How Much is E-Commerce Worth to Rural Businesses?

Susan Watson, Assistant Professor
O. John Nwoha, Program Associate
Gary Kennedy, Department Head and Associate Professor
Kenneth Rea, Vice President for Academic Affairs

Louisiana Tech University
University of Arkansas
Louisiana Tech University
Louisiana Tech University

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Corresponding Author:
Susan Watson
Department of Agricultural Sciences
Louisiana Tech University
P.O. Box 10198
Ruston, LA 71272
swatson@latech.edu

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Abstract
The probability of a business paying for an e-commerce presence ultimately depends on demographic features, experiences with e-commerce, technological expertise, and knowledge of e-commerce opportunities and limitations. Results allow for the assignment of probabilities associated with various business profiles to determine the willingness to pay for an e-commerce presence.

Key Words: e-commerce, internet, rural businesses, willingness to pay

JEL Classifications: A14, C25, D21, O13, O14, O33, Q16

Increased Internet use has drastically altered the way business is conducted. Current Internet use is 186 million users in the U.S. and 945 million worldwide. In the year 2007, projections for the U.S. and worldwide are 230 million and 1,466 million people, respectively (eTForecasts.com). The U.S. once had almost 90% of worldwide users in the mid-1980's, and has continued to drop through time with the latest drop of approximately 20% in 2004. There are many forces adding to the growth of the Internet in other countries as well as the United States including: web cellular phones, pre-paid Internet access cards, broadband Internet connection, wireless Internet access, e-commerce for mobile devices (M-Commerce), Internet cafes in developing countries, declining Internet service provider rates, bundled services, web appliances and interactive web TV, amongst others (eTForecasts.com).

E-commerce sales are approximately 1.9% of total retail sales (U.S. Department of Commerce) with the greatest revenue stemming from computer hardware, furniture, software, books, music, videos, office supplies, food/beverages, and airlines tickets (Abate and Moser). According to the Nelsen-Net Ratings, who conduct analysis and measurement on Internet audiences, the average American spends 80 minutes on-line at work and 26 minutes on-line at home daily, both spending approximately one minute per web page (Neilsen-NetRatings.com). This is not much time for a business to convince a consumer to make a purchase, much less, allow them to conduct the transaction. E-commerce requires a different methodology than the traditional brick and mortar business to make sales.

E-commerce provides an excellent opportunity for many smaller businesses. Entry costs into the marketplace are lowered allowing businesses to compete on an international forum (Dutta and Evrard; Poone and Swatman; and Webb and Sayer). Many new electronic businesses have developed because of this potential (Motiwall and Khan). Successful businesses have

several features in common. They respond to website features that most consumers prefer, such as stock availability, privacy, customer service, order tracking capabilities, and providing detailed product information (Post et al.). However, three of every four on-line businesses fail in the first two years, indicating a need to develop and administer a strategic business model tailored to an e-commerce platform (Paper, Pedersen, and Mulbery). In rural economies, this failure rate is even higher and it becomes necessary to determine what e-commerce products, educational information, and services are worth to these smaller companies. Recent studies have explored consumers willingness to pay for Internet services, but not the sellers willingness to pay for e-commerce services (Blefari-Melazzi, Di Sorte, and Reali; Chellappa and Shivendu; Jiang; Lee, Park, and Kim; Sultan; Suri et al.). There is a lack of information and understanding about what small businesses, particularly rural businesses, would be willing to pay for this opportunity to overcome geographic handicaps and compete with larger companies.

An ongoing USDA Fund for Rural America, Rural Community Innovation project, called the Delta E-Commerce Connection (DECC), is creating diversified economic opportunities over a four-year period for small agricultural and other rural businesses in the Lower Mississippi Delta by assisting in e-commerce business development. The project offers seminars, featuring a set of three educational training modules that relate e-commerce to rural entrepreneurs in a practical fashion. In addition, technical support in website development, developing an Internet marketing strategy, electronic retailing services, and space on a secure server are provided to selected rural businesses for a period of one year. Businesses retaining websites after this time assume responsibility for maintaining and funding their site. During the DECC seminars, the cost structure of e-commerce has always been a topic of great interest for participants. Due to the lack of information and understanding about businesses willingness to pay for e-commerce

products in rural areas, a survey was developed to gauge the value participants placed on the new opportunity. Specific objectives were to determine what representative businesses from Louisiana would pay for a seminar offering information about e-commerce and a bundle of goods including technical assistance for building an e-commerce website and tutoring in the technical skills used to develop and maintain their own website. Elasticities and marginal effects associated with willingness to pay are measured as well.

Materials and Methods

A survey was conducted of businesses participating in a DECC seminar as those businesses have been exposed to educational material concerning e-commerce. The survey instrument examined whether or not participants would be willing to pay for a bundle of packages, including: a workshop to introduce e-commerce terminologies, advantages of e-commerce, how to market products, how to design a website as well as learning how to maintain a website after it is built. Six choices were randomly assigned to participants with few very low and very high offers to minimize the potential for a thick tail in the distribution beyond the highest offer (Loomis). The choices started at $1,000 and increased in $1,000 increments up to $6,000. The level of technology was assessed with the following options for the participant: no access to the Internet or e-mail; access to Internet and e-mail, but no website; business has an informational website; business has an interactive website; or business has a transactional website. Participants were asked if they were aware of the potential of e-commerce before attending a seminar and their perceived level of difficulty for developing an e-commerce presence. Choices included: impossible, very difficult, somewhat difficult, fairly easy, and very easy. Demographic information such as gender, age, place of residence, and occupation were

gathered. Income, annual sales, and annual profit were also included in the survey to determine if these influenced the willingness of a business to pay for specific e-commerce services.

The survey was administered through the mail according to the Tailored Design Methods (Dillman). Contact was first made by mail and e-mail in the form of a pre-notice letter. The pre-notice letter was sent a few days prior to the survey indicating the importance of responding. A cover letter and survey were then sent with a stamped, self-addressed return envelope, followed one week later by a postcard thanking respondents and urging non-respondents to fill out and return the survey. A replacement survey was sent to those not responding to the survey several weeks later. This stimulated another surge of survey responses (Dillman). One-hundred and ninety two surveys were sent out, 126 were returned, a 65.6% response rate, while 93 surveys were filled out completely and deemed usable for the study. Participants were allowed to return blank surveys if they did not want to fill it out or be contacted any further.

The dichotomous choice logit contingent valuation method was used to evaluate willingness to pay using maximum likelihood estimation. Loomis suggests this method to be most appropriate in mail surveys. Alternative methods, such as the open-ended approach, allow the participant to name their own price. This is not the way individuals operate in a market. Instead, the market price is given and the consumer makes a decision to purchase or not based upon the stated price. Another alternative, the iterative bidding process, results in social desirability bias where the consumer will overestimate their willingness to pay to please the interviewer. This method can also be influenced by the price the interviewer starts with (starting point effects), which can influence the final willingness to pay (Loomis). However, the range of prices must be correct as the maximum willingness to pay is inferred with the aid of the logit dichotomous choice model.

The logit model is based on the cumulative logistic probability function which allows all predictions to lie on the 0-1 interval. The model is specified in equation (1) as:

$$(1)\ E(Y_i) = P_i = CPF(Z_i) = CPF(\alpha + \beta X_i) = \left(\frac{1}{1+e^{-Z_i}}\right) = \left(\frac{1}{1+e^{-(\alpha+\beta X_i)}}\right)$$

Where Y_i is the linear probability model equal to $\alpha + \beta X_i + \varepsilon_i$, P_i is the probability of bid acceptance (Prob($Y_i = 1$)), CPF is the cumulative probability function, β is a vector of parameters, and X_i is a matrix of observations. The log-likelihood function to be maximized is specified in equation (2) as:

$$(2)\ LogL = \sum_{i=1}^{n} Y_i Ln(P_i) + \sum_{i=1}^{n} (1 - Y_i) Ln(1 - P_i)$$

The log-likelihood function is maximized by differentiating the Log L with respect to α and β, setting them equal to zero and solving the equations. The equations are consistent and efficient asymptotically (Pindyck and Rubinfled).

Elasticity measures also report meaningful information concerning the changes in the probability of success when an explanatory variable changes. However, when there are many observations, the average is often used as a summary measure. There is no guarantee that the logit function will pass through the summary measure. Therefore, evaluating every observation with predicted probabilities as weights for the observations can address this limitation (Shazam on-line). The elasticities were calculated in equation (3) according to the following specifications for the k^{th} coefficient:

(3) $$E_{ki} = \left(\frac{\partial \hat{P}_i}{\partial X_{ki}} \right) \left(\frac{X_{ki}}{\hat{P}_i} \right)$$

While the weighted aggregate elasticity is specified in equation (4) as:

(4) $$\overline{E}_k^W = \sum_{i=1}^{n} \hat{P}_i E_{ki} / \sum_{i=1}^{n} \hat{P}_i$$

Marginal utility coefficients allow for the change in an independent variable to reflect on the utility index. The logit model marginal effects are specified in equation (5) as:

(5) $$\partial \hat{P}_i / \partial X_{ki} = \frac{\hat{\beta}_k \exp(-X_i' \hat{\beta})}{\left[1 + \exp(-X_i' \hat{\beta})^2\right]}$$

The chi square test statistic is χ^2 = -2[ln ($L_{unrestricted}$ - $L_{restricted}$) with the degrees of freedom equal to the number of slope coefficients. The null hypothesis is that all slope coefficients are equal to zero, where the sign of the coefficient indicates the direction of the effect of the variable on the probability of bid acceptance (Shazam on-line).

Results

The estimated equation is shown in equation (6) below:

$$(6) Log\left(\frac{\Pr Yes}{1-\Pr Yes}\right) = -1.0467 - .00068\text{Amount} + 0.79803\text{Experience} + 0.21380\text{Aware}$$
$$(-0.40732) \quad (-2.43270) \qquad (2.10300) \qquad (0.21866)$$

$$- 0.29750\text{Difficulty} + 0.07868\text{Gender} + 0.20332\text{Age} + 0.05877\text{Place} - .09372\text{Job}$$
$$(-0.55594) \qquad (0.12220) \qquad (0.65475) \qquad (0.19841) \quad (-0.13118)$$

$$0.08640\text{Income} - 0.60582\text{Sales} + 0.11737\text{Profit}$$
$$(0.34816) \qquad (-2.0774) \qquad (0.37873)$$

The logit model coefficient signs estimated by maximum likelihood give the direction of the effect of the change in the explanatory variable on the probability of bid acceptance. The variable Amount had a negative sign indicating that the larger the bid amount, the smaller the probability of bid acceptance. Other negative coefficient signs included the variables: Difficulty, Job, and Sales. Difficulty was a variable that measured the perceived level of difficulty participants had for developing an e-commerce presence. Therefore, the more difficult the business perceived e-commerce to be, the less likely the participant would accept the bid. A business that perceives e-commerce as difficult may find it hard to justify investing as the probability of success decreases the harder the task appears. The Job variable was divided into blue and white-collar occupations. White-collar workers were less likely to accept the proposed bid. This might be due to the training that most white-collar business owners either currently have or the access they possess with respect to e-commerce and Internet technology. Moreover, most white collar workers are risk averse and more reluctant to invest in a technology with an uncertain outcome. Therefore, they would not be willing to pay as high of a price as those with less access. The Sales variable represented annual sales. Businesses with higher sales had a lower probability of bid acceptance. This could be due to the fact that e-commerce would likely

generate more sales and the businesses less willing to pay having already met that goal. They might have also been skeptical that e-commerce would significantly increase their sales.

The remaining variables coefficient signs were positive including: Experience, Aware, Gender, Age, Place, Income, and Profit. The Experience variable measured on a continuum the current level of technology for the business including the following categories: No access to the Internet or e-mail (level 0); access to Internet and e-mail, but no website (level 1); informational website (level 2); interactive website (level 3); and transactional website (level 4). The more experience the business had with technology, the higher the probability of bid acceptance. This is probably because businesses with the most experience with technology have more information on prices and values for various technology-oriented items. Also, the more technically savvy a business is currently, the easier it is to continue to keep up-to-date with technologies. Therefore, the value to these businesses is greater as they will be able to not only set up an e-commerce presence, but maintain and improve it through time.

A dichotomous question concerning the businesses awareness (Aware variable) of the potential of e-commerce indicated that businesses more aware of the potential of e-commerce were more likely to accept the proposed bid. A business must be able to realize the benefits to match it with the associated costs, which ultimately determine the value to a business. The Gender variable was also a 0-1 variable with 1 representing males. The positive sign indicates that if the business was headed by a male, the probability of bid acceptance would increase. Males are usually more technically-oriented than females, on the average, likely influencing this sign. The Age variable indicates that the older the business owner, the higher the probability of bid acceptance. An older business owner likely has more savings and can invest in e-commerce easier than business owners still getting established.

Place was a variable to determine the population of the town in which the business was located. It was found that the larger the population the more likely the bid would be accepted. Larger areas tend to have more resources available, and therefore their population has access to and can learn more about new technologies faster than smaller, rural communities, with a lack of infrastructure for the latest technologies. Larger population areas are usually early adopters relative to the rest of the United States, due to market access in these areas. The Income variable reflected the annual income for the business owner with higher income levels being more likely to accept the proposed bid. This may be reflective of the lower risk associated with having more money on investing in any one particular idea. Profit was a variable that measured the annual profit for the business where the higher profiting businesses had a higher probability of bid acceptance. The most profitable businesses have already either figured out their niche or are outpacing their competitors in some way. They continue to see the value in this through e-commerce.

The overall significance of the model was assessed using the Likelihood Ratio Test. The null hypothesis that all slope coefficients were zero was rejected at the 10% significance level. The Cragg-Uhler R-square reported was 0.309, while the McFadden R-square was 0.233.

Although, the actual coefficients on the logit model mean very little to economists, weighted aggregate elasticities can be determined to assess magnitudes of change. These measures are reported in Table 1 for all continuous variables. For example, on average, a one percent increase in income gives a 0.16 percent increase in the probability of bid acceptance, holding all else constant. Additional weighted aggregate elasticities can be interpreted in the same way. Marginal effects are also noteworthy and are shown in Table 1. It was found that, on average, a $1,000 increase in income leads to a 0.005 increase in the probability of bid

acceptance, holding all else constant. Dummy variable can be interpreted in the same way. For example, if the participant was aware of the potential of e-commerce, there was a 0.001437 increase in the probability of bid acceptance.

Probabilities can be determined for specific business profiles by inserting the variable values into the logistic probability function. The level of technological progress was determined to be an important variable in determining willingness to pay for e-commerce. Holding all variables at the mean and allowing the Experience variable to change will demonstrate how these probabilities also change. For example, a while-collar, male age 45-54 living in a town under 10,000 with annual income of $40,001-60,000, annual sales of $10,000-$50,000, annual profit of $5,001-$10,000 that perceives that developing an e-commerce presence is somewhat difficult would have different probabilities assigned to various bid amounts depending on their level of experience with technology (Figure 1). Table 2 demonstrates these fluctuations.

The level of annual sales was also determined to have a large influence on willingness to pay for e-commerce. Holding all variables constant except sales demonstrates the variability of the probability function. For example, a while-collar, male age 45-54 living in a town under 10,000 with annual income of $40,001-60,000, annual profit of $5,001-$10,000 that perceives that developing an e-commerce presence is somewhat difficult and has a technology level of 2 (informational website) would have different probabilities assigned to various bid amounts depending on the annual sales of the business (Figure 2). Table 3 demonstrates these fluctuations.

Summary and Conclusions

The data for this study are unique in that they represent rural Louisiana's perception of how much e-commerce assistance is worth to the small, rural business segment of the economy. The analysis shows that certain business profiles are more (or less) willing to pay for e-commerce. Specifically, the probability of a business paying various amounts of money for an e-commerce presence depends on demographic features, experiences with e-commerce, level of technological expertise, and the financial status of the business.

Businesses that have traditionally been less competitive in the marketplace, such as small and rural businesses, have the opportunity to develop a dominant presence in the virtual marketplace. However, this comes with an investment in both time and money. By estimating functions to assign probabilities associated with the willingness to pay for an e-commerce presence, one can forecast the likelihood of certain business profiles paying various monetary amounts for an e-commerce presence. These estimates will likely vary by region. In Louisiana, the willingness to pay was shown to be largely influenced by the current level of technology and annual sales. Positive indicators of increased willingness to pay included more experience, being aware of the potential of e-commerce, male business ownership, older business ownership, larger population areas, and higher annual income and profit levels. Negative indicators of decreased willingness to pay for e-commerce included the perceived level of difficulty with creating an on-line presence, white-collar business owners, and larger annual sales.

The forecasting model can assist rural development facilities in determining which businesses value e-commerce the most and can assist in allocating limited funds. Businesses with the highest probabilities of paying for e-commerce can be identified as prime candidates for assistance services, thereby maximizing benefits to society.

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Table 1. Weighted Aggregate Elasticities and Marginal Effect of Logit Model Variables

Variable	**Weighted Aggregate Elasticity**	**Marginal Effect**
Amount	-1.12170	-0.00005
Experience	1.57870	0.05367
Aware	----	.001437
Difficulty	-0.59964	-0.02001
Gender	----	0.00529
Age	0.53240	0.01367
Place	0.11371	0.00395
Job	----	-0.00630
Income	0.16303	0.00581
Sales	-1.1868	-0.04075
Profit	0.18734	0.00789

Table 2. Probability of Bid Acceptance at Various Levels of Technology

Technology Level	**Bid**							
	$100	**$1,000**	**$2,000**	**$3,000**	**$4,000**	**$5,000**	**$6,000**	**$7,000**
Level 0	0.1380	0.0802	0.0425	0.0221	0.0114	0.0058	0.0030	0.0015
Level 1	0.2623	0.1622	0.0897	0.0478	0.0249	0.0128	0.0066	0.0034
Level 2	0.4412	0.3007	0.1796	0.1002	0.0537	0.0281	0.0145	0.0074
Level 3	0.6369	0.4885	0.3271	0.1984	0.1119	0.0602	0.0316	0.0163
Level 4	0.7957	0.6796	0.5192	0.3547	0.2186	0.1247	0.0676	0.0356

Table 3. Probability of Bid Acceptance at Various Levels of Sales

Level of Sales	**Bid**							
	$100	**$1,000**	**$2000**	**$3000**	**$4000**	**$5000**	**$6000**	**$7000**
$0-$1,000	0.8294	0.7258	0.5740	0.4068	0.2588	0.1509	0.0829	0.0440
$1,001-5,000	0.7262	0.5909	0.4237	0.2723	0.1600	0.0884	0.0470	0.0245
$5,001-$10,000	0.5914	0.4407	0.2863	0.1696	0.0941	0.0502	0.0262	0.0135
$10,001-$50,000	0.4412	0.3007	0.1796	0.1002	0.0537	0.0281	0.0145	0.0074
$50,001-$100,000	0.3011	0.1900	0.1067	0.0573	0.0300	0.0155	0.0080	0.0041
$100,001-$500,000	0.1903	0.1135	0.0612	0.0321	0.0166	0.0085	0.0044	0.0022
$500,001-$1,000,000	0.1137	0.0653	0.0343	0.0178	0.0091	0.0047	0.0024	0.0012
$1,000,001-$5,000,000	0.0654	0.0367	0.0190	0.0098	0.0050	0.0026	0.0013	0.0007
$5,000,0001+	0.0368	0.024	0.0105	0.0054	0.0027	0.0014	0.0007	0.0004

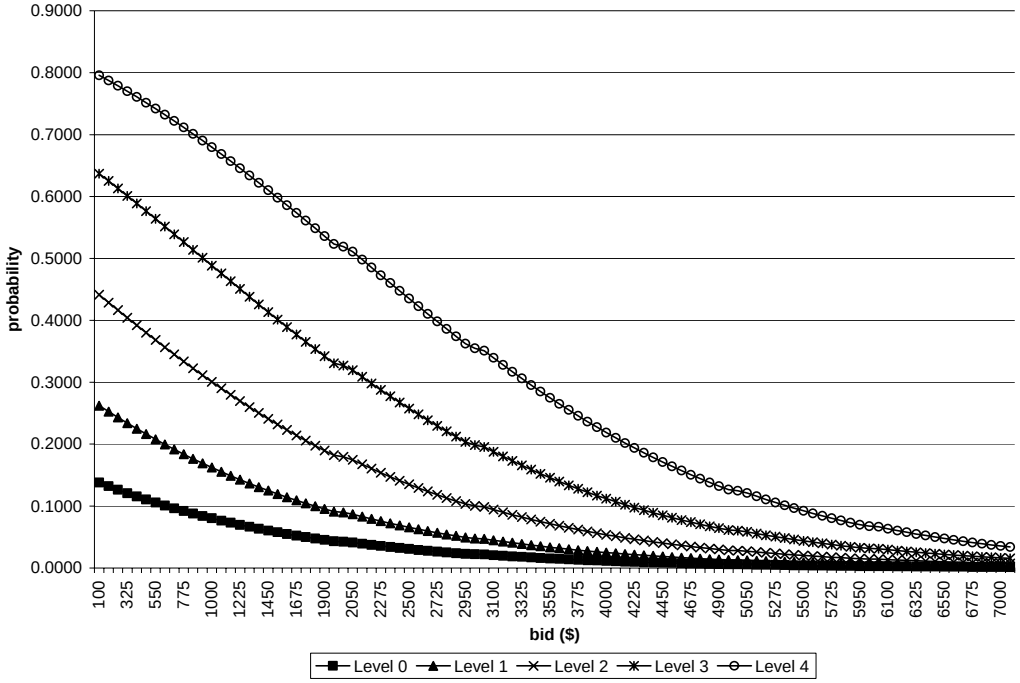

Figure 1. Probability of Bid Acceptance by Technology Level

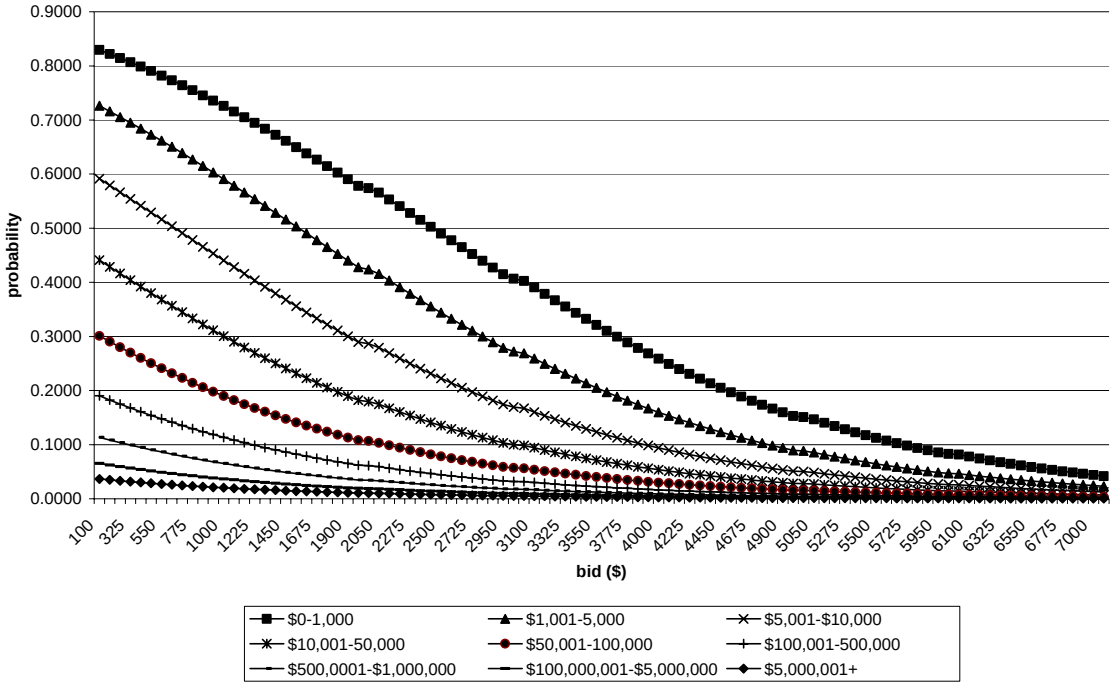

Figure 2. Probability of Bid Acceptance by Level of Annual Sales