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Do Internet-Based Promotion Efforts Work? Evaluating MarketMaker

Samuel D. Zapata, Carlos E. Carpio, Olga Isengildina-Massa,
and R. Dave Lamie

MarketMaker is one of the most extensive collections of electronic searchable food industry-related data engines in the country with over 17,500 profiles, including over 7,600 agricultural producers. This article summarizes the results of a survey that assesses the impact of MarketMaker on agricultural producers registered on the website. Results indicate that, by participating on MarketMaker, producers' annual sales have increased by about \$121. The number of contacts received, new customers gained, and increased annual sales due to participation in the site are positively related to self-registration on the MarketMaker site, time since registration, and monthly time devoted to the website.

Key words: e-commerce, economic impact, effectiveness, direct marketing, nonparametric methods, supply chain

MarketMaker is an interactive web-based resource that provides geo-coded food marketing information to food entrepreneurs and customers. The site was created in 2000 by a team of University of Illinois Extension personnel with the intention of building an electronic infrastructure that would easily connect Illinois food-producing farmers with economically viable new markets to aid in the development of quality driven food supply chains.

MarketMaker enables both producing and consuming users to make informed decisions. For producers, it provides information to help better target consumers and identify potential businesses with which to collaborate. The site allows a producer to select consumer attributes and receive a geo-coded response that shows the location of consumers with those attributes. Consumer data related to six different demographic characteristics can be mapped to locate markets. Full census profiles for geographic markets can also be generated.

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A second feature on the website includes business data that allows producers to identify other potential supply chain partners. Since this data is also geo-coded, the user can find potential business partners that are best situated to serve their intended markets. The mapping feature makes MarketMaker an intuitive vehicle for gathering the marketing data necessary to launch a new value-added venture.

For consumers—households, processors, handlers, retail, and wholesale companies—MarketMaker provides information about where to purchase products or to identify upstream opportunities for adding value before final sale.

Since market systems are rarely defined by state boundaries, a logical progression for the state-level project was to expand to other states. There are 18 states that have launched MarketMaker sites including Illinois, Iowa, Nebraska, Kentucky, New York, Georgia, Mississippi, Michigan, Ohio, Indiana, South Carolina, Colorado, Arkansas, Florida, Pennsylvania, Louisiana, Alabama and Washington, D.C. Several other states are also considering development of a state site. To date, the MarketMaker site includes nearly 17,500 profiles of food-related enterprises—including 7,698 producers—and receives about 1 million hits per month from over 86,000 food industry entrepreneurs.

As the MarketMaker network grows and develops a historical track record, so does the need to formally track the financial, economic, and other benefits to participants. Hence, the main goal of this article is to summarize the results of a survey that assesses the current and potential benefits obtained by agricultural producers¹ using MarketMaker. This information is necessary *to ensure the most efficient allocation of resources dedicated to its support and development*. Entities in the states where MarketMaker is not yet present may also find this information useful as they make decisions regarding allocation of funds to support their clientele.

Parametric and nonparametric methods were proposed to estimate the mean of a variable when its actual value is observed to take a particular value (usually zero) or to fall in a certain interval on a continuous scale. These procedures were necessary since several of the variables in the survey were collected using a discrete number of categories in order to simplify the respondent's task and to encourage response.

Literature Review

Agricultural producers' use of computers and the Internet have increased in recent years. In 2009, 59% of U.S. farms had Internet access and 64% had access to a computer, compared to 29% and 47% in 1999, respectively (USDA-NASS, 2009). One of the potential applications of computers and the Internet in agriculture is e-commerce, which refers to the use of the Internet to market, buy and sell goods and services, exchange

¹ Agricultural producers include both farmers and fishermen.

information via Internet, and create and maintain web-based relationships between participant entities (Fruhling and Digman, 2000).

E-commerce has been said to have the potential to both increase sales, as well as to significantly decrease costs through greater efficiencies of operation. Gains in efficiency could result from the reduction of inventory levels, transportation costs, information costs, and order and delivery times (Batte and Ernst, 2007; and Montealegre, Thompson and Eales, 2007). Moreover, the creation of electronic markets that are expected to be more transparent and competitive than physical markets may attract more consumers and, thus, increase demand and improve the firm's strategic position with customers seeking specific niche products or having geographical restrictions (Batte and Ernst, 2007; and Montealegre, Thompson and Eales, 2007).

In spite of the touted potential of e-commerce to improve profits in agriculture, the literature on the economic impact of e-commerce is very limited. Most of the literature related to the use of computers and the Internet has focused on describing and analyzing the extent of adoption and usage by agribusinesses (USDA-NASS, 2009; and Batte, 2004).

Some research efforts have also concentrated on specific ways farmers use the Internet. According to USDA-NASS (2009), 36% of farms in the United States used computers for farm business, 13% purchased agricultural inputs over the Internet, and 11% used the Internet to conduct marketing activities. The main use of the internet by farmers seems to be related to the exchange of information. Park and Mishra (2003), using the data from the 2000 Agricultural Resource Management Survey (ARMS), found that 83% of U.S. farmers used the internet for price tracking, 56% used it to access agricultural information services, and other (percentage not reported) used the Internet to keep records and transmit data to clients. Similarly, Smith *et al.* (2004)—in a study of 517 farmers in the Great Plains states of Kansas, Iowa, Nebraska, and Oklahoma—found that most of the surveyed farmers used the Internet as a source of information. Specifically, the study reported that 62% of surveyed farmers used the Internet to obtain information on commodity markets, 54% used it to gather technical information on inputs, 36% to retrieve financial information, 73% to collect weather information, and 37% to obtain information on agricultural policy.

Use of the Internet to buy and sell products appears to be less common. Briggeman and Whitacre (2008), using 2005 ARMS data, found that only 6.6% of U.S. farmers used it to purchase farm inputs. Reasons for this unwillingness to buy online could have included quality and service concerns, as well as the fact that the difference in input prices between physical and electronic purchases was not significant (Batte and Ernst, 2007).

Less is known about adoption and use of computers and the Internet by other types of agribusinesses such as input and service providers. However, there is some evidence indicating that rates of adoption and use among them is higher compared to agricultural producers. For example, Ehmke et al. (2001) showed that, as early as 2000, 79% of surveyed agribusinesses comprising farm equipment and service companies in Ohio had Internet access and 16% were selling via the Internet.

In terms of research efforts evaluating the effectiveness of specific e-commerce platforms, we are aware of only two state-level efforts that focus on the impact of MarketMaker for agribusiness operations in Ohio and New York. Fox (2009) developed and implemented a survey of various representatives of Ohio's food chain, including producers, processors, wineries, farmers' markets, and distributors. One of the objectives of the project was to explore changes in marketing practices and market access that resulted from the use of MarketMaker. The survey asked Ohio registered producers if they considered that the MarketMaker site was helping keep more food dollars in the regional economy. Sixty-three percent of producers agreed with the statement. Cho and Tobias (2009) conducted a survey of New York farmers registered on MarketMaker. Survey results indicated that the average increase in annual sales attributed to MarketMaker was between \$225 and \$790. Additionally, 12% of the respondents reported receiving marketing contacts through MarketMaker and using the MarketMaker directory to contact other food industry business partners.

Overall, as the literature review shows, rates of adoption and use of computers and the Internet by U.S. agribusinesses continue to increase; however, the development of e-commerce has been relatively slow and mainly limited to the exchange of information. Studies evaluating the effectiveness of agricultural e-commerce platforms such as MarketMaker are very limited.

Survey Description

To study the impact of MarketMaker, agricultural producers previously registered on the site were surveyed during the months of May and June 2011. The survey instrument was based on logic models² developed by Lamie et al. (2011). Survey development efforts were led by a Clemson University team of researchers working closely with MarketMaker administrators in each state. Final survey instruments were approved by the MarketMaker National Evaluation Committee and the MarketMaker Policy Advisory

² Logic models are graphical depictions of the linkages among a project inputs and outputs. Logic models are used as planning and evaluation tools. A detailed description of logic models development and use can be found in W. K. Kellogg Foundation (2004). Applications of logic models in the academic literature are found in areas such as agricultural technology transfer (Framst, 1995), research and development (Jordan and Mortensen 1997), and industrial modernization (Torvatn, 1999).

Committee. The survey was distributed by email to 4,264 producers³ registered on MarketMaker websites in 14 participating states: Illinois, Iowa, Nebraska, New York, Georgia, Mississippi, Ohio, Indiana, South Carolina, Colorado, Arkansas, Florida, Louisiana, and Washington, D.C.

The questionnaire was divided into four sections. The first section focused on users' experiences with MarketMaker. Section 2 concentrated on participants' perceptions regarding the impact of MarketMaker on their business. The third section asked respondents about their demographic characteristics, as well as business characteristics. Finally, Section 4, which was only applied to producers participating in direct-marketing channels, focused on the impact of MarketMaker on direct marketing.

An invitation email containing a brief description of the project and the link to the questionnaire was sent to all agricultural producers from the participating states. The invitation email clearly reflected the support of the local MarketMaker leaders and administrators. Two reminder emails (one and two weeks after the initial email) were sent to those individuals who had not responded to the survey. To further encourage participation in the survey, respondents were offered the opportunity to enter a drawing to win \$100. Typical completion time of the questionnaire was 5-10 minutes.

The overall response rate of the survey was 7.1% and it generated 304 usable observations. As found in Hamilton (2003) meta-study of 199 online surveys, online survey response rates tend to be low (13.4% average response rate in their study). The sample frame size, number of respondents, and response rate by MarketMaker participant state is shown in Table 1. The states with the highest response rates were Florida (17.5%) and Louisiana (11.5%), and those with the lowest response rates were the District of Columbia (0.0%)⁴ and Nebraska (3.7%).

Estimation of the Means

In order to simplify the respondent's task and to encourage a response, most of the demographic and business information, as well as outcome measures (e.g., number of new contacts found through MarketMaker) were collected using a discrete number of categories, hence the calculation of the mean value of these variables required the use of special statistical techniques (Bhat, 1994; Carpio, Wohlgenant, and Safley, 2008; and Stewart, 1983). In addition to serving as a summary statistic of the variables, mean values of the outcome measures were required, for example, for the calculation of the economic impact of the MarketMaker website at the aggregate level (state and national).

³ Ninety seven percent of producers registered on the website are farmers, 1% are fishermen, and 2% are both farmers and fishermen.

⁴ The frame size in Washington, D.C., only includes six producers

Table 1. Survey Sample Frame Size, Number of Respondents, and Response Rate by State

State	Sample Frame Size	Number of Respondents	Response Rate
<i>Arkansas</i>	45	3	6.67
<i>Colorado</i>	485	28	5.77
<i>District of Columbia</i>	6	0	0.00
<i>Florida</i>	143	25	17.48
<i>Georgia</i>	260	16	6.15
<i>Illinois</i>	737	42	5.70
<i>Indiana</i>	323	31	9.60
<i>Iowa</i>	326	26	7.98
<i>Louisiana</i>	148	17	11.49
<i>Mississippi</i>	93	7	7.53
<i>Nebraska</i>	328	12	3.66
<i>New York</i>	753	49	6.51
<i>Ohio</i>	361	35	9.70
<i>South Carolina</i>	256	13	5.08
<i>Total</i>	4,264	304	7.13

In this section, we present two alternative approaches used for the estimation of the mean values: a parametric and nonparametric approach. The parametric approach was adapted from the literature on the estimation of equations using data in which the dependent variable is only observed to fall in a certain interval (Stewart, 1983; and Bhat, 1994). The nonparametric procedure was adapted from the survival statistical literature (Turnbull, 1976) and the contingent valuation literature (Day, 2007).

We denote the true (but unobserved) variable of interest for the i^{th} individual is y_i . The probability that y_i is in the k^{th} interval⁵ with boundary values of $A_{(k-1)}$ and A_k , is given by:

$$(1) \quad P(A_{(k-1)} \leq y_i \leq A_k) = F(A_k) - F(A_{(k-1)}) \quad i = 1, 2, \dots, N,$$

where $F(\cdot)$ is the underlying probability distribution of variable y (Day 2007; and Turnbull 1976).

The probability of observing a particular set of responses in a random sample of N individuals from the population of interest is then given by the likelihood function:

$$(2) \quad L = \prod_{i=1}^n F(A_k) - F(A_{(k-1)}).$$

In order to express the likelihood function in terms of all interval options available to the respondent, we create a dummy variable d_{ik} which indicates whether an individual chooses the k^{th} interval among K options. Using this indicator variable and the generic likelihood function in (2), the resulting log-likelihood function is:

$$(3) \quad \ln L = \sum_{i=1}^N \ln \sum_{k=1}^{K+1} d_{ik} [F(A_k) - F(A_{(k-1)})].$$

Parametric Procedure

The parametric procedure used for the estimation of the mean of y assumes that the variable follows a normal distribution with mean μ and variance σ^2 . Consequently, the log-likelihood function can be written as:

$$(4) \quad \ln L = \sum_{i=1}^N \ln \sum_{k=1}^{K+1} d_{ik} \left[\Phi \left(\frac{A_k - \mu}{\sigma} \right) - \Phi \left(\frac{A_{(k-1)} - \mu}{\sigma} \right) \right],$$

where $F(\cdot)$ in equation (3) has been replaced by the cumulative standard normal $\Phi(\cdot)$. Parameter estimates for μ and σ can then be obtained by using the maximum likelihood estimation procedures. Since in some of the cases the first "interval" option offered to the respondents was zero, the term $\ln \sum_{k=1}^{K+1} d_{ik} \left[\Phi \left(\frac{A_k - \mu}{\sigma} \right) - \Phi \left(\frac{A_{(k-1)} - \mu}{\sigma} \right) \right]$ needs to be replaced by $\ln \phi \left(\frac{\mu}{\sigma} \right)$ for those respondents who selected this interval option (e.g., number of contacts in Table 4).

Parameter estimates obtained in equation (4) can also be used to estimate the conditional mean of the unobserved y_i^* using (Stewart, 1983):

$$(5) \quad E(y_i | y_i \in \text{kth interval}) = \mu + \sigma \left[\frac{\phi \left(\frac{A_{(k-1)} - \mu}{\sigma} \right) - \phi \left(\frac{A_k - \mu}{\sigma} \right)}{\Phi \left(\frac{A_k - \mu}{\sigma} \right) - \Phi \left(\frac{A_{(k-1)} - \mu}{\sigma} \right)} \right] \quad i = 1, 2, \dots, N.$$

Notice that the previous literature using data in which a variable is only observed to fall in a certain interval has focused on two main issues: 1) the imputation of the values of the unobserved variable for each respondent, and 2) the analysis of the effect of explanatory variables on the conditional mean of the unobserved variable. In contrast, the objective of our analysis is the estimation of the mean of the marginal distribution of the variable of interest.

Nonparametric Procedure

Estimation of the mean of the variables of interest was also carried out using the nonparametric approach for interval-censored data proposed by Turnbull (1976). This technique does not impose ad hoc assumptions about the probability distribution of the variable of interest y . This is important since several of the variables analyzed in this study are likely not normally distributed and it is unknown to what extent the normal approximation is appropriate.

Given that the probability distribution of y (F) is unknown, Turnbull's procedure considers each $F_k = F(A_k)$ as a parameter to be estimated. Moreover, in order to ensure that the likelihood estimates define a valid cumulative distribution function, the estimation algorithm needs to be expressed as a constrained maximization problem of the form:

$$(6) \quad \text{Max}_F \ln L(F|d) = \sum_{i=1}^N \ln \sum_{k=1}^{K+1} d_{ik}(F_k - F_{(k-1)})$$

$$\text{Subject to: } 0 = F_0 \leq F_1 \dots \leq F_{K+1} = 1.$$

Since (6) is strictly concave, the F_k estimates are unique. Estimation is then carried out using Turnbull's self-consistent algorithm (Day, 2007; Gomez, Calle, and Oller, 2004; and Turnbull, 1976). The expected value of y can thus be written as (Haab and McConnell, 1997):

$$(7) \quad E(y) = \int_0^{A_K} y \cdot dF(y) = \sum_{j=1}^M \int_{A_{k-1}}^{A_k} y dF(y).$$

Replacing y by the lower or upper bound of each interval, it can be shown that the lower (LB) and upper bound (UB) estimates of the expected value of y ($E(y)$) are:

$$(8) \quad E(y_{LB}) = \sum_{k=1}^{K+1} A_{k-1} (F_k - F_{(k-1)})$$

$$(9) \quad E(y_{UB}) = \sum_{k=1}^{K+1} A_k (F_k - F_{(k-1)})$$

Hence, the drawback of using the nonparametric procedure is that it generates upper and lower bounds of the mean of the distribution rather than a unique point estimate. Maximization of the log-likelihood functions was performed using the computing software Matrix Laboratory (MATLAB).

Results

The results section includes summary statistics for respondent characteristics, summary statistics concerning MarketMaker registration and use, as well as producer perceptions about the impact of MarketMaker. This section also includes a brief discussion about the relationships between MarketMaker outcomes and some characteristics of the use of the MarketMaker website by producers. For the categorical variables, we mainly used the estimated parametric mean in the discussion of results. A short discussion about the difference between the parametric and nonparametric means estimates is presented at the end of the section.

Characteristics of Respondents

Survey results indicate that nearly 94% of the respondents were the owners or the managers of the business. This finding gives more credibility to their answers concerning the characteristics of the operation and the impact of MarketMaker on their business performance. Forty-nine percent of respondents were female. This percentage is higher than that reported by operators interviewed in the 2007 Census of Agriculture which possibly has to do with the fact that women are the dominant users of computers on family farms (Mackrell, 2006). On the other hand, the average age of the survey respondents was 53 years which is consistent with the U.S. Census of Agriculture data (54.9 years) (USDA-NASS, 2009).

Regarding characteristics of the business, survey respondents indicated that their operations generate, on average, about \$152,500 in total annual sales (versus \$134,806 for the U.S. census), and that income from their business activities represents 38.9% of the individual's total family income compared to 28% for the average U.S. farmer

(USDA-NASS, 2009). Table 2 presents a complete description of the key variables describing respondent and business characteristics.

MarketMaker Registration and Use

Most of the agricultural producers responding to the survey (73%) indicated they had registered on the site by themselves, 7% indicated they were registered by someone else, and 20% did not know how they became enrolled in MarketMaker. This finding may be explained by the fact that, in some states, sometimes producer lists provided by state departments of agriculture were used to initially populate their MarketMaker databases.

On average, respondents have been registered on the site for 20 months. About 33% of respondents have been registered for less than 12 months, 40% have been registered between 12 and 24 months, and 27% have been registered for more than 24 months (Table 2). Producers reported various degrees of intensity with respect to the use of MarketMaker features (see Table 3). The features that were most commonly used (sometimes and frequently) are the "log on to check or update profile" (24% of users), "search for products" (26%), and "search for buyers and sales opportunities" (25%). Less commonly used features included "search for business partnerships" which was used sometimes or frequently by about 17% of users; "use the buy/sell Forum," a relatively new feature introduced in 2010 (15%); and "find target market for your products" (13%). This table also stands to imply that about 42% of registered producers could be considered as non-users of MarketMaker, 37% were passive users, 18% average users and only 3% were active users. Thus, efforts should be made to encourage more active use of the website by registered producers.

In relation to the time devoted to the website, producers registered on MarketMaker spend about 23 minutes per month managing their account, with nearly 82% of the producers devoting less than 30 minutes per month on MarketMaker-related activities (Table 2). Producers were also asked about the type of customers they intended to reach with MarketMaker. Survey results indicate that 82% of agricultural producers use the MarketMaker website to reach individual consumers, 30% to connect with business buyers, and 10% to contact other producers. Hence, even though a lot of effort by the MarketMaker administrators has been devoted to promote business-to-business activities on the site (Lamie et al., 2011), producers still perceived MarketMaker mainly as a tool to reach individual consumers.

Table 2. Description and Summary Statistics of Respondents Characteristics

Variable Name (Units)	Category	Category Proportion	Mean		Std. Dev.
			Nonparametric lower and upper bounds	Parametric	
<i>Relationship with the business</i>	Owner	86.04			
	Manager	7.79			
	Employee	4.22			
	Other	1.95			
<i>Gender</i>	1=Female	0.49		0.51	0.25
	0=Male	0.51			
<i>Age</i>				52.93	12.81
<i>Total annual sales (\$1,000)</i>	Less than \$10	37.09	(123.66, 262.32)	151.5	267.9
	\$10 to \$50	21.52			
	\$50 to \$100	14.57			
	\$100 to \$250	9.93			
	\$250 to \$500	5.96			
	\$500 to \$1,000	3.97			
	Over \$1,000	6.95			
<i>Share of total family income from farming (%)</i>	Less than 10	34.72	(33.12, 42.60)	38.85	34.40
	10 to 20	13.96			
	21 to 30	8.30			
	31 to 40	4.15			
	41 to 50	6.42			
	51 to 60	3.02			
	61 to 70	2.64			
	71 to 80	4.53			
	81 to 90	5.66			
	91 to 100	16.60			

Table 2. Description and Summary Statistics of Respondents Characteristics (continued)

Variable Name (Units)	Category	Category Proportion	Mean		Std. Dev.
			Nonparametric lower and upper bounds	Parametric	
<i>Time registered on MarketMaker (Months)</i>	Less than 1	1.52	(14.35, 24.38)	20.02	13.02
	1 to 6	13.13			
	7 to 12	18.69			
	12 to 24	39.90			
	24 to 36	16.16			
	36 to 48	7.07			
	more than 48	3.54			
<i>Time spent on MarketMaker activities (Mins/mon)</i>	Less than 30	81.52	(9.77, 41.27)	24.35	22.67
	30 to 60	14.22			
	61 to 120	1.42			
	121 to 300	2.84			

Table 3. MarketMaker Features and their Rate of Use by Producers.

Feature	Never	Rarely	Sometimes	Frequently
Log on to Check or Update Profile (such as adding new information, photos, social media links, business contacts, alerts, etc.)	0.25	0.51	0.22	0.02
Search for Products	0.37	0.37	0.23	0.03
Search for Business Partnerships (e.g., to find other companies to sell products)	0.49	0.33	0.16	0.02
Search for Buyers and Sales Opportunities	0.41	0.35	0.21	0.04
Find a Target Market for Your Products (e.g., using demographic data, food consumption data)	0.48	0.38	0.11	0.02
Use the Buy/Sell Forum	0.55	0.30	0.12	0.03
Other	0.80	0.15	0.03	0.02

Producers' Perceptions about Impact of MarketMaker

Survey questions related to the impact of MarketMaker asked respondents about its perceived impact on the total number of contacts received due to their participation in the site, total number of new customers gained, and the increase in annual sales since producers registered in the website (Table 4). Producers indicated that, as a result of their participation with MarketMaker, they have been contacted, on average, about 2.6 times by customers, input suppliers, and other producers. At the same time, nearly 64% of producers in the sample had not received any contacts due to MarketMaker. However, the proportion of producers who had received marketing contacts through MarketMaker in our sample (36%) is greater than the 12% reported by registered New York producers (Cho and Tobias, 2009).

In terms of the number of new customers gained, respondents indicated that their participation has helped them obtain an average of 1.5 new customers even though 72% of the respondents indicated that they have gained no new customers through the site.

Lastly, survey respondents' perceived average annual increase in sales due to MarketMaker was estimated at about \$121, with 75% of the participants indicating the increase in annual sales was \$25 or less. The overall increase in annual sales due to MarketMaker in the sample was lower than that found by Cho and Tobias (2009) where the average increase in annual sales assisted by MarketMaker reported by New York producers was between \$225 and \$790. This finding may be due to the fact that our sample combined producers from different states that may have had MarketMaker presence for a shorter period of time than New York or it could reflect the success of New York MarketMaker administrators' marketing and training programs.

Since the statistics discussed previously are values across producers with different characteristics, we also present the values of the perceived impacts of MarketMaker across different types of users⁵. Figures 1 to 3 display the perceived number of additional contacts, new customers, and increases in annual sales for groups of users differentiated by the type of registration (Figure 1), time registered in MarketMaker (Figure 2), and time spent on the site (Figure 3). As indicated in the figures, all of the business outcome measures seem to be positively related to self-registration in MarketMaker, the amount of time since registering on the site, and the amount of time users spend on MarketMaker activities. In fact, producers who registered themselves on the MarketMaker website have received, on average, almost twice as many additional contacts and customers than those who were registered by someone else or do not know how they were enrolled in MarketMaker. This finding suggests that more education and promotion of MarketMaker

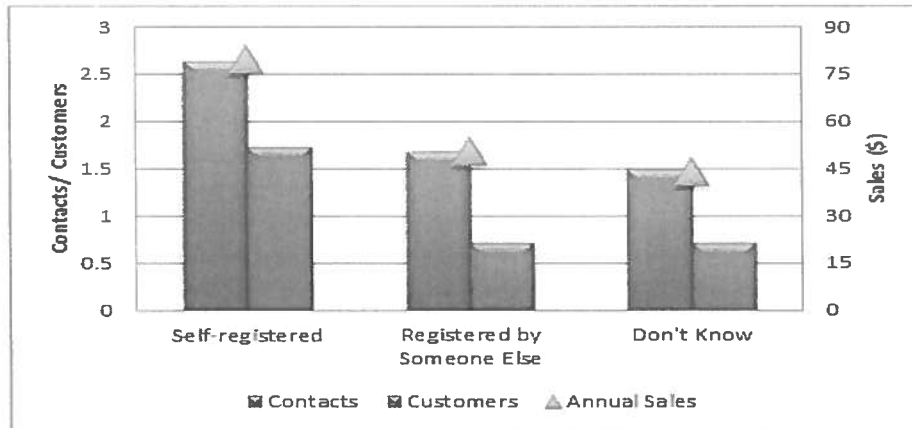
⁵ The number of additional contacts, new customers and increase in annual sales for groups of users in Figures 1 to 3 were calculated using equation (5).

Table 4. Perceived Additional Marketing Contacts, New Customers and Increase in Annual Sales as a Result of Participating in MarketMaker.

Variable Name	Category	Category Proportion	Mean		Std. Dev.
			Nonparametric lower and upper bounds	Parametric	
<i>Marketing contacts</i>	0	63.57	(1.31, 4.35)	2.61	4.78
	1 to 9	28.87			
	10 to 20	5.15			
	21 to 30	2.41			
<i>New customers</i>	0	72.06	(0.89, 2.17)	1.54	3.33
	1 to 5	19.12			
	6 to 10	6.99			
	11 to 20	1.10			
	More than 20	0.74			
<i>Annual sales</i>	Under \$25	75.00	(76.58, 227.97)	121.3	715.61
	\$25 to \$50	6.45			
	\$51 to \$75	2.82			
	\$76 to \$99	4.44			
	\$100 to \$499	7.66			
	\$500 to \$999	2.02			
	\$1,000 to \$4,999	1.21			
	\$5,000 to \$9,999	0.00			
	More than \$10,000	0.40			

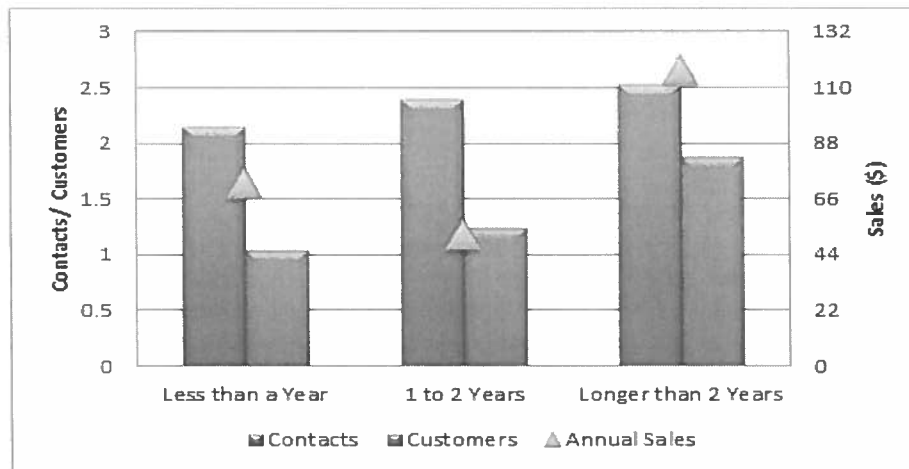
Note: Marketing contacts and new customers refer to the total contacts and customers gained since the producer became registered on the MarketMaker website.

are needed to encourage self-registration. Moreover, as Figure 3 suggests, producers who reported spending between 30 and 60 minutes per month on the MarketMaker website had an average annual sales increase of \$242 compared to only \$32 for those users who spent less than 30 minutes a month on MarketMaker-related activities. This finding suggests that MarketMaker state and national leaders should encourage producers to become more active users of MarketMaker to achieve the desired benefits from participation.



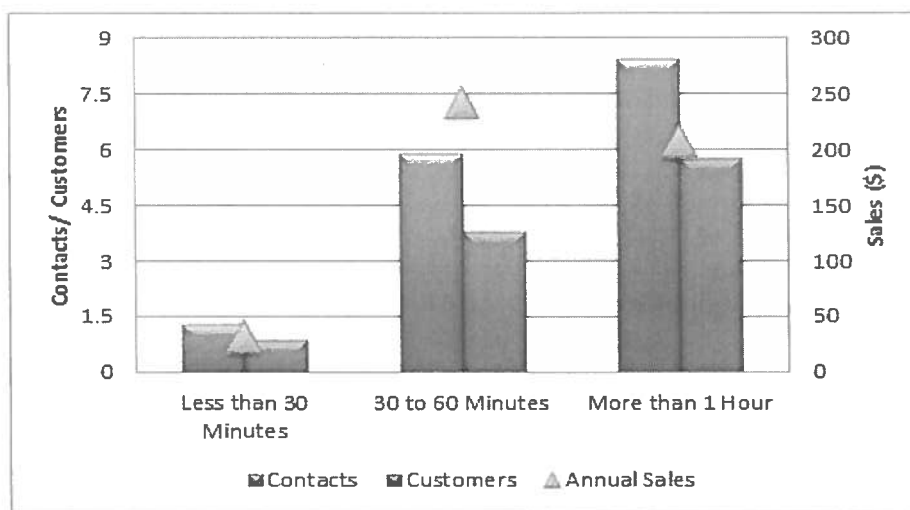
Note: Marketing contacts and new customers refer to the total contacts and customers gained since the producer became registered on the MarketMaker website.

Figure 1. Perceived Additional Marketing Contacts, New Customers and Increase in Annual Sales due to MarketMaker by Registration Type.



Note: Marketing contacts and new customers refer to the total contacts and customers gained since the producer became registered on the MarketMaker website.

Figure 2. Perceived Additional Marketing Contacts, New Customers and Increase in Annual Sales due to MarketMaker by Time Registered in MarketMaker.



Note: Marketing contacts and new customers refer to the total contacts and customers gained since the producer became registered on the MarketMaker website.

Figure 3. Perceived Additional Marketing Contacts, New Customers and Increase in Annual Sales due to MarketMaker by Time Spent (Monthly) on Activities Associated with MarketMaker.

MarketMaker Impact on Direct Sales

The optional section for those producers participating in direct marketing channels—to consumers or wholesale buyers—was completed by 267 agricultural producers which corresponds to about 88% of the total respondents. Forty-eight percent of this group of respondents participated in direct marketing to individual consumers, 4% in direct marketing to wholesale buyers, and 48% participated in direct marketing to both individual consumers and wholesale buyers.

Survey respondents indicated that, as a result of their participation with MarketMaker, they have received, on average, a total of 1.9 additional marketing contacts seeking information about their direct market activities, but the majority of surveyed producers (63%) indicated that they have not received any additional marketing contacts through MarketMaker. Average annual increases in direct sales due to participation in MarketMaker was 0.7% (76% of the sample experienced no increase in this type of sales) and 1.2% (85% of the sample experienced no increase in this type of sales). Therefore, as in the case of the overall impact of MarketMaker on all business activities, the impact of the site on direct marketing activities seems to be perceived by producers as relatively

modest so far. A detailed description of the impact of MarketMaker on participants' direct marketing channels is shown in Table 5.

Table 5. Perceived MarketMaker Impact on Direct Marketing Activities.

Variable Name	Category	Category Proportion	Mean		Std. Dev.
			Nonparametric lower and upper bounds	Parametric	
<i>Marketing contacts</i>	0	62.87	(1.33, 3.14)	1.93	3.87
	1 to 5	24.55			
	6 to 10	8.38			
	11 to 20	2.99			
	More than 20	1.20			
<i>Increase in annual direct sales to individual consumers</i>	0%	76.21	(0.66, 1.75)	0.74	1.83
	1% to 5%	18.15			
	6% to 10%	3.63			
	11% to 20%	1.61			
	21% to 40%	0.40			
<i>Increase in annual direct sales to wholesalers</i>	0%	84.56	(0.96, 2.02)	1.17	5.20
	1% to 5%	8.09			
	6% to 10%	4.41			
	11% to 20%	1.47			
	21% to 40%	0.74			
	Over 40%	0.74			

Note: Marketing contacts refers to the total contacts gained since the producer became registered on the MarketMaker website.

Parametric vs. Nonparametric Mean Estimation

Two important points need to be noted regarding the estimation of the parametric and nonparametric means of the variables elicited and reported in intervals. First, the parametric estimate of the mean of every categorical variable was contained in the interval formed by the lower and upper nonparametric estimates of the mean (see Tables 2, 4, and 5). Second, results of the nonparametric analysis indicated that the estimated \hat{F}_k values could be calculated using the "raw" proportions of observations belonging to each category. For example, for the variable total annual sales in Table 2, $\hat{F}_1 = 37.09$ and $\hat{F}_2 = 37.09 + 21.52 = 58.61$. Hence, this result suggests that the nonparametric upper and lower bound of the mean of the distribution can be estimated simply using the raw proportions of the summary data without having to optimize equation (6). However, more research is needed to formally prove this empirical finding.

Summary and Conclusions

Although e-commerce is expected to improve agricultural profits, literature on the potential economic impact of e-commerce is very limited. In this study, we present the results of a survey that investigated the impact of the MarketMaker website on the business performance of agricultural producers. This paper also introduces econometric modeling innovations for the use of parametric and nonparametric procedures for the estimation of the distribution mean of a variable (continuous or discrete) that is only observed to fall in a certain interval. In our context, the calculation of the mean values of the distribution was important for the estimation of aggregate impacts across all site users.

MarketMaker intends to provide marketing information to both producers and consumers in order to facilitate their market interactions. However, survey results indicate that the perceived impact of MarketMaker on various business outcomes—sales, new customers, and marketing contacts—are presently relatively modest. The results of this study also show that the effectiveness of MarketMaker is strongly linked with how it is used by producers. For example, producers who registered themselves on the MarketMaker website have received, on average, almost twice as many additional contacts and customers than those who were registered by someone else or do not know how they were enrolled in MarketMaker. Hence, the best approach to "sell" the site is to actively promote it directly to producers instead of adding names from previously constructed producer lists. Another interesting finding is the positive relation between the amount of time spent on the site and the perceived impact of MarketMaker. The challenge is that only about 21% of producers seem to be average or active users of

MarketMaker. On average, producers don't spend enough time on activities associated with MarketMaker (23.3 minutes per month) to gain its full benefits. Therefore, the average impact of the website has been moderate so far.

As a result of their participation with MarketMaker, producers have received an average of 2.6 marketing contacts, and have gained an average of 1.5 new customers. Additionally, MarketMaker has assisted farmers and fishermen in increasing their annual sales by an average of \$121. Individual consumers are the main type of customers targeted through MarketMaker activities.

Nearly 88% of producers registered on MarketMaker participate in direct marketing to individual consumers and wholesale buyers. MarketMaker has helped these producers receive an average of 1.9 marketing contacts seeking information about their direct-market activities. Also, due to participation in MarketMaker, producers have increased their annual direct sales to individual consumers by 0.7% and to wholesale buyers by 1.2% on average.

Since these findings are based on the survey questions that only reflect perceived impacts, it is not certain to what extent these perceptions reflect reality. For example, MarketMaker does not currently allow buying and selling of products through the website, thus the only approach to obtain sales data is through producer surveys. In any case, producer support for the site will likely be based on its perceived impact on their businesses; hence, it is recommended that MarketMaker state and national leaders more actively seek to improve their visibility and perceived impact. For instance, MarketMaker could encourage customers—maybe through using coupons—to mention the website in their interaction with producers.

As the logic models developed by Lamie et al. (2011) indicate, the development of the MarketMaker website is a necessary, but not sufficient condition for the success of MarketMaker. Marketing, promotion, and training that integrate MarketMaker into a broader strategic decision-making context for users is also needed. As states consider the adoption of MarketMaker, they should consider providing dedicated resources not only for site development and maintenance, but also for programmatic development and delivery. This will require some combination of state-level reallocation of existing resources or identification of new resources to deliver more directed training and promotion.

In addition, MarketMaker website development should focus on encouraging initial registration by users themselves and on providing good reasons for users to return to the site to benefit from the additional features that MarketMaker offers. Focus groups conducted with MarketMaker users suggest that the current site could benefit from efforts to package carefully selected elements of the current MarketMaker site to specific user groups to make it more "user-friendly" (Lamie et al., 2011). The current configuration of

the site is, perhaps, most useful to user groups that can devote time to the effort. Therein lies a conundrum because household consumers and other direct marketing targets are the least likely to invest time in learning how to use the site, yet producers overwhelmingly hope to use MarketMaker to reach them.

It is important to note that the results of this study are preliminary and a second round of surveys and analyses are expected to be conducted in Fall 2011 to obtain a larger sample of users. Future work with this dataset will also involve an analysis of the relationship between short-term, medium-term (e.g., time spent on the site and use of futures) and long-term outcomes (e.g., increases in sales) using multivariate statistical techniques. The information obtained from this analysis can be useful in identifying the MarketMaker features that are more likely to result in positive, long-term outcomes for producers. Additionally, a willingness to pay (WTP) study will be conducted to obtain an estimate of the overall economic value that registered producers place on the services received from MarketMaker. We believe that the WTP measure will incorporate the value of other benefits of MarketMaker beyond those measured by the metrics presented in this study.

Future work evaluating MarketMaker should compare the results of this study, which uses cross-sectional data, with analyses using longitudinal or panel data in order to better capture the dynamics of MarketMaker users' behaviors (in addition to potential gains in the precision in estimations). In fact, the information generated in this survey can be used as baseline information for these types of future studies.

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