Some producers who were aware of TFF and PTP but had chosen not to participate reported that they felt that they did not have enough information about the programs to understand how they could benefit from them. The positive association between attendance at the events and program participation suggests that the events help producers better understand the benefits. Furthermore, the impact of attendance at extension educational events on the probability of participation in both PTP and TFF is actually greater when producers had already attended more than one event in the preceding five years. This result further illustrates the importance of extension education in increasing awareness of and participation in both programs (with a larger impact on PTP).

The agencies and institutions that sponsor such programs may benefit from evaluating their efforts to promote the programs among producers since a

significant number of respondents in this study reported being aware of the programs' existence but not well-informed about the services they provide. Currently, efforts to increase awareness and participation among farmers are focused on television commercials, printed ads, news media reports, and websites, all of which are likely to indirectly increase awareness (Tennessee Farm Bureau 2012, Tennessee Department of Agriculture 2012). In addition, representatives of the PTP program have attended producer trainings and given farmers an opportunity to sign up for the programs onsite. Sponsoring organizations might consider collaborating with extension in efforts to increase participation in the marketing programs but might also explore alternative information channels for producers who do not rely on the extension programs to obtain marketing information. There is a considerable amount of overlap between PTP and TFF. Those commonalities could be leveraged to increase participation in a single, more general program promoting locally grown foods in Tennessee.

Farm and farmer characteristics did not affect the probability of participating in PTP and TFF differently. This result suggests that the two programs attract a similar type of fruit and vegetable producer so there is potential for successful coordination of program efforts to increase the awareness and participation of producers.

A limitation of this research was the relatively small sample size available for analysis, which limits the generalizability of the findings. Only about 34 percent of the respondents who answered the question regarding awareness were aware of both programs and qualified for the analysis. Thus, the low level of awareness in part explains the relatively small sample. However, note that this study captures about 35 percent of the fruit and vegetable farmers who were participating in TFF but only about 11 percent of the fruit and vegetable producers participating in PTP.

Fruit and vegetable farmers are eight times more likely than other farmers to sell their produce through local food outlets. However, the programs evaluated in this study also promote livestock and dairy products, and PTP promotes food processing as well. An expansion of this analysis to other enterprises would more fully identify the types of producers who most benefit from the programs.

Finally, further research is needed regarding consumers' perceptions and preferences for produce labeled with TFF and PTP logos and their willingness to pay for products marketed through the programs. With a more complete picture of the effectiveness of state-sponsored marketing programs, policymakers could make better-informed decisions regarding improvement and perhaps even a merger of the Tennessee programs.

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