International Food and Agribusiness Management Review
Volume 18 Issue 1, 2015

The Use of Electronic Payment Machines at Farmers Markets: Results from a Choice Experiment Study

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Abstract

The use of electronic payment machines offer vendors an alternative payment method which can increase farmers markets' sales and customer base. In this study, we elicited the value that managers and vendors assign to different machines' features. Also we estimated customers' values on different markets' features, including access to electronic payment machines. Managers were willing to pay for user-friendly machines, excellent customer service, and excellent quality machine technology. Customers were also willing to pay for excellent quality food, for vendors that are local farmers, and for an entertaining atmosphere. We found no evidence of customers willing to pay premium prices for having access to electronic payment machines at farmers markets. Findings from this study should be useful to those designing ways to implement electronic payment machines at farmers markets in order to increase adoption rates.

Keywords: electronic payment machines, farmers markets, choice experiment

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Introduction

Farmers markets are becoming increasingly popular in industrialized countries such as the U.S., E.U., Canada, New Zealand, among others. Whereas countries in Latin America, Africa, and Asia (except Japan) tend to display a larger tradition towards commercializing food products in local village markets with wholesale and retail functions (Reardon et al. 2003). Economic and social factors have increased consumer participation at farmers markets (Pascucci 2011, Varner and Otto 2007, Guthrie et al. 2006, Neil 2002). Economic factors include farmers' need for diversified sources of income and consumers' accessibility to locally grown food. Social factors include development of informal economy and trust, preservation of open space and the positive atmosphere of farmer's markets. This phenomenon is common to industrialized countries, including the U.S. (Gumirakiza et al. 2014, Conner et al. 2010, Brown and Miller 2008, McGarry-Wolf 2005, Neil 2002, Sommer et al. 1981), Italy (Pascucci 2011), New Zealand (Guthrie et al.. 2006), Canada (Feagan 2004), and the U.K. (Lyon et al. 2009, Kirwan 2006, Archer 2003, Trobe 2001). Some consumer segments have the perception that locally produced food is of higher quality and healthier compared to non-local food (Pascucci 2011, Conner et al. 2010, Carpio and Isengildina-Massa 2009, Brown and Miller 2008, Ostrom 2006, Feagan 2004, Zepeda and Leviten-Reid 2004, Trobe 2001, Govindasamy et al. 2000, Murdoch et al. 2000). In general, farmers markets are considered a harbinger of the second industrial revolution, able to attract discerning consumers who exhibit a renewed respect for small-scaled farmers (Guthrie et al. 2006).

In the U.S. farmers markets are an important sales outlet for agricultural producers and have become increasingly critical to the survival of small and midsized specialty-crop farmers, who consider direct marketing to be their most feasible outlet and a way to capture higher returns (Detre et al. 2011). The number and popularity of farmers markets, in the U.S., has increased significantly in recent years, from 1,755 markets in 1994 to 8,144 in 2013, a 364% increase (U.S. Department of Agriculture, Agricultural Marketing Service 2013). Mirroring rapid national growth, sales at farmers markets in Washington State[1] have increased from $5 million total annual gross sales in 1997 to an estimated $50 million in 2010 (Washington State Farmers Markets Association 2013).

Purchases at most markets are made in cash. Research with the U.S. market consumers has 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 those obtained through the Supplemental Nutrition Assistance Program (SNAP)—the largest nutritional assistance program funded by the U.S. Department of Agriculture, Food and Nutrition Service—cannot be accepted at farmers markets without electronic benefit transfer (EBT) technology. In 2005, only 6.8% of farmers markets across the U.S. reported the use of EBT terminals (U.S. Department of Agriculture, Agricultural Marketing Service 2009). This lags far behind the level of participation in food nutrition programs, which is higher than ever before. In 2013, 47.6 million Americans were enrolled in SNAP, at a cost of $79.9 billion (U.S. Department of Agriculture, Food and

[1] The state of Washington, located in the Pacific Northwest region of the U.S. is the 18th largest state in the U.S., with an extension equivalent to 184,661 square kilometers. Washington is the 13th most populated state in the US with 6.9 million people (U.S. Census Bureau 2013). About 60% of the population in the state lives in the Seattle Metropolitan Area.

Nutrition Service 2014). An EBT system enabling SNAP benefit redemptions would enable farmers markets to reach a larger customer base and realize increased sales. In 2013, the total value of SNAP redemptions at farmers markets and farm stands doubled from $2 million to $4 million. While this amount is negligible when compared to the total of $76 billion in redeemed SNAP benefits, it indicates the potential for farmers markets to increase their share of SNAP dollars by making EBT technology available (Wasserman et al. 2010, U.S. Department of Agriculture, Food and Nutrition Service 2014).

This study is part of a project aiming to increase sales of high-value specialty crops at farmers markets and assess the economic potential of wireless electronic payment card machines including EBT/credit and debit (hereafter electronic payment machines). We calculated the economic value farmers markets' managers and vendors who participated in the 2011 Washington farmers market pilot program posited on different features of electronic payment machines. Additionally, we investigated if customers were willing to pay premium prices for food sold at farmers markets' if electronic payment machines were accessible. This should provide cues to policy makers and farmers markets' leaders/advocates where to concentrate efforts to increase technology adoption rates. Also would inform electronic payment machine's providers on the features and services to prioritize in order to increase the use of this technology at farmers markets. Results from this study also signals if customers would be willing to pay premium prices in order to have access to electronic payment machines at farmers markets.

Electronic payment machines were implemented at the 2011 Washington farmers market pilot program, by enabling customers to purchase, at the manager's booth, a specific number of tokens with their credit/debit/EBT card, which they could then spend at the vendors' booths. The tokens differed by transaction type (i.e., credit, debit, EBT) and across markets. Vendors turned in their tokens to the market manager to be reimbursed. During the 2011 season, seventeen participating farmers markets reported sales of $336,499 through the wireless machines, with 11,692 credit, debit, and EBT transactions. Credit card transactions represented 57% ($192,592), debit card transactions 32% ($106,467), and EBT transactions 11% ($37,439) of total sales (Ordóñez 2013). The 2011 Washington farmers market pilot program supplied markets the wireless machine, covering the cost of the machine and costs of the extra battery, carrying case, case of paper, encryption programming fee, payment card industry fee, and wireless network. The pilot program also provided funds for annual fees associated with the machine, funds for marketing materials, and technical assistance with record keeping and accounting. 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. Some markets covered these costs by charging vendors a percentage of credit/debit sales to cover these costs, while others used the higher stall fees that resulted from increased sales.

Data

In-person interviews were conducted, with twelve managers, forty-eight vendors[2], and ninety-six customers at twelve farmers markets, participating in the 2011 Washington farmers market pilot program, from July to October 2011. We selected these markets to represent a diversity of size

[2] We recognize that the sample size is small, but argue that large samples do not always lead to the soundest results; mostly they would be reflected in the significance of the coefficients. See the discussion in McCloskey (1985) where it is mentioned that statistically significant does not mean substantively or economically significant, and its misinterpretation might lead to inaccurate conclusions.

types and geographical locations across Washington State. At each market we interviewed the market manager, four specialty crop vendors, and eight customers. As required by the Institutional Review Board (IRB) when surveying human subjects, before administering the survey, the respondent was read a cover letter to inform of the study's purpose, assure confidentiality of information provided, and explain the nature of the choice experiment questions. For the latter, it was mentioned to respondents' that there were no right or wrong answers and that the best for the study would be to have their most accurate valuation possible. After the interview, managers and vendors were compensated with $20 in cash and customers with $5 cash.

Survey questions included: (1) discrete choice scenarios to elicit respondents' values for having electronic payment machines at farmers markets; (2) questions about electronic payment machines at farmers markets; (3) general information about the market and the selection of products (for managers and vendors) or purchasing behavior (for customers); and (4) respondents' socio-demographic information. The managers' and customers' surveys refer to the market where the interview took place. Because vendors can sell at more than one market, their survey focused on the market where they had the highest dollar amount of sales for the 2010 season.

Discrete Choice Experimental Design

During the discrete choice experiment, we presented respondents with a set of hypothetical scenarios. For managers and vendors, each scenario referred to a situation in which they were considering purchasing wireless technology with market funds. The scenarios were framed using a set of assumptions to ensure control of factors that could affect decision-making. Note that this set of assumptions was different from the context under the 2011 Washington farmers market pilot program. For example, for the managers' and vendors' surveys, machines would be bought with the market's 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. Customers would buy tokens at this central location, and buy at the vendors' booth using tokens. 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.

To identify the electronic payment machines and farmers markets' features to include in this study, we consulted previous research on consumer purchasing preferences and behaviors at farmers markets (Ragland et al. 2011, U.S. Department of Agriculture, Agricultural Marketing Service 2009, Lev and Stephenson 2001) and spoke to experts on supplying electronic payment machines to farmers markets. In the managers' survey, market features were: (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)[3]; (2) credit card fees (percentage of dollar amount per transaction); (3) debit card

[3] To closely mimic the costs that managers incur, we used a combination of capital costs (fixed cost of equipment) and variable costs (seasonal wireless fees). We recognize this as a potential limitation of the study. An ideal case would have included fixed and variable costs separately, or calculated the equivalent seasonal cost of owning the machine.

fees (the personal identification number [PIN] fees and the percentage of dollar amount per transaction); (4) EBT fees (charge per transaction); (5) quality of the technology (the ability of the machine provider to supply adequate technical assistance and obtain a reliable wireless signal); and (6) the machine provider's customer service (timely resolution of disputes, capacity for solving problems, and friendly staff).

The vendors' choice scenarios included: (1) quality of the technology, (2) customer service, and (3) fees. We assumed that each market has one central machine and uses tokens for transactions; we considered machine features that would interest vendors in the context of the pilot program. The quality of the technology would affect vendors realizing a sale. If the machine was not working properly customers might be discouraged of buying at the market thus put in danger a potential sale. If the electronic payment machine provider had a poor customer service, markets could experience delays in resolution of potential disputes and vendors would not be reimbursed on time. Fee levels were consistent with average fees charged by wireless machine providers to farmers markets. These fees were presented as a percentage of the sale amount for four types of transactions: credit card, debit card used as credit card, debit card used with PIN, and EBT. For simplicity, we assumed that the sale amount for each of the four transactions equaled $5, with the total dollar amount of the sale being $20.

The consumers' survey presented scenarios related to market features, including: (1) having local farmers as vendors, (2) quality of food offered, (3) atmosphere (e.g., music, bands, or similar entertainment), (4) availability of electronic payment machines, and (5) prices. Prices were set for a bundle of goods rather than for one good, to mimic price levels charged at a farmers' market as realistically as possible. The bundle of goods included one pound of apples, one head of romaine lettuce, one pound of tomatoes, 4.4 ounces of berries, and one pound of onions. The prices were consistent with current prices at Washington 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. Managers, vendors, and customers were presented with ten, twelve, and seven choice scenarios, respectively. We asked respondents to choose one of three alternatives presented in each choice scenario. For managers and vendors, the first two alternatives offered different combinations of wireless machine and provider features. The third option showed a situation in which no wireless machines would be used at the market. For customers, the first two alternatives described two markets with combinations of the features described above, and the third option allowed respondents not to choose either market. Table 1 presents the wireless machine and provider features given to managers, vendors, and customers. Figure 1 is an example of the choice experiment scenario.

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

Features	Level 1	Level 2	Level 3
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 Percent fees, includes all fees for four transactions: with credit card, debit card, debit card PIN, EBT. Each transaction with $5 expenditure, with total gross sales of $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 food sold	Poor	Excellent	
Atmosphere	Not entertaining	Very entertaining	
Price For a bundle of goods including 1 lb. of apples, 1 head of romaine lettuce, 1 lb. of tomatoes, 4.4 oz. of berries, 1 lb. onions.	$8.00	$8.75	$9.50

Sample Market Managers Survey

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

	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 (PC) fee, statement fee (for an entire season), wireless network (for an entire season).*	$875	$775	
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%	No Credit/Debit or /EBT machines
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

Methods

Discrete choice experiments are a form of conjoint analysis used to determine the relative importance of various product attributes in consumers' choice processes (Louviere et al. 2001, Adamowicz et al. 1998). This approach assumes that consumers derive utility from a product's attributes rather than the good itself (Lancaster 1966) and is consistent with the random utility model (Ben-Akiva and Lerman 1985). In this study, the decision-making of farmers' market managers, vendors, and customers were framed into the random utility model. This model assumes that managers and vendors derived a benefit from having electronic payment machines at the market and that customers benefit from shopping at farmers markets. Managers, vendors,

and customers were presented with several alternatives associated with electronic payment machines and farmers markets features. They chose the alternative that provided them the greatest benefit. This benefit was the present value of all the elements that managers, vendors, and customers consider when making their respective choices according to their preferences or utility.

Estimation

Assume the utility that managers, vendors, and customers derive from choosing option *j* is given by,[4]

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

where $V_{ij}$and $\varepsilon_{ij}$are, respectively, the deterministic and stochastic portion of utility. Note V_{ij} is determined by respondents *i* and attribute levels of option *j*. In our case, j = 1, 2, or 3. The probability that decision maker *i* will choose option *j* is given by,

$$(2)\quad \text{Prob}\{\text{alternative } j\} = \text{Prob}\begin{Bmatrix} V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik}\,;\ \forall\, k \in C = \\ \{\text{alternative 1, 2, or 3}\} \end{Bmatrix}$$

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

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

Equation 3 describes a conditional logit model, which assumes that the independence from irrelevant alternatives (IIA) axiom holds. Results for a Hausman test suggest that the IIA axiom holds for managers and vendors, but not for customers[5]. Likelihood ratio tests to evaluate for heteroscedascity were conducted for the managers' and vendors' models, resulting in no evidence of heteroscedascity. Hence, managers and vendors' model parameters were estimated using the conditional logit and the customers' model parameters were estimated via mixed logit.

Characteristics of individuals' responding to the discrete choice scenarios were included in all three models. We followed a similar rationale as in Train and Atherton (1995), Revelt and Train (1998) and Hoyos et al.. (2009). In our case, all possible variables collected in our surveys, were evaluated for inclusion. To select the individual specific variable that would yield the outperforming model, we used the following criteria: reasonable willingness-to-pay estimates

[4] In equations 1–3, all three groups (managers, vendors, and customers) are identified with *i*, and alternatives presented to all three groups are identified with *j*. Equations 4–6 have different subscripts for each group.

[5] The Hausman test for managers yielded χ^2=1.96, p-value=0.98; for vendors χ^2=0, p-value=1; and for customers χ^2=50.73, p-value=3.35×10^{-9}. We failed to reject the null hypothesis that IIA holds for managers and vendors, but reject for customers. The likelihood ratio test for managers resulted χ^2=0.232, p-value=0.89; for vendors χ^2=3.558, p-value=0.169. We failed to reject the null hypothesis that homoscedascity holds for managers and vendors.

(Louviere et al.. 2005, Hensher 2006, Hoyos 2009) [6] and measures of goodness of fit including the Akaike information criterion (AIC), the Bayes information criterion (BIC), and the likelihood ratio index. We conducted three regressions for each group of respondents (e.g., managers, vendors, and customers), one not including respondents' characteristics, and the other two with the highest performing models including such characteristics.

For the managers, the two respondents' characteristics selected were number of vendors in the market and the years managing the market.

The deterministic portion of the utility model for managers is given by,

$$(4)\ V_{mp} = \propto_3 + \beta_{1m}(Credit\ card\ fees)_{mp} + \beta_{2m}(Debit\ card\ fees)_{mp} + \beta_{3m}(EBT\ fees)_{mp} + \beta_{4m}(Customer\ service)_{mp} + \beta_{5m}(Quality\ of\ technology)_{mp} + \beta_{6m}(Ease\ of\ use)_{mp} + \beta_{7m}(Costs \times manager/marketcharacteristic_a)_{mp},$$

where V_{mp} is the indirect utility that manager *m* gets when choosing alternative *p*; $\propto_3$ is the alternative specific constant (hereafter ASC) for the none option, given that we are dealing with un-labeled choice options; β_{1m} through β_{7m} are the parameters to estimate and represent the marginal utility of each variable in the model; *credit card fees* is the percentage of the dollar amount of one credit card transaction; *debit card fees* is the percentage of the dollar amount of one debit card transaction, including PIN fees; *EBT fees* is the amount of money per EBT transaction; *ease of use* is a binary variable that equals 1 if equipment is user friendly and 0 otherwise; *quality of technology* is a binary variable that equals 1 if machine provider excels in technical assistance and 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 timely resolution of disputes, capacity of solving problems, and friendly staff and 0 otherwise; and *costs* is the wireless machine prices, 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; $manager/market\ characteristic_a$ is the specific characteristic of the manager/market, *a*=number of vendors and years managing the market. Note that *a*=1 if none characteristic was included in the model.

For the vendors' model, the deterministic portion of the utility is given by,

$$(5)\ V_{vq} = \gamma_3 + \beta_{1v}(Customer\ service \times vendor\ characteristic_b)_{vq} + \beta_{2v}(Quality\ of\ technology \times vendor\ characteristic_b)_{vq} + \beta_{3v}(fees \times vendor\ characteristic_b)_{vq},$$

[6] Louviere et al. (2005), Hensher (2006), and Hoyos (2009) discussed the use of different distributions of random parameters when estimating discrete choice models. They concluded that although there were distributions that could lead to a better fit, it would be at the expense of less realistic WTP distributions, thus they favor the specification of distributions leading to more reasonable WTP estimates.

where V_{vq} is the indirect utility vendor *v* gets when choosing alternative *q*; γ_3 is the ASC for the none option; β_{1v} through β_{3v} are the parameters that 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 and 0 otherwise; $vendor\ characteristic_b$ is the specific characteristic of the vendor, *b*= daily stall fee, number of farmers markets where vendors sell their products (*b*=1 if no vendor characteristic was included in the model); *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; and *fees* are the percentage of the dollar amount spent in four transactions: credit, debit card, debit using a PIN, and EBT.

For the customers' model, the characteristic specific to the respondent was the number of years shopping at the farmers market. Similar to the vendors' model, we interacted the attributes of farmers markets with number of years customers' have shopped at farmers' markets.

The customers' deterministic portion of the utility is given by,

$$(6)\ V_{cr} = \delta_3 + \beta_{1c}(Local\ farmers \times customer\ characteristic_h)_{cr} + \beta_{2c}(Quality\ of\ food \times customer\ characteristic_h)_{cr} + \beta_{3c}(Amostphere \times customer\ characteristic_h)_{cr} + \beta_{4c}(Electronic\ payment\ card \times customer\ characteristic_h)_{cr} + \beta_{5c}(Price)_{cr},$$

where V_{cr} is the indirect utility customer *c* gets when choosing alternative *r*; δ_3 is the ASC for the none option; β_{1c} through 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 market vendors are local and 0 otherwise; $customer\ characteristic_h$ is the characteristic specific to the customer *h*=shopping frequency, years shopping at farmers' markets, (note that h=1 if none customer characteristic was included in the model); *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; *electronic payment card* is a binary variable that equals 1 if the market is provided with electronic payment machines and 0 otherwise; and *price* is the price paid by customers for a bundle of goods. Parameter estimates for all three models were calculated using SAS©[7].

The managers' willingness-to-pay (WTP) for electronic payment machine features is obtained by,

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

where WTP_k is the WTP for the electronic payment machine feature *k* (including credit, debit, and EBT fee; ease of use; quality of the technology; and customer service), β_k is the parameter estimate for electronic payment machine feature *k*, and $\beta_{7m}$is the parameter estimate for the cost

[7] We recognize that a limitation of our coefficients' estimation is the use of PROC MDC in SAS©, a procedure that does not provide options to specify repeated choices made by the same individual.

of the electronic payment machine to the market's manager. Similar estimations are made for vendors' WTP for machine features. Coefficients used were customer service, quality of the technology, and fees. For customers, the WTP for market features is given by,

$$(8)\quad \mathrm{WTP}_{\mathrm{l}} = -\frac{\beta_{\mathrm{lc}}}{\beta_{\mathrm{5c}}},$$

where WTP_l is the WTP for market feature l, including local farmers, quality of the food, atmosphere, and access to electronic payment machines at the market; β_l is the parameter estimate for market features; and $\beta_{5c}$is the parameter estimate for the price of a bundle of goods in the market. The standard deviation for each WTP was estimated by parametric bootstrapping (Krinsky and Robb 1986).

Results

Summary Statistics

Fifty eight percent (7 of 12) of farmers' market managers interviewed were somewhat familiar with the use of electronic payment machines in the market, as they had been using it for at least two years. Fifty percent of respondents stated that they would continue participating in programs that facilitate access to electronic payment machines at markets and 50% said that they would use market funds to procure this technology (Table 2). These results do not provide a conclusive evidence of managers favoring the use of the technology in the market, under the context of the 2011 Washington farmers market pilot program. It might be that the additional task of having to run the centrally located machine and keeping records of transactions might deter them for favoring the technology. In addition, novel competing technologies have emerged, as for example the Square® for smartphones that has the potential to offer enhanced convenience for both managers and vendors at a reasonable cost. Markets had on average 16 years in operation, with 48 stalls, 52 vendors, and 1,912 customers on a typical day (Table 2). In 2006, the national average for years in operation was 15 years. Comparing these results with the Far West (which includes the State of Washington) one can claim that our sample of managers was representative of the region. For the Far West, the average number of vendors was 51 and the average number of customers per week, was 1,379 (U.S. Department of Agriculture, Agricultural Marketing Service 2009).

Of vendors surveyed, 38% indicated that their largest market (in terms of sales for the 2010 season) had electronic payment machines, and 35% observed an increase in sales resulting from the use of electronic payment machines (Table 3). On average, vendors traveled 38 miles to reach their largest market (in terms of dollar sales in 2010), the market opened 24 weeks a year (mostly from May to October), the daily stall fee was $41, and have 7 years selling at the market. Vendors surveyed were predominantly Caucasian (75%), had at least some college degree (67%) and were 44 years old. Our sample is somewhat comparable to the national level, where vendors across the U.S. traveled on average 26 miles to sell at their markets and 90% were Caucasian (U.S. Department of Agriculture, Agricultural Marketing Service 2009).

Table 2. 2011 Farmers markets survey, managers' summary statistics.

Features	Number of Markets (N=12)	Mean	Std. dev.	Min.	Max.
Use of electronic payment machines					
Capacity to accept electronic payment cards	7.00				
Procured/subsidized the machines through pilot program	6.00				
Would continue participating in similar projects	6.00				
About the market					
Years of operation		15.54	8.66	3.00	32.00
Stalls in the market		47.36	18.52	22.00	75.00
Vendors in the market		52.00	20.87	22.00	100.00
Shoppers in a typical day		1911.55	1442.45	100.00	4750.00
Distribution of vendor categories in the market					
Farmers	19.00				
Farmer processors	5.00				
Resellers	0.25				
Prepared food vendors	4.00				
Artisan crafters	9.00				
Product assortment across markets					
Fresh fruits	12.00				
Plants, nursery	12.00				
Prepared foods	12.00				
Processed food products	12.00				
Fresh vegetables	12.00				
Coffee	11.00				
Cut flowers	11.00				
Baked goods	10.00				
Cheese, dairy	10.00				
Eggs	10.00				
Meat	10.00				
Fish, seafood	6.00				
Other types of products	6.00				
Wine, cider	3.00				
Managers' information					
Years of experience managing the market	4.00	3.95	4.64	1.00	18.00
Managers with at least some college education	10.00				
Age		47.73	10.05	34.00	65.00
Caucasian	12.00				

Table 3. 2011 Farmers markets survey, vendors' summary statistics.[1]

Features	Number of Vendors (N=48)	Mean	Std. Dev.	Min.	Max.
Use of electronic payment machines					
Yes	18.00				
No	22.00				
Don't know	8.00				
Vendors' category in the market					
Farmers	48.00				
Farmer processors	3.00				
Resellers	4.00				
Prepared food vendors	1.00				
Artisan crafters	2.00				
Product category					
Distribution of products					
Fresh vegetables	41.00				
Fresh fruits	29.00				
Plants, nursery	19.00				
Cut flowers	13.00				
Eggs	4.00				
Grain flour	3.00				
Meat	3.00				
Prepared foods	2.00				
Processed food products	2.00				
Fish, seafood	1.00				
About the vendor					
Number of weeks market is open during the year		23.56	7.57	8.00	52.00
Miles traveled to reach market		38.30	52.77	15.00	255.00
Daily stall fee		41.06	38.25	15.00	200.00
Years selling products at market		6.63	6.22	1.00	24.00
Number of markets where products are sold		2.96	2.40	1.00	10.00
Number of vendors with some college education	32.00				
Age		44.21	13.99	19.00	68.00
Number of vendors who are Caucasian	36.00				

Note. [1] This survey refers to the market where the vendor obtained the largest sales in terms of dollars for 2010.

Only 29% of customers interviewed had used some form of credit, debit, or EBT payment when making purchases at a farmers' market, and 42% would buy more now that they were aware that they could use electronic payment cards at the farmers' market (Table 4). Only 4% found using electronic payment machines to be challenging, but no specific challenges were noted. Top purchases among customers interviewed were fresh vegetables, fresh fruits, prepared foods, baked goods, cheese, dairy, and coffee. This was consonant with results of a 2010 dot survey in Washington D.C. where the top three products that customers reported purchasing were fresh fruits and vegetables, baked goods, and prepared foods (Ragland 2011). Customers' primary reason for buying at farmers markets was to support local farmers, followed by increased access to healthy, environmentally friendly, and tasty food. Also, this is in agreement with the 2006 National farmers markets survey where markets' managers were interviewed and they

considered freshness, taste and access to local food as the three top reasons customers shopped at farmers markets ((U.S. Department of Agriculture, Agricultural Marketing Service 2009).

Table 4. 2011 Farmers markets survey, customers' summary statistics.

Features	Number of Customers (N=96)	Mean	Std. Dev.	Min.	Max.
Use of electronic payment cards					
Use credit/debit or EBT	29.00				
Do not use credit debit or EBT	67.00				
Planning to buy more with credit/debit/EBT	42.00				
Product category bought					
Fresh vegetables	70.00				
Fresh fruits	62.00				
Prepared foods	59.00				
Baked goods	33.00				
Cheese, dairy	19.00				
Coffee	19.00				
Cut flowers	14.00				
Processed food products	13.00				
Meat	12.00				
Eggs	9.00				
Plants, nursery	7.00				
Fish, seafood	5.00				
Wine, cider	5.00				
Grain, flour	2.00				
Primary reason for shopping at farmers markets					
Support a local farmer	48.00				
Healthy food	40.00				
Environmentally friendly food	22.00				
Tasty food	19.00				
Atmosphere	16.00				
Seeing friends	13.00				
Use credit/debit card & EBT	8.00				
Affordable food	5.00				
Crafts	4.00				
Prepared foods	3.00				
About customer					
Amount spent or planned to spend		21.65	15.14	0.00	100.00
Shopping frequency (0=this is my first visit, 5=weekly)		3.84	1.51	0.00	5.00
Years shopping at farmers markets		7.71	6.69	0.00	30.00
Customers with at least some college education	73.00				
Age		47.15	17.05	18.00	85.00
Number of customers who are Caucasian	78.00				

Customers interviewed that they spent or planned to spend $22 on average, with a shopping frequency of twice a month. They were on average 47 years old, 78% were Caucasian, and 73%

had at least some college education. Our sample is representative of farmers markets customers across the U.S. For example, Ragland et al. (2011) reported that 52% of farmers markets' customers interviewed in Washington D.C. usually spent $20 per market visit. Our sample is comparable to Elepu and Mazzocco (2010) who surveyed 508 consumers in six farmers markets in Illinois, and found that in general consumers were 47 years old, 83% were Caucasian, and 94% had at least some college education. In Gumirakiza et al. (2014), who interviewed 1,488 farmers markets customers in Utah and Nevada, customers' average age was 42 and shopping frequency was approximately once a month (4-7 times per season).

Discrete Choice Experiment Results

Table 5 depicts results from three managers' models, with and with no inclusion of managers' characteristics.

Table 5. Parameter estimates for the conditional logit model depicting farmers markets managers' preferences for having electronic payment card machines at their market.

Variables	**Model 1** No inclusion of managers' characteristics	**Model 2** Including # vendors in the farmers market	**Model 3** Including years managing farmers market
ASC - none option	0.361	1.358	3.383
	(6.414)1	(6.308)	(6.133)
Credit card fees	-1.102	-1.875	-1.401
	(5.890)	(5.765)	(5.678)
Debit card fees	-4.326**2	4.709**	-3.884**
	(1.847)	(1.856)	(1.750)
EBT fees	-0.863**	-0.945**	- 0.807**
	(0.379)	(0.390)	(0.374)
Quality of technology	4.336***	4.689***	4.163***
	(0.927)	(0.966)	(0.916)
Customer service	2.928***	2.711***	2.803***
	(0.674)	(0.674)	(0.676)
Ease of use	3.126***	2.968***	2.745***
	(0.778)	(0.795)	(0.756)
Cost	-3.968***	--	--
	(1.502)	--	--
Cost x # vendors in the farmers market	--	-0.033***	--
	--	(0.011)	--
Cost x years managing the farmers market	--	--	-0.118**
	--	--	(0.052)
Number of observations	110.000	110.000	110.000
Log likelihood	-78.130	-77.089	-79.089
Akaike information criterion	172.260	170.178	174.179
Bayes information criterion	193.864	191.782	195.783
Pseudo R-square	0.354	0.362	0.346

Notes. [1] Numbers in parenthesis are standard errors. [2]*,**,*** indicates statistically significant at the 1%, 0.05%, and 0.01% levels, respectively.

Across all three models, debit and EBT card fees were negative and statistically significant indicating that these fees would have a negative impact on the probability that managers choose to have electronic payment machines in the market. Credit card fee was not statistically significant. One would expect that credit card fees had an impact on the managers' probability of choosing electronic payment cards, however this was not reflected in our results. Recall that during the 2011 Washington farmers market pilot program 57% of all transactions using electronic payment machines were with credit cards (compared to 32% with debit and 11% with EBT). Improved quality of the technology, customer service, and ease of use had a positive and statistically significant effect on the probability of choosing electronic payment machines in the market. In the context of this study, with one centralized machine at the managers' booth, it was expected that improvements in the quality of technology, customer service and ease of use would imply less time resources (e.g., timely payment to vendors, time devoted in each transaction, staff time in each transaction or solving malfunctions, and so on) invested in having electronic payment machines at the market. The cost of the machine was negative and statistically significant across three models. The scale of the cost coefficient was different when including respondents characteristics and not. This signals that managers with more vendors in the market and with more years managing the market tended to be less concerned with the cost of the machine. The outperforming model was the one including the number of vendors in the farmers market. This model yielded willingness-to-pay estimates consonant with the machine costs in the choice scenarios, and superior measures of goodness of fit compared with the other two models.

For vendors, three models were estimated with and with no inclusion of vendors' characteristics (Table 6). Only the model with no inclusion of vendors' characteristics, displayed a statistically significant and positive ASC for the none option. This signals that vendors would be better off with no electronic payment cards in the markets. Walters (2012) explained that electronic payment machines might not be a good fit for every farmer vendor. She mentioned it was possible that vendors selling at multiple markets each week, selling at large urban markets, selling year round, selling higher priced items, having on the farm sales might not favor this technology. Although the reason why these types of vendors would not favor the technology was not explicit in the text, we assume it was because the extra time transactions with the electronic payment card involves and the delay in receiving reimbursements when compared to cash. In fact, some vendors interviewed in this study, commented that the centrally located wireless machine was convenient for them, as they did not have sufficient staff capacity at their booth, or the financial resources to access the technology by themselves. Across the three models, improvements in the quality of the technology and customer service had a positive effect on the probability of choosing to have electronic payment machines in the market. Improvements in the quality of the electronic payment machine implied flawless transactions and satisfied customers who might be willing to repeat the experience. An improved customer service (from the electronic payment machine provider) was associated with efficient resolution of potential disputes and timely payments. An increase in the fees charged for transactions negatively impacted the probability of having these machines. The outperforming model was the one including the number of markets where vendors sold products. This model yielded willingness-to-pay estimates consonant with percentage fees in the choice scenarios, in comparison to the model not including vendors' characteristics. Also, this model (the outperforming one) yielded superior measures of goodness of fit compared to model including the daily stall fee paid by vendors (Table 6).

Table 6. Parameter estimates for the conditional logit model depicting farmers markets vendors' preferences for having electronic payment card machines at their market.

Variables	**Model 1** No inclusion of vendors' characteristics	**Model 2** Including daily stall fee	**Model 3** Including # markets where vendors sell products
ASC - none option	3.006***[1]	-0.219	0.215
	(0.400)[2]	(0.158)	(0.158)
Quality of technology	1.420***	--	--
	(0.143)	--	--
Customer service	1.755***	--	--
	(0.153)	--	--
Fees	-1.152***	--	--
	(0.194)	--	--
Quality of technology x daily stall fee	--	0.013***	--
	--	(0.003)	--
Customer service x daily stall fee	--	0.021***	--
	--	(0.003)	--
Fees x daily stall fee	--	-0.036***	--
	--	(0.004)	--
Quality of tech. x # markets where vendors sell	--	--	0.237***
	--	--	(0.037)
Customer serv. x # markets where vendors sell	--	--	0.344***
	--	--	(0.045)
Fees x # markets where vendors sell	--	--	-0.480***
	--	--	(0.060)
Log likelihood	-446.126	-524.962	-495.310
Akaike information criterion	900.251	1058.000	998.630
Bayes information criterion	917.676	1075.000	1016.000
Pseudo R-square	0.295	0.170	0.220

Notes. [1]*,**,*** indicates statistically significant at the 1%, 0.05%, and 0.01% levels, respectively. [2] Numbers in parenthesis are standard errors.

For customers, three models were estimated including and not including customers' characteristics associated with farmers markets (Table 7). Note that none of the variables was statistically significant in the model including shopping frequency (Model 2). The ASC for the none option was statistically significant and positive when not including customers' characteristics (Model 1) and statistically significant and negative when including the number of years customer was shopping at farmers markets (Model 3). This implied that with more years shopping at farmers' markets, customers showed a preference for shopping at this type of market compared to other type of outlets. The quality of the food sold, vendors being local farmers, and entertaining market atmosphere had a statistically significant and positive effect on the probability that consumers chose to shop at a farmers market. This outcome was consistent with the reasons customers gave for shopping at farmers markets (Ragland et al. 2011; U.S. Department of Agriculture, Agricultural Marketing Service, 2009). The ability to use an electronic payment card resulted statistically significant and positive in Model 1 (not including

customers' characteristics) but not statistically significant in Model 3 (including number of years customers shopped at farmers' markets). Even more, the standard deviation coefficient for electronic payment card resulted statistically significant and positive signaling heterogeneous preferences across respondents. Customers with more years shopping at farmers markets were not willing to pay premium prices in order to have access to the technology. The price coefficients were statistically significant and negative indicating that higher prices would affect the probability that costumers' shop at farmers markets. The outperforming model was the one including the number of years customers have shopped at farmers markets. The outperforming model yielded WTP estimates comparable to prices in the choice scenarios compared to the model not including customers' characteristics. It also exhibited superior goodness of fit compared to the model including shopping frequency (Table 7).

Table 8 lists managers and vendors' WTP for electronic payment machines' features and customers' WTP for farmers' market features. Managers were willing to discount $143/machine for a one percent increase in debit card fees, and $29/machine for a dollar increase in EBT fees. Conversely managers were willing to pay $90, $82, and $142/machine for having a user- friendly machine, excellent customer service, and excellent quality of the machine technology, respectively. To provide context, recall that the cost of machines in this study ranged from $675-$875. Results reveal that electronic payment machine providers might consider lowering their debit card fees and providing excellent quality machines to attract farmers markets' managers as clients.

Vendors were willing to pay an equivalent to 0.72% ($0.14) fee per $20 transaction for having excellent customer service and 0.49% ($0.10) fee per $20 transaction for having excellent machine quality technology. Recall fees in the choice experiment ranged from 0.6% ($0.12) to 1.4% ($0.28) per $20 transaction. A poor customer service might indicate that markets could experience delays in resolution of potential disputes and vendors would not be reimbursed on time. The quality of the technology might affect vendors realizing a sale. If the machine was not working properly customers might have been discouraged of buying at the market. Electronic payment machine providers seeking to attract farmers markets' vendors (under the context of this study) as clients must consider excelling in customer service and quality of the machine technology.

Customers were willing to pay price premiums equivalent to $4, $3, and $2/bundle of goods for having an excellent quality food offered, for vendors being local farmers, and for an entertaining atmosphere, respectively. Prices in the choice experiment scenarios ranged from $8-$9.5/bundle of goods. As of 2011, customers were not willing to pay premium prices to access electronic payment machines. This implies that a strategy consisting of charging premium prices might not be the best way of financing the electronic payment machines, as customers were not willing to pay additional for accessing them. However, 70% of customers surveyed did not use an electronic payment card when shopping at farmers markets during 2010, which indicates that it might take time for customers to get use to the technology, realize its convenience, and be willing to pay price premiums for it. Also, that 42% of surveyed individuals indicated they would buy more knowing that these machines were available in the market, signals the need to increase awareness among customers.

Table 7. Parameter estimates for the mixed logit model depicting customers' preferences for farmers markets' features including the use of electronic payment card machines.

Variables	**Model 1** No inclusion of respondents' characteristics		**Model 2** Including shopping frequency		**Model 3** Including years shopping at farmers' markets	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
ASC – none option	7.069***[1]	--	-1.438	--	-4.020***	--
	(1.802)[2]		(1.002)		(0.934)	
Vendors are local farmers	2.191***	0.067	--	--	--	--
	(0.290)	(1.813)				
Quality of food sold	2.732***	0.766*	--	--	--	--
	0.328)	(0.442)				
Entertaining atmosphere	0.875*	0.122	--	--	--	--
	(0.509)	(2.449)				
Use electronic payment card	1.218***	1.135***	--	--	--	--
	(0.239)	(0.422)				
Price	-0.133	--	--	--	--	--
	(0.150)					
Vendors are local farmers x shopping frequency	--	--	4.398	1.987	--	--
			(8.048)	(3.640)		
Quality of food sold x shopping frequency	--	--	6.215	5.889	--	--
			(11.347)	(10.702)		
Entertaining atmosphere x shopping frequency	--	--	2.539	1.894	--	--
			(4.775)	(3.426)		
Use electronic payment card x shopping frequency	--	--	1.617	6.551	--	--
			(3.055)	(12.114)		
Price x shopping frequency	--	--	-0.900		--	--
			(1.588)			
Vendors are local farmers x years shopping at farmers' markets	--	--	--	--	1.271***	0.276
					(0.490)	(0.2588)
Quality of food sold x years shopping at farmers' markets	--	--	--	--	1.664***	1.381**
					(0.640)	(0.560)
Entertaining atmosphere x years shopping at farmers' markets	--	--	--	--	0.769*	1.101**
					(0.442)	(0.558)
Use electronic payment card x years shopping at farmers' markets	--	--	--	--	0.256	1.530**
					(0.186)	(0.632)
Price x years shopping at farmers' markets	--	--	--	--	-0.413***	
					(0.138)	
Number of observations	665.000		665.000		665.000	
Log likelihood	-395.025		-425.688		-416.97	
Akaike information criterion	810.049		871.377		853.939	
Bayes information criterion	855.047		916.375		898.937	
Pseudo R-square	0.459		0.417		0.429	

Notes. [1]*,**,*** indicates statistically significant at the 1%, 0.05%, and 0.01% levels, respectively. [2] Numbers in parenthesis are standard errors.

Table 8. Farmers markets managers', vendors', and customers' willingness-to-pay (WTP) for electronic payment cards' features.

Features	Managers[1] ($/machine)	Vendors[2] (% fee/4 transactions)	Customers[3] ($/bundle of goods)
Increase in credit card fees	-56.809	--	--
	(60.777)[4]		
Increase in debit card fees	-142.682**[5]	--	--
	(325.287)		
Increase in EBT fees	-28.648**	--	--
	(95.422)		
Ease of use	89.930***	--	--
	(291.063)		
Customer service	82.142***	0.716***	--
	(225.578)	(0.092)	
Quality of electronic payment card technology	142.076***	0.493***	--
	(333.629)	(0.075)	
Quality of food sold at farmers' market	--	--	4.026***
			(2.510)
Vendors are local farmers	--	--	3.076***
			(2.050)
Entertaining atmosphere at the farmers market	--	--	1.861*
			(2.718)
Ability to use electronic payment card	--	--	0.618
			(1.527)

Notes. [1] Using coefficients from model that included number of vendors in the farmers market. [2] Using coefficients from model that included number of markets where vendors sell products. [3] Using coefficients from model that included the years shopping at farmers markets. [4] Numbers in parenthesis are standard deviations calculated via parametric bootstrapping. [5] *,**,*** indicates statistically significant at the 1%, 0.05%, and 0.01% levels, respectively.

Conclusions

Enabling electronic payment machines at farmers markets represents an opportunity for vendors to increase sales and expand their customer base. In this study, we estimated the economic value managers and vendors posit on different machine features. We also calculated the value customers posit on farmers markets features including access to electronic payment machines.

In a context where there is one centrally located machine per market at the manager's booth, managers appear to value the quality of the machine technology ($142/machine), ease of use ($90/machine), and the provider's customer service ($82/machine). Managers seemed to be concerned with increases in debit and EBT card fees, as they were willing to discount $143 and $28/machine, respectively. Our results signal that individuals managing larger markets (in terms of the number of vendors) and with more years managing the market would be less concerned with the cost of the machine. Those willing to spread the implementation of electronic payment machines at farmers markets might prioritize working with larger-scale and experienced

managers. Farmers markets' vendors were willing to pay 0.72%, and 0.49% in fees for an excellent provider's customer service and excellent quality of the machine technology. With one centralized machine located at managers' booth, vendors valued a timely resolution of potential disputes hence timely reimbursement, and customers pleased with the machine transaction process and willing to repeat the experience. Electronic payment machine providers seeking to work with farmers markets and gain vendors' approval must consider excelling in customer service and quality of their technology. Farmers markets' customers valued accessing to excellent quality of food ($4/bundle of goods), farmers being local ($3/bundle of goods), and entertaining atmosphere ($2/bundle of goods). Customers were not willing to pay premium prices for having access to electronic payment machines at farmers markets. The fact that 70% of the customers surveyed did not use these machines in 2010, and that 42% indicated they would buy more knowing that these machines were available in the market, signals the need to increase awareness among customers.

Enabling the use of electronic payment machines at farmers markets is a promising way to increase sales and expand customer base. That our findings do not signal an overwhelming acceptance of this technology from managers, vendors, and customers might reflect the early stages of implementation and the limited awareness of all benefits to be realized. With the appearance of competing ways of implementing electronic payment machines (e.g., Square®) managers and vendors must carefully analyze benefits and costs of having access to this technology. A centralized electronic payment location might appear attractive to small vendors with staff limitations and who cannot afford the technology by themselves. However, they would have less control on the reimbursement timing. This study was focused on Washington State farmers' markets, but similar programs are in place in other States, and market managers and advocates could benefit from the results of this investigation by prioritizing on markets more likely to adopt, by establishing relationships with electronic payment machine providers excelling in services more valued by managers and vendors, and by increasing awareness across customers on the accessibility to electronic payment terminals at farmers markets.

Acknowledgment

This study was funded by the Washington State Department of Agriculture Specialty Crop Block Grant Program, "Increasing High-Value, Specialty and Sustainable Crop Sales through Farmers markets: Assessing the Economic Potential of Electronic Benefits Transfer and Credit Card Capability 2010-1013."

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