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The Use of Wireless Capability at Farmers Markets: Results from a Choice Experiment Study

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1. Introduction

Farmers' markets popularity has risen significantly over recent years. In fact, the number of farmers markets went from 1,755 in 1994 to 7,864 in 2012, an increase of 348% (U.S. Department of Agriculture, Agricultural Marketing Service 2013). Mirroring the rapid growth in farmers' market statistics nationally, in Washington State, sales at farmers markets have increased from $5 million total annual gross sales in 1997 to an estimated $50 million in 2010 (Washington Farmers Markets Association, 2013). Farmers' markets constitute an important sales outlet for U.S. agricultural producers. These markets are increasingly critical to the survival of small and mid-sized specialty crop farmers who consider direct marketing as their most feasible outlet and a means of capturing higher returns (Detre et al. 2011). In addition, economic and social factors are behind the increased consumer participation at farmers' markets (Varner and Otto, 2007). Among these reasons the preeminent is the consumers' perception that locally produced food is generally of a higher quality (Conner et al, 2010; Carpio and Isengildina-Massa, 2009; Brown and Miller, 2008; Ostrom and Jussaume, 2007; Zepeda & Leviten-Reid, 2004; Govindasamy et al, 2000; Murdoch et al, 2000).

At most markets, purchases are made in cash. Research with market customers found that running out of cash is one of the biggest reasons for limiting market purchases (Lev and Stephenson, 2001). In addition, basic food benefits such as the Supplemental Nutrition Assistance Program (SNAP) cannot be accepted at farmers' markets without electronic benefit transfer (EBT) technology. SNAP is the largest nutritional assistance program funded by the U.S. Department of Agriculture Food and Nutrition Service. Participation at SNAP is at historic high levels. In 2012, 47 million Americans participated in SNAP at a cost of $75 billion dollars (Gregory et al., 2013). Having an EBT system that enables the redemption of SNAP would help

farmers' markets tap into a larger customer base and realize increased sales. In most instances SNAP users face limitations to access to healthy food retailers (Andrews et al, 2013). Enabling SNAP at farmers markets could help alleviate such limitations. Compared to 2008, the total value of SNAP redemptions at farmers markets and farm stands doubled from $2 million to $4 million. This amount is negligible compared to the total amount of redemptions at $50 billion. However, is an indication of the growth potential for farmers' markets to increase their share of SNAP dollars by having EBT technology available at the market (Wasserman et al, 2010)?

In WA State the legislature passed the 2008 Local Farms Healthy Kids Act, with the goal of strengthening the connections between the state's agricultural industry and the state's food procurement procedures and expand local agricultural markets, improve the nutrition of children and other at-risk consumers, and have a positive impact on the environment. As a result, the 2009 Farmers Market Technology Improvement Pilot project was established to increase access to fresh fruits, vegetables, quality meat, and dairy for WA residents and to increase the number of SNAP recipients at farmers markets. This pilot project assisted twenty WA farmers markets in developing the capability to accept wireless electronic payment cards, including EBT. Introducing this capability at farmers markets, with this project, increased sales by approximately 10% or by about $15,786 per market, per season (Ordóñez, 2010).

This study is part of a larger project aimed to increase high-value specialty crop sales through farmers' markets and assess the economic potential of EBT and credit card capability and is a continuation of the Farmers' Market Technology Improvement Pilot, explained above. In this study, we assess the economic value of current EBT/credit/debit technologies for WA farmers' market managers, vendors, and customers participating in the 2011 WA wireless program. We hope that the findings in this study will help policy makers and wireless machine

providers to improve facilitating this technology to farmers markets. In addition, this study will show evidence if consumers would be willing to pay premium prices at farmers' markets where this technology is available. Note that we focus in consumers in general, not necessarily SNAP users. We use three survey tools targeting managers, vendors, and customers. Each survey included a discrete choice experiment in which we elicit managers' and vendors' perceived values for wireless machine attributes, and customers' perceived values for farmers' market features, including wireless capacity.

In this study, the implementation of the EBT and credit card capability at farmers markets consisted of having the market sell tokens to customers, typically at the manager's booth. These tokens were different across types of transaction (e.g., credit, debit, EBT) and across markets. Customers bought a specific amount of tokens with their credit/debit/EBT card, then spent tokens at vendors' booths. Vendors turned in their tokens to the market manager for reimbursement. Then, market managers counted tokens and reimbursed vendors. Under this arrangement, during the 2011 season, 17 participating farmers markets amounted $285,211 in additional to cash sales, with 8,250 transactions including credit, debit, and EBT. Credit card transactions represented 57% ($162, 487), debit card 25% ($70,092), and EBT 12% ($33,438) of the total amount of sales during the season (Ordóñez et al., 2012). The project assisted participating markets by providing the wireless machine whose costs included the cost of the machine itself, cost of the extra battery, carrying case, case of paper, encryption programming fee, payment card industry fee, and wireless network. The project also provided funds for annual fees associated with the machine, funds for marketing materials, and technical assistance on record keeping and accounting. However, additional costs such as the fees per transaction, wages for machine operators, and the time to reconcile transactions and fees charged from bank

and processor were not covered. To cover these additional costs some markets charged vendors a percentage of the credit/debit sales. Also, increased sales resulted in increased stall fees that were used by some markets to partially cover costs.

The remainder of this paper is organized as follows: Section 2 describes the methods used to collect data and the estimation strategy, Section 3 presents results, and Section 4 offers some concluding remarks.

2. Data

We conducted in-person interviews with a total of 12 managers, 48 vendors and 96 customers at 12 farmers markets across WA State, from July to October 2011. We selected these 12 markets to represent a diversity of size types and geographical locations across WA State. We requested in-person interviews with the market manager, four specialty crop vendors, and eight customers in each visit. Managers and vendors were compensated with $20 in cash for their time and willingness to participate in the study. We requested the market manager's authorization to contact eight customers and conduct in-person interviews at the market. Customers were compensated with $5 cash. During the visit, we met with the market manager. S/he identified four vendors who had previously been informed about the study and who had agreed to participate. Simultaneously, we approached customers soliciting participation in the survey. During the in-person interview, we explained about the study, the goal, and the dynamics of the survey. We informed respondents that all information would be kept confidential and that if they felt uncomfortable with the questions they could opt to not answer or not continue participating. After the interview, participants received the monetary compensation.

The questions in the survey included: (1) the discrete choice scenarios to elicit respondents' values for wireless capacity at farmers markets; (2) questions about wireless capacity at farmers markets; (3) general information about the market, the selection of products (for managers and vendors), and purchasing behavior (for customers); and (4) socio-demographic information of respondents.

Discrete choice experimental design

The discrete choice experiment consists of presenting respondents with a set of hypothetical scenarios. For managers and vendors, each scenario refers to a situation in which they are considering purchasing the wireless technology with market funds. They would have to choose one option from the three presented. We made assumptions to assure control of other factors that might affect decision-making. These assumptions were aligned with the pilot program in place for the markets surveyed. For example, for the managers' and vendors' survey, machines would be bought with the market's own funds, with no help of grants or subsidies. The market would pay all initial expenses and monthly fees (e.g., wireless network, processing, annual and statement fees). There would be one machine per market housed in a central location. Volunteers would run the machines; that is no labor costs would be associated with the operation. Fees per transaction would be passed on to vendors. Each hypothetical purchasing scenario presented three options. The first two options exhibited different combinations of the wireless machine and provider's features. The third option depicted a situation in which no wireless machines would be used at the market.

Previous research on farmers markets and consumer purchasing preferences (Ostrom and Jussaume, 2007; Lev and Stephenson, 2001) and experts on supplying wireless machines to farmers markets were consulted to identify the wireless capability and farmers market features to

include in this study. In the managers survey, these features included: (1) *costs* (the cost of the machine plus the cost of the extra battery, carrying case, case of paper, encryption programming fee, payment card industry fee for an entire season, and wireless network for an entire season); (2) *credit card fees* (percentage of dollar amount per transaction); (3) *debit card fees* (the personal identification number (PIN) fees and the percentage of dollar amount per transaction); (4) *EBT fees* (charge per electronic benefit transfer transaction); (5) *quality of the technology* (the ability of the machine provider to supply adequate technical assistance and obtain a reliable wireless signal); (6) *wireless machine provider's customer service* (the timely resolution of disputes, capacity for solving problems, and friendly staff).

The vendors' choice scenarios features included: (1) *quality of the technology*, (2) *customer service*, and (3) *fees*. Recall that in this study we assume one central machine per market and the use of wooden tokens for transactions. Thus we consider machine features that would be of interest to vendors under the context assumed. The fee levels were consistent with average fees charged by wireless machine providers to farmers markets, and represented four different types of transactions: credit card, debit card used as credit card, debit card used with a PIN number, and EBT.

The consumers' survey presented scenarios related to farmers markets. Market features included: (1) *having local farmers as vendors*, (2) *the quality of food offered*, (2) *the atmosphere at the market* (any entertainment at the market such as the presence of music bands or similar entertaining features), (3) *the availability of EBT/credit/debit technology*, and (4) *prices*. Prices were conceived for a bundle of goods rather than for one good, to mimic as realistically as possible price levels charged at a farmers market. The bundle of goods included one pound of apples, one unit of romaine lettuce, one pound of tomatoes, 4.4 ounces of berries and one pound

of onions. The prices used were consistent with prices charged at WA farmers markets during the period of the study.

Using the SAS® procedures PROC PLAN and PROC OPTEX we created a main effects design. We based this choice of design on Lusk and Norwood (2005) who found that this type of design generates more precise willingness-to-pay (WTP) estimates. Before personally administering the survey, a cover letter was read to the respondent. With this we informed respondents about the purpose of the study, ensured confidentiality, and explained the nature of the questions. A total of 10, 12, and 7 choice scenarios were presented to managers, vendors, and customers, respectively. In each choice question there were three alternatives: two wireless machine provider options for managers and vendors and two farmers markets features for customers. The third alternative was "No credit/debit/EBT capability" for managers and vendors and "Would not choose either of these markets" for customers. Table 1 presents the wireless machines and providers' features levels used in scenarios presented to managers, vendors, and customers. Figure 1 depicts an example of the one choice experiment scenario.

3. Methods

Discrete choice experiments (DCE) are a form of conjoint analysis used to elicit the relative importance of various product attributes in consumers' choice process (Louviere, Hensher, and Swait, 2001; Adamowicz et al., 1998). This approach assumes consumers derive utility from the product attributes rather than the good itself (Lancaster, 1966) and is consistent with the random utility model (Ben-Akiva and Lerman, 1985). In this study, farmers' market managers, vendors, and customers are framed into the random utility model. This model assumes that managers and vendors derive a benefit from accessing wireless capability at the market, and that customers

benefit from shopping at farmers markets. These benefits are known to the managers, vendors, and customers but not to the researcher. Managers, vendors, and customers are presented with several alternatives associated with wireless capacity and farmers' markets features. They will choose the alternative that provides them the greatest benefit. Benefit is the present value of all the elements managers, vendors, and customers consider in their respective choices according to their preferences, the same role that for the consumer represents utility.

Estimation

Assume the utility managers, vendors, and customers derive utility from choosing option *j* is given by[1],

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

where V_{ij} and ε_{ij} are the deterministic and stochastic portion of utility. Note V_{ij} is determined by the respondents *i* and attribute levels of option *j*. In our case, *j* = 1, 2, or 3.

The probability a decision maker *i* will choose option *j* is given by,

$$\text{Prob}\{\text{alternative } j\} = \text{Prob}\left\{V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik};\ \forall\, k \in C_i = \{\text{alternative 1, 2, or 3}\}\right\} \quad (2)$$

If we assume ε_{ij} is independently and identically distributed over the *j* options and *N* decision makers, and follows a standard type I extreme value distribution, we can rewrite (2) as,

$$\text{Prob}\{\text{alternative } j\} = \frac{e^{V_{ij}}}{\sum_{k \in C} e^{V_{ik}}} \quad (3)$$

Equation 3 describes a conditional logit model. The conditional logit model assumes that the independence from irrelevant alternatives (IIA) axiom holds. Results for a Hausman test

[1] For simplicity in equations 1-3 we identify all three groups (managers, vendors, and customers) by *i* and alternatives presented by *j*. The equations 6-8 have different subscripts for each group.

suggest that the IIA axiom holds for all three models[2] (managers, vendors, and customers). Thus we estimated parameters via the conditional logit model.

To control for the effects of the different sizes (in terms of the number of stalls) of the markets surveyed, we interacted a weight factor[3] for number of stalls with each choice attribute and price. The deterministic portion of the utility[4] for the managers is given by,

$$V_{mp} = \propto_{mp} + \beta_{1m}(Credit\ card\ fees\ x\ size)_{mp} + \beta_{2m}(Debit\ card\ fees\ x\ size)_{mp} + \beta_{3m}(EBT\ fees\ x\ size) + \beta_{4m}(Customer\ service\ x\ size)_{mp} + \beta_{5m}(Quality\ of\ technology\ x\ size)_{mp} + \beta_{6m}(Ease\ of\ use\ x\ size)_{mp} + \beta_{7m}(Costs\ x\ size)_{mp} \quad (4)$$

where V_{mp} is the indirect utility manager m gets when choosing alternative p, $\propto_{mp}$ is the alternative specific constant depicting the p alternatives presented to manager m, β_{1m} - β_{8m} are the parameters to estimate and represent the marginal utility of each variable in the model, *credit card fees* is the percentage of dollar amount per credit card transaction, *size* is the size of the market measured in number of stalls, *debit card fees* is the percentage of dollar amount per debit card transaction, including PIN fees; *EBT fees* are the amount of dollars per EBT transaction, *ease of use* is a binary variable that equals 1 if equipment is easy to use and 0 otherwise, *quality of technology* is a binary variable that equals 1 if machine provider excels in technical assistance and that the wireless signal is reliable and 0 otherwise, *customer service* is a binary variable that equals 1 if machine provider customer service is outstanding in terms of

[2] The Hausman test results for all three (managers, vendors, customers) weighted (by either size of the market or by age of respondent) models were χ^2=0, p-value=1. The explanation for the weight models follows in the next paragraph in the text and footnote 3.

[3] The weight factor for the manager's model is the quotient obtained by dividing each respondent's number of stalls by the largest number of stalls in the dataset, number of stalls ranged from 22 to 75. Similar calculations were done for the vendor's and customer's model, in which the weight factor was the quotient obtained by dividing each respondent's age by the largest age in the dataset. Vendors' ages ranged from 19 to 68 and customers' from 18 to 85.

[4] Because the considerable differences in magnitude of variables included in the managers' model ($875 vs. $0.09), each attribute level was scaled so that the mean levels equaled one to facilitate model convergence.

timely resolution of disputes, capacity of solving problems, and friendly staff, 0 otherwise; *Costs* are the wireless machine price including the machine itself, extra battery, carrying case, case of paper, encryption programming fee, payment card industry fee for an entire season, and wireless network for an entire season.

For the vendors' model we interact a weight factor for age of vendors with each choice attribute and price to account for the effect of the different vendors' ages. The vendor's deterministic portion of the utility is given by,

$$V_{vq} = \alpha_{vq} + \beta_{1v}(Customer\ service\ x\ age)_{vq} + \beta_{2v}(Quality\ of\ technology\ x\ age)_{vq} + \beta_{3v}(Fees\ x\ age)_{vq} \quad (5)$$

where V_{vq} is the indirect utility vendor *v* gets when choosing alternative *q*, α_{vq} is the alterative specific constant depicting the *q* alternatives presented to vendor *v*, β_{1v} - β_{3v} are the parameters to estimate and represent the marginal utility of each variable included in the model, *customer service* is a binary variable that equals 1 if machine provider customer service is outstanding in terms of timely resolution of disputes, capacity of solving problems, and friendly staff, *age* is a continuous variable representing vendor's age, *quality of technology* is a binary variable that equals 1 if machine provider excels in technical assistance and that the wireless signal is reliable and 0 otherwise,; *fees* are the fees vendors have to pay assuming four transactions: credit, debit card, debit using a PIN, and EBT, for simplicity it was assumed that each transaction totals five dollars being the gross sale for all four transactions twenty dollars.

For the customer's model we interact a weight factor for age of customers with each choice attribute and price to account for the effect of the different customers' ages. The customer's deterministic portion of the utility is given by,

$$V_{cr} =$$

$$\alpha_{cr} + \beta_{1c}(Local\ farmers\ x\ age)_{cr} + \beta_{2c}(Quality\ of\ food\ x\ age)_{cr} +$$

$$\beta_{3c}(Amostphere\ x\ age)_{cr} + \beta_{4c}(Wireless\ capability\ x\ age)_{cr} + \beta_{5c}(Price\ x\ age)_{cr} \quad (6)$$

where V_{cr} is the indirect utility customer *c* gets when choosing alternative *r*, α_{cr} is the alterative specific constant depicting the *r* alternatives presented to customer *c*, β_{1c} - β_{5c} are the parameters to estimate and represent the marginal utility of each variable included in the model, *local farmers* is a binary variable that equals 1 if vendors at farmers markets are local and 0 otherwise, *quality of food* is a binary variable that equals 1 if quality of food sold at market is of excellent quality and 0 otherwise, *atmosphere* is a binary variable that equals 1 if the market atmosphere is entertaining and 0 otherwise, *wireless capability* is a binary variable that equals 1 if the market is provided with wireless capability, *price* is the price paid by customers when shopping at the farmers market, for simplicity this price has been set for a bundle of goods. Parameter estimates were calculated using SAS®.

The managers' willingness-to-pay (WTP) for wireless capability features is obtained by,

$$WTP_k = -\frac{\beta_{km}}{\beta_{7m}} \quad (7)$$

where WTP_k is the WTP for the wireless capability feature *k* including credit, debit, and EBT fees, ease of use, quality of the technology, and customer service, β_k is the parameter estimate for wireless capability *k*; and $\beta_{7m}$is the parameter estimate for the cost of the wireless capability to the market's manager. Similar estimations are made for the WTP of wireless capability features for vendors, with the difference that parameter estimates wireless features only included customer service and quality of the technology and fees were used instead of cost. For customers the WTP for farmers markets' features is given by,

$$WTP_l = -\frac{\beta_{lc}}{\beta_{5c}} \quad (8)$$

where WTP_l is the WTP for markets' feature l including local farmers, quality of the food, atmosphere, and wireless capability, β_l is the parameter estimate for farmers markets' features; and $\beta_{5c}$is the parameter estimate for the prices of a bundle of goods in the farmers markets.

4. Results

Summary statistics

Summary statistics of the general characteristics of the managers, vendors, and customers interviewed are presented in Tables 2, 3, and 4 respectively. Results in Table 2 indicate that 58% (7 out of 12) of the farmers markets' managers interviewed were somewhat familiar with the use of wireless capacity in the market, as they were using it at least for two years. Fifty percent of these respondents were returning participants of the 2010 program through the WA Farmers Market Technology Improvement Pilot Program. Similarly 50% of respondents stated that they would continue participating in similar programs facilitating access to wireless capability at markets. Fifty percent expressed that they would use market funds to procure this technology. The markets surveyed were, in general, well established as the average length of time since formation was 16 years. Product assortment across markets indicates that all markets supply fruits, vegetables, plants and nursery products. This suggests that any technology aimed to increase sales at farmers markets will represent a benefit to specialty crop farmers. Managers interviewed had on average four years of experience in the job. Eighty three percent of the managers surveyed had an education beyond some college. On average managers were 50 years old and Caucasian (Table 2).

Because vendors could sell at more than one market, the survey was focused on the market where the vendors had the largest amount of sales, for the 2010 season (see Table 3). Vendors' responses refer to such market, which is not necessarily the market where the interview took place. We asked vendors about their perception of wireless capacity at farmers markets. Thirty eight percent of vendors interviewed indicated their largest market (in terms of sales for the 2010 season) had some form of wireless capacity, and 35% (of all vendors interviewed) observed an increase in sales due to the wireless machines. To know more about the market characteristics where specialty crop vendors interviewed sold their products we asked general questions about the market. During the 2010 season, the market opened, on average, for 4 hours during one specific day. During the same season, the markets opened for an average of 21 weeks. Mostly, markets were open on Saturday and Wednesday from May to October. By design, all vendors interviewed were specialty crop farmers. Yet, we asked them to pick all other categories besides "farmers" that they belong to. Only three vendors were farmer processors, four were resellers, two were artisan crafters, and one was a prepared food vendor. Most specialty crop vendors interviewed sold fresh vegetables, fresh fruits, nursery plants, and cut flowers. Vendors interviewed traveled, on average, 38 miles from their operation site to the largest market. The average stall fee they paid was $39 dollars per day. This fee included all types of fees that the stall would represent. Vendors had on average seven years of experience selling at the largest market. On average, they sold at three markets. Sixty seven percent of vendors had an education level of at least some college. Vendors' average age was 42 and 75% of them were Caucasian (Table 3).

To assess customers' opinions about using credit/debit or food stamps at farmers markets we interviewed 96 customers at the markets visited (Table 4). Thirty percent stated they used

some form of credit/debit or food stamp payment when making purchases at a farmers' market. Forty-three percent stated they would buy more now that they know they could use credit/debit/food stamps at the farmers' market. Only four percent expressed they had challenges when using the wireless technology, but no challenges were specifically mentioned. Customers interviewed bought fresh vegetables, fresh fruits, prepared foods, baked goods, cheese dairy, and coffee. Customers' primary reason to buy at farmers markets was to support a local farmer followed by increased access to healthy, environmentally friendly, and tasty food. In general customers interviewed planned to spend $20.50/per visit to the farmers markets. Customers interviewed have shopped at farmers markets for, on average, five years. Seventy-six percent had an education level of at least some college degree. Their average age was 47 years and 81% of them were Caucasian (Table 4).

Discrete choice experiment results

Parameter estimates for the managers, vendors, and customers are listed in Tables 5, 6, and 7, respectively. As expected, the cost of the machine, credit, debit, and EBT fees per transaction have a negative effect on the managers' probability of choosing a wireless machine. Only fees for using a debit card (including PIN fees) resulted statistically significant on the probability of choosing a wireless machine provider. Quality of the technology, customer service, and ease of use have a positive and statistically significant effect on the probability of choosing a wireless machine provider (Table 5).

In the vendors' model the alternative specific constant for both options presented are statistically significant and negative. This means that the probability vendors chose not to have a wireless machine in the market is larger than the probability of having one. The fees per transaction have a statistically significant and negative effect on the probability of choosing a

wireless machine provider. Both the quality of the technology and customer service have a statistically significant and positive effect on the probability of choosing a wireless machine provider (Table 6).

In the customers' model the alternative specific constant for both options presented are statistically significant and positive. This indicates that the probability customers chose to purchase at farmers markets is larger than the probability of not purchasing there. The prices for a bundle of goods have a statistically significant and negative on the probability of choosing a farmers markets. The fact that vendors are local farmers and the quality of the food sold has a statistically significant and positive effect on the probability that consumers choose a farmers' market. This is aligned with the reasons customers stated they shop at farmers markets. The atmosphere at the market is not statistically significant different from zero. The use of credit/debit/EBT card is statistically significant and positive to customers' probability of choosing a farmers' market.

Managers and vendors' WTP for wireless machines features and customers' WTP for farmers markets' features are listed in Table 8. Managers are willing to discount $0.12 per transaction, for an increase in credit card fees from 1.69% to 1.78%. Similarly they are willing to discount $0.71 per transaction, for an increase in debit card fees from 1.49% to 1.89%, and $0.05 for an increase in EBT fees from $0.09 to $0.35 per transaction. Conversely, managers would like to pay $1.16 and $1.78 per transaction, for an improvement in customer service and quality of technology from poor to excellent, respectively. Considering that the average total cost of a machine ranges from $675 to $875 (including cost of the machine, extra battery, carrying case, case of paper, encryption programming fee, payment card industry (PC) fee, statement fee (for all season), wireless network (for all season)) managers' willingness to

discount and pay, as estimated in this study, seem nil. This might be due to the relative small portion that per transaction fees represent compared to the total cost of the machine. If we scale this WTP to the actual number of transactions made during one season, these quantities are different. In 2011, on average across 20 markets participating in the pilot program, there were 280 credit, 180 debit, and 90 EBT transactions (Ordonez, 2012). Thus, assuming managers are willing to buy a wireless machine for one season, they are willing to discount $34 from the total cost of the machine for an increase in credit card fees from 1.69% to 1.78% per season. They are willing to discount $128 for an increase in debit card fees from 1.49% to 1.89%, and $5 for an increase in EBT fees from $0.09 to $0.35, per machine. Managers would like to pay $147, $213 and $326 per machine for an improvement in, respectively, the ease of use, customer service, and quality of technology from poor to excellent.

Vendors' WTP for an improvement in the wireless machine technology quality and in the machine provider customer service from poor to excellent is, respectively, $0.65 and $0.89 per transaction. Customer service is highly regarded by farmers markets' vendors and the most important feature for a wireless machine. Note the differences in WTP between managers and vendors for wireless machine features. For the managers (who are in most cases the machine operators) the quality of the technology is the most important feature, while for vendors it is the customer service. Under the protocol used in this project with token redemptions, managers have to deal with machines failures, thus quality of the technology is the most important feature for them. Also, if the wireless provider's customer service is poor, vendors will be affected, as they may not receive their reimbursement in a timely manner, thus customer service is the most important feature for vendors. Perhaps these results would be different if a different protocol is used, for example, enabling each vendor with wireless capacity.

Customers' WTP for improving the quality of the food offered from poor to excellent is $2.26 per bundle of goods. WTP for having local farmers as vendors in the market is $2.21 per bundle of goods. WTP for being able to use credit/debit/EBT cards at the market was $0.84 per bundle of goods. This information is useful to market managers and vendors who are considering implementing this technology at the farmers markets. There is evidence that customers value being able to use other forms of payment different from cash. As mentioned above, we interviewed customers in general, not necessarily SNAP users. Nonetheless, we prove that wireless machines in farmers' markets could increase sales, enable price premiums, and facilitate SNAP redemptions.

5. Conclusion

Facilitating wireless capability to farmers' markets represents an opportunity for market vendors to increase sales and expand their customer base to SNAP recipients. In this study, we assess the economic value of current EBT/credit/debit technologies for WA farmers' market managers, vendors, and customers participating in the 2011 WA wireless program. This study offers useful information for policy makers and wireless machine providers to improve facilitating the implementation of wireless capacity at farmers markets. When using a protocol based on token redemption, managers, vendors, and customers value having wireless capacity at the farmers' market. Managers value the quality of technology more than credit or debit card fees. For vendors, customer service was more important than the quality of technology. Consumers are willing to pay premium prices at farmers' markets where this technology is available. For customers, quality of the food was the most important feature of a market, followed by the ability

to support local farmers. Enabling the use of credit/debit/food stamp cards was third in importance, ahead of market atmosphere.

Results from this study are encouraging to farmers markets' managers and farmers markets' association representatives who are seeking for ways to increase the number of sales and the dollar amount of each sale at the market. In fact, one of 2013 WA State Farmers' Market Association Advocacy Priorities is to expand farmers' markets and vendors' abilities to accept food assistance benefits. They note that this will expand sales opportunities for farmers and increase access to healthy food to SNAP recipients (WA State Farmers' Markets Association, 2013). Note that having access to wireless technology at the farmer market is not a simple task to implement. Managers and vendors must face costs and challenges. Besides the costs associated with purchasing the machine and the monthly service fees, the market needs to have staff running the machine and have a reliable accounting system in place to be able to track sales and fees per transaction. Thus, an issue faced by the markets is how to handle the extra costs of having wireless capacity at the market. This technology will be adopted when the benefits realized exceed the costs. The benefits include the increased sales (including the SNAP redemption) and premium prices. To enhance these benefits, promotional campaigns are needed to increase awareness among customers of the use of credit and debit cards at markets and to promote SNAP redemption. Finally, this study is focused on WA, but similar programs are in place in other states across the nation, and market managers, association representatives, and policy makers could benefit from the results of this investigation.

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Table 1. Wireless machines, machine providers, and farmers markets' features used in the choice experiment scenarios presented to managers, vendors, and customers.

Features	Levels		
Managers			
Costs (includes cost of the machine, extra battery, carrying case, case of paper, encryption programming fee, payment card industry (PC) fee, statement fee (for all season), wireless network (for all season))	$675.00	$775.00	$875.00
Credit Fees (percentage of total sales per transaction)	1.69%	1.74%	1.78%
Debit Fees (Including PIN Fees) (percentage of total sales per transaction)	1.40%	1.55%	1.89%
EBT (dollars per transaction)	$0.09	$0.15	$0.35
Quality of technology (technical assistance, wireless signal, etc.)	Poor	Excellent	
Customer service (timely resolution of disputes, capacity of solving problems, friendly staff)	Poor	Excellent	
Ease of use	Not user friendly	User friendly	
Vendors			
Fees (Includes all fees for 4 transactions: with credit card, debit card, debit card PIN, EBT. Each transaction with $5 expenditure, being the total gross sales $20)	$0.60	$1.00	$1.40
Quality of technology (technical assistance, wireless signal, etc.)	Poor	Excellent	
Customer service (timely resolution of disputes, capacity of solving problems, friendly staff)	Poor	Excellent	
Customers			
Vendors are local farmers	Not at all	All of them	
Quality of the food sold	Poor	Excellent	
Atmosphere	Not entertaining	Very entertaining	
Price (for a bundle of goods including 1 pound of apples, 1 unit of romaine lettuce, 1 pound of tomatoes, 4.4 oz. of berries, 1 lb. onions)	$8.00	$8.75	$9.50
I can use my credit card or debit card or food stamps	No	Yes	

Table 2. Farmers markets Managers' Summary Statistics.

Survey question	Response (N=12)
Use of wireless capacity in the market	*Number of market managers*
Markets with the capacity to accept wireless electronic payment cards in 2010	7
Markets that procured/subsidized the machines through the Farmers Market Technology Improvement Pilot Program	6
Markets that would continue participating in similar projects to fund the technology	6
Age and size of the markets	*Average across 12 managers*
Number of years the market is operating	16
Number of stalls in the market	45
Number of vendors in the market	49
Distribution of vendor categories in the market	*Number of market managers*
Farmers	19
Farmer processors	5
Resellers	0.25
Prepared food vendors	4
Artisan crafters	9
Product assortment across markets	*Number of vendors offering this product (N=12)*
Fresh fruits	12
Plants, nursery	12
Prepared foods	12
Processed food products	12
Fresh vegetables	12
Coffee	11
Cut flowers	11
Baked goods	10
Cheese, dairy	10
Eggs	10
Meat	10
Fish, seafood	6
Other types of products	6
Wine, cider	3
Managers' socio-demographics	*Response*
Years of experience managing the market	4
Number of managers who have at least some college education	10 (out of 12)
Average age	50
Number of managers who are Caucasian	12 (out of 12)

Table 3. Farmers markets Vendors' Summary Statistics.

Survey question	Response (N=48)
Use of wireless capacity in the market	*Number of vendors*
Yes	18
No	22
Don't know	8
Vendors' category in the market	
Farmers	48
Farmer processors	3
Resellers	4
Prepared food vendors	1
Artisan crafters	2
Product category	
Distribution of products	
Fresh vegetables	41
Fresh fruits	29
Plants, nursery	19
Cut flowers	13
Eggs	4
Grain flour	3
Meat	3
Prepared foods	2
Processed food products	2
Fish, seafood	1
Vendors' socio-demographics	*Response*
Years of experience selling at the largest market (in terms of sales for 2010)	7
Average number of markets where they sold in the 2010 season	3
Number of vendors who have who have at least some college education	32 (out of 48)
Average age	42
Number of vendors who are Caucasian	36 (out of 48)

Table 4. Farmers markets Customers' Summary Statistics.

Survey question	Response (N=96)
Use of wireless capacity in the market	*Number of customers*
Use credit/debit or food stamp	29
Do not use credit debit or food stamp	67
Product category bought	
Fresh vegetables	70
Fresh fruits	62
Prepared foods	59
Baked goods	33
Cheese, dairy	19
Coffee	19
Cut flowers	14
Processed food products	13
Meat	12
Eggs	9
Plants, nursery	7
Fish, seafood	5
Wine, cider	5
Grain, flour	2
Primary reason for shopping at farmers' market	
Support a local farmer	48
Healthy food	40
Environmentally friendly food	22
Tasty food	19
Atmosphere	16
Seeing friends	13
Use credit/debit card & food stamps	8
Affordable food	5
Crafts	4
Prepared foods	3
Customers' socio-demographics	*Response*
Years shopping at farmers markets	5
Number of customers who have at least some college education	73 (out of 96)
Average age	47
Number of customers who are Caucasian	78 (out of 96)

Table 5. Parameter Estimates for Managers Conditional Logit Model for Wireless Features at Farmers markets.

Wireless feature	Parameter estimate
Alternative specific constant for option 1	0.35
	(0.62)[1]
Alternative specific constant for option 1	0.06
	(0.62)
Cost (dollars per machine including extra battery, carrying case, case of paper, encryption programming fee, payment card industry fee for an entire season, and wireless network for an entire season)	-1.94
	(1.36)
Credit card fees (percentage of total sales per transaction)	-2.50
	(2.12)
Debit card fees (including PIN Fees) (percentage of total sales per transaction)	-2.80*[2]
	(1.56)
EBT fees (dollars per transaction)	-0.41
	(0.32)
Quality of technology (technical assistance, wireless signal, etc.)	3.47**
	(0.78)
Customer service (timely resolution of disputes, capacity of solving problems, friendly staff)	2.27**
	(0.63)
Ease of use	1.56**
	(0.64)
Number of observations	110.00
Log likelihood	-94.05

[1] Numbers in parentheses are standard errors.

[2] * and ** mean estimate is statistically significant at the 10% and 5% level, respectively.

Table 6. Parameter Estimates for Vendors' Conditional Logit Model for Wireless Features at Farmers markets.

Wireless feature	Parameter estimate
Alternative specific constant for option 1	-0.86**[1] (0.24)[2]
Alternative specific constant for option 2	-0.92** (0.25)
Fees (for 4 transactions: with credit card, debit card, debit card PIN, EBT. Each transaction with $5 expenditure, being the total gross sales $20)	-1.96** (0.26)
Quality of technology (technical assistance, wireless signal, etc.)	1.28** (0.18)
Customer service (timely resolution of disputes, capacity of solving problems, friendly staff)	1.74** (0.20)
Number of observations	576.00
Log likelihood	-498.65

[1] * and ** mean estimate is statistically significant at the 10% and 5% level, respectively.

[2] Numbers in parentheses are standard errors.

Table 7. Parameter Estimates for Customers' Conditional Logit Model for Farmers Markets' Features

Market feature	Parameter estimate
Alternative specific constant for option 1	1.94**[1]
	(0.37)[2]
Alternative specific constant for option 2	1.33**
	(0.37)
Price (dollars for a bundle of goods including 1 pound of apples, 1 unit of romaine lettuce, 1 pound of tomatoes, 4.4 oz. of berries, 1 lb. onions)	-1.23**
	(0.12)
Vendors are local farmers	2.72**
	(0.24)
Quality of the food sold	2.79**
	(0.29)
Atmosphere	0.00
	(0.40)
Use credit/debit/EBT card at the farmer market	1.04**
	(0.25)
Number of observations	665.00
Log likelihood	-432.39

[1] * and ** mean estimate is statistically significant at the 10% and 5% level, respectively.

[2] Numbers in parentheses are standard errors.

Table 8. Farmers Markets Managers' and Vendors' Willingness-to-Pay for Wireless Machines' Features

Wireless feature	WTP Managers ($/transaction)	WTP Vendors ($/transaction)	WTP Customers ($/bundle of goods)
Credit card fees: 1.69% vs. 1.78% of sale per transaction	-0.12	--	--
Debit card fees (including PIN fees): 1.49% vs. 1.89% of sale per transaction	-0.71	--	--
EBT fees: $0.09 vs. $0.35 per transaction	-0.05	--	--
Ease of use: user friendly vs. not user friendly	0.80	--	--
Customer service: excellent vs. poor	1.16	0.89	--
Quality of technology: excellent vs. poor	1.78	0.65	--
Vendors are local farmers: yes vs. no	--	--	2.21
Quality of the food sold: excellent vs. poor	--	--	2.26
Atmosphere: entertaining vs. not entertaining	--	--	0.00
Use credit/debit/EBT card at the farmer market: yes vs. no	--	--	0.84

Please mark with an "X" the option (JUST ONE) that you would choose given these three options.

	Option 1	Option 2	Option 3
COSTS *(Includes cost of the machine, extra battery, carrying case, case of paper, encryption programming fee, payment card industry (PCI) fee, statement fee (for an entire season), wireless network (for an entire season)*	$875	$775	No Credit/Debit/EBT capability
CREDIT CARD FEES *(Percentage of dollar amount per Transaction)*	1.69%	1.74%	
DEBIT CARD FEES *(Including PIN fees) (Percentage of dollar amount per Transaction)*	1.4%	1.9%	
EBT FEES *(Dollars per Transaction)*	$0.09	$0.34	
EQUIPMENT QUALITY *(Includes Wireless Signal)*	Poor	Excellent	
CUSTOMER SERVICE *(Timely Resolution of Disputes, Capacity of Solving Problems, Friendly Staff)*	Poor	Excellent	
EASE OF USE	Not User Friendly	Not User Friendly	
	 **I would choose**	 **I would choose**	 **I would choose**

Figure 1. Example of a choice scenario used in the market managers' survey