Farmer demand for financial record-keeping system attributes

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Abstract

Purpose – The purpose of this paper is to determine which financial record-keeping system farmers use, as well as what system attributes farmers value and to what degree.

Design/methodology/approach – This research uses a choice experiment to examine farmer's demand for attributes of financial record-keeping systems. A sample from the general Michigan farm population is compared to samples from university and agribusiness record system clients.

Findings – Results reveal that university and agribusiness clients are willing to pay considerably more for a farm-specific record system to backstop their farm management decisions.

Practical implications – The results provide an understanding of farmer demands for farm financial record systems and can be used to position record-keeping systems to meet those demands.

Originality/value – This paper describes and analyzes farm financial accounting system use and preferences by type.

Keywords Accounting systems, Financial management, United States of America, Farms, Consumer behaviour, Records management

Paper type Research paper

Modern farm management requires acquiring and processing a great deal of information for decision making. Detailed production data, for example milk or crop yields, can be used to make finely tuned input use decisions to maximize profit. On the financial side, accounting records are used to analyze profitability, solvency and liquidity. Farm financial records are required for federal and state tax-reporting purposes, but greater value may be realized in the information they provide for management purposes (Harsh *et al.*, 1992). Past research has found that the most common records kept by farmers are financial records (Batte *et al.*, 1990). The system chosen will depend on many factors including cost, ease of use and time constraints of the farm managers.

If a farmer utilizes a financial record-keeping system affiliated with a university or a farm business management association, the financial information may be summarized and used to benchmark farm financial performance over time. This summary farm financial information has public good qualities as it can often be used for applied research and outreach purposes. In addition, financial summaries are economic intelligence regarding the viability and competitiveness of agricultural industries. These university programs are often applied research and extension programs that have some degree of public subsidy. Past research has indicated that the subsidy is important in maintaining farm membership (Howard and Filson, 1994). In light of current tight budgets at virtually every level of public funding, these programs are increasingly scrutinized with respect to generating revenue while serving the public interest.

Farm accounting systems can vary widely in form and use from general paper logs to computerized systems. On-farm computerized systems vary from simple cash systems

Agricultural Finance Review
Vol. 71 No. 2, 2011
pp. 259-276

0002-1466
DOI 10.1108/00021461111152609

which are essentially electronic checkbooks to sophisticated cash/accrual systems. Larger operations may forgo an on-farm system altogether and opt for an accounting service. With a large number of computerized farm financial record-keeping systems available today, some agriculture-specific systems have been struggling to identify appropriate market segments and attributes that meet farmer demand. Declining numbers of commercial farms mean that total potential quantity demanded is also declining over time. In addition, some general accounting systems that apply to small businesses of all types can spread the system costs and thus, charge a lower price than farm-specific systems. Farms managers need not adopt financial accounting systems specific to agriculture as alternative systems that are cash or cash/accrual systems are widely available at a lower cost than farm-specific software. The potential advantages of farm-specific software include, for example, incorporated knowledge of farm tax law and farm-specific charts of accounts. University extension services in many states support or license software for financial analysis – although these programs are less common than in the past as the consolidation of agriculture and declining university budgets have eliminated many of these programs. Similarly, some agribusiness firms offer software, support, analysis and consulting along with farm financial record-keeping systems. Many of the attributes of the farm-specific accounting systems are related to providing information for management decisions, enhancing convenience of use, reducing transactions costs or increasing the efficiency of other factors of production. For example, accrual accounting readily provides the solvency position of the farm business at a given time. The same information with a cash accounting system would require additional effort to track, for example, inventories and accounts payable and receivable. The accrual system requires more work up-front but is easier to withdraw information from later. Other accounting system aspects may include customer support or service to answer farm accounting questions. By providing such services, universities and agribusiness firms may be able to extract a higher fee.

Past research has examined how accounting system and financial management affect farm performance (Gloy *et al.*, 2002; Gloy and LaDue, 2003). Marcellino and Wilson (2006) found that farmers viewed their records as extremely valuable. However, no one has examined the demand for farm financial record-keeping systems as a function of the system attributes. The primary goal of this research was to understand the potential market for farm financial record-keeping systems. Specific objectives included determining which financial record-keeping system attributes farmers value and to what degree. With respect to the university or agribusiness that is offering these systems, understanding these issues help to reveal whether a market exists and will continue to exist in the future and how they can compete for a share of this market. For agribusinesses competing in these markets, this information can help them make profit-maximizing decisions and efficiently provide demanded goods and services. For land-grant universities with a long history in farm accounting extension and related applied research programs, this information can assist in decisions regarding asset use in a time of severely declining budgets.

We examine the value and tradeoffs in computerized farm financial system attributes using a survey of Michigan farmers. As part of the survey, farmers completed a series of demand-revealing choices in simulated farm financial system choice scenarios. These simulated market experiments (frequently referred to as choice experiments) required participants to select between alternative record-keeping systems possessing

different attributes. Survey techniques that permit the screening of different product attributes can provide valuable information about the nature of demand (Cameron and James, 1987). Choice experiments allow one to examine attributes and combinations that do not currently exist on the market (Jayne *et al.*, 1996; Rubey and Lupi, 1997; Tonsor *et al.*, 2005). This method has been increasingly applied to agribusiness managerial decisions (Lusk and Hudson, 2004). Recent choice experiment literature has, for example, investigated adoption of or participation in industry programs (Norwood *et al.*, 2006), and determined values associated with situation-specific attributes, such as preferences for contract or program design (Roe *et al.*, 2004). Choice experiment results must be carefully considered in light of hypothetical bias. Loureiro *et al.* (2003, p. 53) examined the utility of stated preferences to measure actual behavior and concluded that "[. . .] consumers' stated preferences are effective in predicting actual market behavior." Others have reached similar conclusions about the accuracy of choice experiments (Cummings *et al.*, 1995; Rubey and Lupi, 1997; Blumenschein *et al.*, 1998). Also, we note that choice experiments are widely used in marketing (Louviere *et al.*, 2000) and the kinds of tradeoffs respondents face in choice experiment methods have some advantages over other stated preference methods for estimating willingness to pay (WTP) (Boxall *et al.*, 1996). We apply stated preference methods to computerized farm financial record systems to understand demand. Our results provide an understanding of farmer demands for these systems and can assist in positioning record-keeping systems to meet those demands.

The paper proceeds as follows. First, we explain the survey samples and instrument. The focus is on the hypothetical choice experiment that is used to derive demand for the financial record-keeping system attributes. Then the underlying Lancasterian utility model and estimation methods are presented. Survey results are presented in the next sections with the farm operation, operator and current financial system characteristics followed by the choice experiment results. The paper concludes with a discussion of the implications for farm financial accounting systems.

Survey development and implementation

In order to assess the current use and potential demand for farm financial record-keeping systems, a mail survey was distributed to a total of 2,742 Michigan farms in February 2009. Three distinct groups were surveyed: clients of Michigan State University's farm financial record program (university), clients of a large Michigan-based agribusiness (agribusiness) and a random sample of Michigan commercial farming operations. The survey was sent to the complete list of university ($n = 427$) and agribusiness ($n = 501$) clients. In addition, to compare to the general farm population, we randomly drew 1,814 farms from commercial farms in the database of the Michigan office of the US Department of Agriculture's National Agricultural Statistics Service (referred to hereafter as the NASS (2009) set). Because we were interested in commercial farming operations, the random sample was drawn to include farms with $100,000 or more in farm sales. According to NASS, there were approximately 8,000 farms that fit that definition so our random sample included about 23 percent of all farms in Michigan in 2008 with $100,000 or more in sales. University or agribusiness clients that were randomly drawn by NASS were purged and replaced so that there was no overlap between the three data sources.

In considering the results across groups, obviously there are distinct differences between the NASS group and the university and agribusiness populations, as these latter

farms have a demonstrated record of working with their respective organizations on farm financial management activities. The university clients utilized either a computerized or a paper accounting system provided through MSU and often have close relationships with extension personnel. The MSU project has been on-going for many decades with some clients participating for the entire period. The program is state wide and has diversity in terms of farm type and size. While it has many aspects similar to farm business management associations in other states, it is not one. The MSU project serves to provide accounting services and business analysis summaries for a fee. This information is used to understand the financial health of Michigan agriculture and consider potential policy effects where relevant. The agribusiness program is also state wide and has operated for many years. The agribusiness clients are diverse with respect to farm enterprises and size but had a common affiliation with respect to utilizing this firm's consulting and financing services. The agribusiness has a much less formal record-keeping arrangement than the university program. More broadly, the NASS sample represents the general population of commercial Michigan farms. Naturally, the university and agribusiness samples were not expected to be representative of the general farm population, rather by contrasting the operator and operation characteristics, systems, attributes and demands of these three populations we can offer insight into their respective farm management needs and insight into segmenting the market for farm financial records systems.

Following a three-contact survey method (Dillman, 1999), we mailed an initial survey, a reminder postcard two weeks later, and then a second survey to non-respondents two weeks after the postcard. We received a total of 944 useable responses in total representing an overall response rate of 34.4 percent. This response rate was deemed acceptable given the financially sensitive nature of some of the information collected. The response rate varied by group: university clients responded at a 55.3 percent rate; agribusiness clients at a 27.7 percent rate; and the NASS random sample at a 28.5 percent rate. The results are presented and discussed by group to facilitate a discussion of the characteristics related to those farms that chose the university and agribusiness farm accounting systems compared to the "typical" Michigan farm.

Respondents were queried about their current financial record-keeping system. In order to ensure that responses were consistent and clear, the survey provided definitions of computerized financial record-keeping systems. Specifically, the survey stated:

> Three types of computerized systems can be used for on-farm financial record-keeping: (1) *simple cash system*, (2) *general cash/accrual accounting system*, or (3) *farm cash/accrual accounting system*.
>
> *A simple cash system* is essentially an electronic checkbook. It allows users to enter data on cash transactions, write checks from the computer, reconcile the checkbook, and create reports for tax purposes. The information is not sufficient to calculate farm cost of production without additional accrual adjustments. Quicken is an example of a simple cash system.
>
> *A general cash/accrual accounting system* uses double entry accounting and can generate either cash or accrual reports. While it requires more knowledge and effort to use, the use of accrual accounting means that accurate balance sheets and income statements are more readily available than using cash accounting. It will allow payroll management. These programs are not specific to agriculture but often have an agriculture chart of accounts available. QuickBooks is an example of a general cash/accrual accounting system.
>
> *A farm cash/accrual accounting system* includes all of the general cash/accrual system attributes but is specifically tailored for a farm business. It contains a chart of accounts for

the farm. It may contain a farm depreciation schedule and it may include the ability to compare performance with similar farms through bench-mark reports. Telfarm, Ag Manager and Redwing are examples of farm cash/accrual accounting systems.

Alternatively, perhaps you forgo your own computerized financial record keeping and use a paper system or hire an accounting service.

Available response categories for their current system included: none, paper, spreadsheet, simple cash, general cash/accrual, farm cash/accrual and "other." "Other" included, for example, those farms who utilized an accountant for financial record keeping. There was a wide degree of variation in system form and function in some of the categories – especially paper and spreadsheet systems. For example, paper systems may have to be entered into an electronic form – as is the case with the university clients who still utilize a paper system – or simply be maintained as a ledger on the farm. Spreadsheets were essentially electronic ledgers that were created by the farm manager.

Choice experiments (also called stated preference methods) involve asking individuals to choose from alternative bundles of attributes, as opposed to rating or ranking the attributes (Adamowicz *et al.*, 1998). Choice experiments simulate real-life situations and permit multiple attributes to be evaluated, thereby allowing estimation of tradeoffs among different alternatives (Lusk *et al.*, 2003). The system attributes for the choice experiment were determined through discussions with agribusiness and extension farm management personnel. The attributes chosen relate to cost, service and outputs. Levels were chosen to span the range of common systems. These attributes and associated levels are shown in Table I.

In the choice experiment, system type could be a simple cash accounting system (e.g. Quicken), a general cash/accrual system (e.g. QuickBooks™) or a farm cash/accrual system (e.g. university). Given the increased level of information relevant for management decisions that is provided by the general and farm accrual systems, the null hypothesis was that farmers would be willing to pay the largest amount for a farm system and more for a general cash/accrual system than a simple cash system.

Feature	Description
System type	Three types are available: simple cash system (e.g. Quicken); general cash/accrual system (e.g. Quickbooks); farm cash/accrual system (e.g. university, agribusiness)
Initial program price	The price of the system is specified as an initial investment in the program
Annual fee	Some systems have an annual fee
On-farm system setup and training	Assistance in installing the software and teaching you to use it. Setup is either not available, available for $1.50 per min or included as part of the fees
Technical phone support	Answers questions regarding software or hardware issues Technical phone support is either not available, available for $1.50 per min or included as part of the fees
Phone support with knowledge of agriculture	Refers to support that has experience with agricultural issues and agricultural tax law. Agricultural phone support is either not available, available for $1.50 per min or included as part of the fees
Benchmark reports	Are summary reports that can be used to compare your farm's financial performance with other similar firms. These reports are either included or not available

Table I.
Choice experiment attributes and levels

The cost of the computerized accounting system was divided into two parts: an initial investment and an annual fee. The initial investment was a one-time expenditure that varied from $100, reflecting a simple cash system, to $1,500, reflecting a relatively high-cost farm cash/accrual system. The annual fee varied from $0/year, which would be more typical for a simple system with no support, to $1,200/year, which would generally be accompanied by support and resulting farm reports.

The final four attributes were related to services that accompany the system in question. "On-farm setup and training" and "technical phone support" are self-explanatory. "Phone support with knowledge of agriculture" referred to support from people with experience with agricultural issues and agricultural income tax law which has many important unique rules. "Technical phone support" and "phone support with knowledge of agriculture" had one of three possible levels: not available, available for $1.50/min, or included as part of system cost or annual fee. The attributes "on-farm setup" and "benchmark reports" for comparing farm financial performance to similar farms each had two levels: included or not available. As is typical in the choice experiment literature, our questionnaire providing written descriptions of each of the attributes followed by the choice question which used a tabular format to display and summarize the attributes associated with a pair alternatives (Louviere *et al.*, 2000; Hoehn *et al.*, 2010).

An orthogonal fractional design was used to select choice scenarios in which system prices and attributes were uncorrelated, thereby allowing identification of the effects of prices and system attributes (Kuhfeld *et al.*, 1994). The SAS procedures PLAN and OPTEX were used to reduce the large number of potential system configurations to a manageable number while still being able to infer WTP for all possible configurations (D-efficiency = 89.87). A main-effects linear model was assumed. This technique resulted in a design of 28 orthogonal scenarios (i.e. statistically independent scenarios). The choice experiment was divided into blocks to ease respondent fatigue. Seven versions of the survey were mailed to producers, each had four choice scenarios where respondents were asked whether they preferred system A or B (see Table I for an example of a discrete choice). Because farm purchase of financial record systems is infrequent, a great deal of the farms might prefer to choose "neither" as is often presented as option "C" in choice experiments. We wanted, however, to assess the value of these attributes rather than a large number of "opt outs" (Fenichel *et al.*, 2009). Therefore, we presented only two options and "forced" a choice. The WTP results should be interpreted as how much the respondents would pay for that attribute if they were in the market for a record-keeping system.

Modeling consumer choice

The model of consumer behavior we use follows Lancaster in that utility is derived from the attributes of the goods rather than the good themselves. Following this approach, the data are analyzed using random utility models. Since our primary objective was to estimate demand for farm financial record systems with a varying set of attributes that were not necessarily available in the current market, stated preferences were used to overcome the lack of market data.

Random utility models provide an economic foundation for the use of discrete choice models (McFadden, 1973). Consumers choose the product that gives them the highest utility from among the set of alternatives. All of the relevant product attributes are

known to the consumer when the choice is made. Randomness enters the model because not all of the relevant attributes are measured by the researcher. In our case, the *i*th consumer is faced with *J* alternative farm financial systems. Each of the systems is described by a vector of attributes that can be measured by the researcher. We denote this vector of attributes, including price, as $\mathbf{x_{ij}}$. The conditional indirect utility of alternative *j*, U_{ij}, can be represented by a deterministic component $\beta\mathbf{x_{ij}}$, and a random term, ε_{ij}, as follows:

$$U_{ij} = \beta\mathbf{x_{ij}} + \varepsilon_{ij}. \tag{1}$$

Conditional on choosing alternative *j*, U_{ij} represents the maximum utility that consumer *i* can attain given the attributes $\mathbf{x_{ij}}$. The vector β parameterizes the utility index, and the elements of β reflect the relative utility of each of the attributes. Faced with *J* alternatives, if the consumer ranks a particular alternative, *k*, as best, then U_{ik} is assumed to be the maximum utility. Let Y_i be a variable indicating the best alternative for individual *i*. The probability that alternative *k* is best is given by:

$$\text{prob}(Y_i = k) = \text{prob}(U_{ik} > U_{ij}) \quad \text{for all } j = k. \tag{2}$$

The probability functions in equation (2) serve as our expected demand functions for each set of the discrete products (Rubey and Lupi, 1997). To estimate these functions using maximum likelihood techniques, we assume that the ε_{ij} are i.i.d. normally distributed which yields a probit model for our choice estimation. Assuming the systematic component of the total utility U_{jt} is linear in parameters, the specification of the general model is, $V_j = \beta_1 x_{j1} + \beta_2 x_{j2} + \cdots + \beta_n x_{jn}$ where x_{jn} is the *n*th attribute for alternative *j* and β_n is the parameter associated with the *n*th. Using these regression results, the WTP for the *n*th attribute is calculated from the coefficients as the ratio of the coefficient of that attribute to the absolute value of the price coefficient.

Farm and financial record system characteristics

Table II presents summary statistics for each set of respondents. The average primary operator age was mid-50s for the NASS sample (and the average age for the NASS sample was statistically different than the other two client groups at the 0.10 level). While the number of years of education was similar in magnitude, university clients had significantly more education than the other groups. University clients also had several years more experience in farming than the other samples consistent with their older operator age.

Off-farm income and/or benefits were important to families on 49.8 percent of NASS operations. This percentage was slightly lower for the university clients and higher for the agribusiness clients perhaps indicating that there were more part-time farmers in the agribusiness set. Partnerships were more common in the university and agribusiness sets than in the general farm population. The university and agribusiness clients were also more likely to be limited liability corporations (LLCs) and less likely to be family or non-family corporations than the general farm population. Almost all farms had crop enterprises of some type while less than half of the NASS sample had livestock enterprises of any type. Almost six in ten university and agribusiness clients had livestock enterprises which made it more common than livestock enterprises in the NASS sample.

	Sample		
	NASS	University clients	Agribusiness clients
Operator age (years)			
Average	54.6[a,b]	58.2[c]	53.4
SD	11.3	10.9	12.3
Operator education (years)			
Average	13.7[a]	14.0[c]	13.5
SD	1.9	1.9	1.8
Experience at current farm (years)			
Average	30.2[a]	35.4[c]	27.8
SD	13.7	13.9	13.5
Off-farm income/benefits (%)			
	49.8	47.1	56.5
Organization (%)			
Sole prop.	61.0	61.3	64.7
Partnership	9.2	13.0	13.2
LLC	11.8	17.4	12.9
Corp., family	15.6	7.0	8.8
Corp., non-family	2.3	1.3	0.7
Crop. enterprises (%)			
	93.4	91.7	94.7
Livestock enterprises (%)			
	49.2	58.4	58.8
Acres operated			
Average	909[b]	820[c]	1,118
SD	1,257	747	1,301
Acres owned			
Average	399	474	460
SD	4,501	439	489
Current farm financial (none)			
	2.3	0	2.7
System type (%)			
Paper	41.2	7.4	14.6
Spreadsheet	11.9	8.5	7.1
Simple cash	6.8	2.4	7.5
General cash/accrual	19.6	5.9	15.0
Farm cash/accrual	9.4	74.8	45.1
Other	8.8	4.1	8.0

Table II.
Operator and operation characteristics

Notes: Significant difference at [a]0.1 level between NASS and university group means; [b]0.1 level between NASS and agribusiness group means; [c]0.1 level between university and agribusiness group means

Agribusiness clients operated the largest farms measured by total acres operated. University clients had the least average acres operated but owned the most acres. Field crops (e.g. corn, soybeans, wheat) were the most common crop enterprise in all three sets. University and agribusiness clients were more likely to have forage enterprises as they also had the livestock enterprises that would utilize these crops. Fruit and vegetable enterprises were present on 20-25 percent of the farms in each set.

University and agribusiness clients were more likely to have dairy-related enterprises but virtually all other livestock enterprises were present with about

the same frequency as the NASS sample. Respondents were also queried about their current level of debts. Results indicated that agribusiness clients had a slightly higher level of debt relative to assets. About a quarter of the NASS and university respondents indicated they were debt free. The modal category was in the financially solvent range of less than 40 percent debt-to-asset ratio in all three groups.

Respondents were asked to specify their financial record-keeping system from a list that included: none, paper, spreadsheet, simple cash, general cash/accrual, farm cash/accrual and other. Table II summarizes the frequency of current record-keeping systems by respondent group. In the NASS sample, the most common category was a paper system with 41 percent indicating that was their financial record system. About 20 percent indicated that they had a general cash/accrual system (i.e. QuickBooks™) while 12 percent had a spreadsheet. Farm-specific cash/accrual record systems were the fourth most common category with 9.4 percent while slightly more than 2 percent did not have any system.

As was expected, the university and agribusiness clients were more likely to have a farm-specific computerized farm financial record-keeping system. The university clients all indicated using a system of some type and about three quarters had a computerized farm cash/accrual system. Spreadsheets and paper ledgers were the next most common categories. Agribusiness clients indicated a heterogeneous set of systems with 45 percent possessing a farm cash/accrual system and about 15 percent each indicating paper and general cash/accrual systems.

The fact that not all respondents recognized the university or agribusiness system to which they were members might reflect that they were unaware that their system was actually a farm cash/accrual system – and were likely not taking advantage of the information provided by that system. There are multiple ways that farm clients interface with the university and agribusiness systems. For example, some farmer clients utilize a paper book that is entered at the university which looks much like a paper version of a spreadsheet but is actually a farm cash/accrual system (albeit not computerized on the farm). Alternatively, these answers might reflect that the operation had more than one system – perhaps one for tax accounting and another for farm decision making and the response was relative to the alternative system.

Many attributes of the current record system were collected. Table III summarizes the cost of the system with two terms: the initial investment and the annual fee. It is common for accounting systems to charge an annual fee that provides services such as technical support and updates. The average initial cost was remarkably similar – and was not significantly different statistically – across all three groups from $600 to $650. The fact that the median was less than the mean indicates that the distribution of cost was skewed with many values less than the mean and a few large values. There was a tremendous amount of variation in the initial system cost values as the SD and range from minimum to maximum indicate. There were a few large greenhouses, as well as large poultry and hog operations in the NASS sample that contributed to the large average and SD. The variation of cost was less across the university and agribusiness respondents, since they were on a relatively uniform type of operation and record systems.

The annual fees paid were significantly higher for the university clients than either of the other groups. In fact, the median annual fee value of the NASS group was 0. This occurred because a number of the NASS farmers were on systems that only

	NASS	Sample University	Agribusiness
Initial investment ($)			
Mean	597	650	603
SD	811	609	608
Median	300	500	400
Min.	0	0	0
Max.	5,000	3,500	3,000
Annual fees ($)			
Mean	208[a]	515[c]	239
SD	476	282	451
Median	0	162	15
Min.	0	0	0
Max.	3,500	2,000	2,500
Current age (years)			
Mean	8.0[a]	16.3[c]	7.2
SD	6.4	11.3	7.3
Median	7	14	4
Min.	0	0	1
Max.	30	50	30

Table III.
Initial system purchase, annual cost, age and expected life

Notes: Significant difference at [a]0.10 level between NASS and university group means; [b]0.10 level between NASS and agribusiness group means [c]0.10 level between university and agribusiness group means

required a one-time fee (e.g. Quicken™). As we discuss below, the general farm population represented by NASS respondents cited price as an important reason for choosing their current system much more frequently than did the university or agribusiness clients.

The average age of the current system of university clients was more than 16 years. This reflects the presence of many paper systems, as well as a number of computerized systems still using a DOS computer. In contrast, the average system age for the agribusiness and NASS populations was 7.2 and 8.0 years, respectively. It appears that Michigan farm managers are reticent to change record-keeping systems.

Table IV summarizes the reasons that the current financial record-keeping system was chosen. The three most common reasons the current system was selected in the NASS sample were convenience, ease of use and price. Ignoring the residual "other" category, the most common reasons in the agribusiness sample were convenience, ease of use and relationship with the provider. University clients most often indicated that the payroll system (two-thirds of respondents) was the reason they chose the system followed by the depreciation schedule and convenience.

Both the university and agribusiness clients indicated that their relationship with provider was much more important to them in selecting a record system than the general population did. Similarly, system support – both phone and on-farm – was more important to those clients than the general farm population. Perhaps reflecting the value that university and agribusiness clients felt they received from their systems, price was a less important factor than in the general farm population.

	Sample		
	NASS (%)	University clients (%)	Agribusiness clients (%)
Price			
Responses	16.6	7.6	10.2
Operations	36.8	30.1	30.2
Convenience			
Responses	25.2	12.7	20.2
Operations	55.8	50.0	59.7
Output reports			
Responses	7.3	11.5	9.3
Operations	16.3	45.3	27.3
Depreciation schedule			
Responses	2.6	14.8	6.1
Operations	5.7	58.5	18.0
Payroll			
Responses	7.3	66.5	6.1
Operations	16.1	26.3	18.0
Relationship with provider			
Responses	5.2	10.7	13.7
Operations	11.5	42.4	40.3
Phone support			
Responses	3.4	11.7	8.0
Operations	7.6	46.2	23.7
On-farm support			
Responses	2.2	9.3	7.1
Operations	4.8	36.9	20.9
Ease of use			
Responses	25.0	12.1	16.3
Operations	55.5	47.9	48.2
Other			
Responses	5.2	2.9	29.2
Operations	11.5	11.4	8.6

Notes: Multiple responses were possible so that the total number of responses exceeded the number of operations; thus, the results are expressed both as a percentage of responses and percentage of operations

Table IV.
Reasons respondents chose current financial record-keeping system

Choice experiment results and interpretation

Table V presents the coefficients resulting from a binary probit estimation of the choice experiment responses for each of our three groups. With respect to the coefficients, all had the expected signs and many were significant especially in the case of the university sample. More interesting than the coefficients are the marginal effects of the attributes. The NASS farm managers were less likely to choose a system as the system cost increased, either in terms of initial investment or annual fees. As the initial price increased by $1 relative to the alternative system, the likelihood of choosing that system declined by 0.018 percent. Similarly, an $1 increase in the annual cost relative to the alternative decreased choice probability by 0.038 percent. The attributes that significantly affected the likelihood that a system was chosen included farm cash/accrual rather than a simple cash system (+9.3 percent), on-farm setup (+5.4 percent) and technology support (+10.3 percent). As the NASS sample is statistically representative of Michigan farms,

Table V.
Probit coefficients and marginal effects of farm financial accounting system attributes

	Sample											
	NASS						University clients					
Attribute	Coef.	SE	Marginal effect	SE	Coef.	SE	Marginal effect	SE	Coef.	SE	Marginal effect	SE
Initial cost	-0.0004	0.0001	-0.0002***	0.00004	-0.0004	0.0001	-0.0002***	0.00004	-0.0003	0.0001	-0.0001*	0.00006
Annual fee	-0.01	0.0001	-0.0004***	0.00005	-0.0006	0.0001	-0.0003***	0.00005	-0.0006	0.0002	-0.0002***	0.00007
General cash/accrual	0.21	0.13	0.08	0.05	0.37	0.15	0.15**	0.06	0.38	0.21	0.15*	0.08
Farm cash/accrual	0.23	0.13	0.10*	0.05	1.03	0.14	0.41***	0.06	0.63	0.19	0.25***	0.07
On-farm setup	0.14	0.0779	0.05*	0.03	0.16	0.08	0.07**	0.03	0.29	0.10	0.12***	0.04
Tech support for fee	0.070	0.09	0.04	0.03	0.29	0.10	0.12***	0.04	0.05	0.15	0.02	0.06
Tech support included	0.26	0.09	0.10***	0.04	0.55	0.09	0.22***	0.04	0.23	0.12	0.09*	0.05
Ag knowledge for fee	-0.04	0.11	-0.02	0.04	0.15	0.11	0.06	0.04	0.02	0.15	0.009	0.06
Ag knowledge included	0.14	0.12	0.06	0.05	0.44	0.12	0.18***	0.05	0.46	0.18	0.18***	0.07
Benchmark reports	0.01	0.08	0.01	0.03	-0.10	0.08	-0.04	0.03	0.03	0.12	0.01	0.05
n			0. 713					0.742		346		

Note: Statistical significance at: *0.10, **0.05 and ***0.01 levels

these are the attributes that organizations wishing to increase market share of their farm financial record-keeping system should target.

University clients also were less likely to purchase more expensive systems although these farm managers were less sensitive to higher prices than the general population. University clients were more likely to choose either a general cash/accrual (+14.7 percent) or a farm cash/accrual (+41.2 percent) system than a simple cash system. These farm managers also valued on-farm setup, technology support for a fee or included in the system price, and agricultural knowledge if included. Agribusiness clients were very much like the university sample although they were less likely to choose the farm cash/accrual system over the simple cash system and only chose technology support when it was included in the system cost.

WTP calculations seek to determine the change in cost that keeps utility unchanged given a change in an attribute level. In other words, such calculations seek the amount of a given attribute that equates the marginal benefit and the marginal cost of a change. Generally, price or some money metric is included in choice experiments to allow for easy interpretation of the tradeoffs of the utility associated with an amount of money and an attribute level. The choice experiment used in this analysis included two price terms for farm financial record systems: the initial investment in software ($) and an annual fee ($/year) in each scenario. These values can be used to calculate WTP either in annual terms or in terms of the initial investment. In another choice experiment, Train (1985) used variable and fixed cost coefficients to estimate an implicit discount rate, r, as a ratio:

$$\frac{\beta_{vc}}{\beta_{Fc}} = \left(\frac{r}{1-(1+r)^{-t}}\right),$$

where n is the number of years the investment (or technology) is expected to last. When valuing something such as ecosystem services, many studies define the t (life) in the choice experiment – for example, by asking how much people will pay for clean water over a ten-year period – and then calculate the implied discount rate. In contrast, in our application we were interested in calculating t. Unlike in the ecosystem services example, we have some idea what an appropriate discount rate is for agriculture. Based on previous research, we know that 10 percent is an appropriate discount rate for Michigan farms (Wolf *et al.*, 2002). For our purposes, the coefficients are those for the annual fee (variable cost) and initial investment (fixed cost). Using a 10 percent discount rate, the implied technology life was 2.56 years for the NASS sample and 2.51 for the agribusiness clients but only 1.76 years for the university sample. We examined a range of 5-15 percent for discount rate and the implied technology life values were fairly stable. Over these discount rates, the implied technology life varied from 2.35 to 2.81 years for the NASS sample; 1.64 to 1.88 years for the university sample and 2.31 to 2.75 years for the agribusiness sample. Since the average farm had their current system eight to 16 years, these values are much less than the average age of the farm's current system. Recall that many of the current systems were paper or spreadsheet based and that convenience and familiarity were key considerations in the farmer's choice of system. We believe this low-implied technology life likely reflects the uncertainty that farmers have about changing to a new computerized accounting system. One of the factors weighted highest by farmers was having a system that was easy to learn – not something we could easily capture in a choice experiment. Thus, the responses likely

reflect the uncertainty that farmers feel about any change. Consider also that computers are extremely inexpensive today. These low prices may encourage new purchases which correlate with farms changing software systems.

WTP for a one unit change in an attribute is calculated by dividing that attributes coefficient by the price variable. Since we have two independent price terms, WTP estimates are presented both in terms of the initial investment and the annual fee (Table VI). In order to consider statistical variability in estimates of WTP, a 90 percent confidence interval for mean WTP values was calculated using the delta method. The delta method estimates the variance of a non-linear function of two or more random variables by taking a first-order Taylor series expansion around the mean value of the variable and calculating the variance on that newly created random variable (Greene, 2000, p. 674). Following Hole (2007), the delta method estimate of the variance of a WTP estimate is given by:

$$\mathrm{var}(\hat{WTP}_k) = [(\hat{WTP}_{\beta_k})^2 \,\mathrm{var}(\hat{\beta}_k) + (\hat{WTP}_{\beta_c})^2 \mathrm{var}(\hat{\beta}_c) + 2{*}\hat{WTP}_{\beta_k}{*}\hat{WTP}_{\beta_c}{*}\mathrm{cov}\ (\hat{\beta}_k\hat{\beta}_c)],$$

where $\hat{WTP}_{\beta_k}$ and $\hat{WTP}_{\beta_c}$ are the partial derivates of the estimated WTP for verified attribute k with respect to β_k and β_c, respectively. Using the variance of the WTP estimate, confidence intervals are calculated in the standard way.

One result that jumps out – and is a direct consequence of the relative coefficients on the price variables – is that the annual WTP values are not much smaller than the one-time initial investment WTP. The uncertainty about changing systems is evident in the fact that farmers were often willing to pay almost as much on an annual basis

Attribute	NASS	Sample University clients	Agribusiness clients
Annual basis ($/year)			
General cash/accrual	219 (−0.26, 438)	583[a] (215, 951)	682[a] (77, 1,286)
Farm cash/accrual	242[a] (39, 445)	1,630[a] (1,199, 2,061)	1,131[a] (555, 1,707)
On-farm setup	141[a] (10, 272)	258[a] (49, 466)	521[a] (123, 920)
Tech support for fee	67 (−81, 216)	463[a] (198, 727)	89 (−355, 532)
Tech support included	269[a] (112, 426)	862[a] (532, 1,193)	417[a] (3, 831)
Ag knowledge for fee	−46 (−225, 132)	242 (−56, 541)	40 (−400, 480)
Ag knowledge included	148 (−60, 356)	694[a] (313, 1,075)	828[a] (135, 1,522)
Benchmark reports	13[a] (11, 16)	−151 (−356, 53)	48 (−307, 403)
Initial price basis ($)			
General cash/accrual	474 (−36, 984)	898[a] (232, 1,564)	1,451 (−326, 3,228)
Farm cash/accrual	524[a] (66, 981)	2,511[a] (1,509, 3,513)	2,407[a] (212, 4,603)
On-farm setup	305[a] (6, 605)	397[a] (44, 749)	1,110 (−68, 2,288)
Tech support for fee	146 [-177, 470]	713[a] [253, 1,173]	189 [-744, 1,122]
Tech support included	582[a] (209, 1,025)	1,328[a] (704, 1,953)	888 (−176, 1,952)
Ag knowledge for fee	−101 (−488, 287)	373 (−90, 837)	85 (−854, 1,025)
Ag knowledge included	320 (−147, 788)	1,069[a] (412, 1,726)	1,764 (−192, 3,719)
Benchmark reports	279 (−264, 322)	−233 (−578, 112)	103 (−624, 830)

Table VI.
WTP (90 percent CI) for record system attributes

Note: [a]Confidence interval does not contain zero

for an attribute as they were for a one-time up-front investment. This reflects a desire to have high annual fees rather than a large sunk cost in a new system. Annual fees can be later dropped and one explanation is that the farmers would rather have an annual "way out" than make a substantial investment in a system they might not like.

Computerized farm accounting systems were one of three types: simple cash, general cash/accrual or farm cash/accrual. Because the choices must include one of those three, we omitted the simple cash category. Therefore, in Table VI the $242/year in the second row should be interpreted as the amount NASS respondents were willing to pay to have a farm cash/accrual system rather than a simple cash system. Similarly, the omitted categories were always the "without" case: without on-farm setup, without phone support, without agricultural knowledge and without benchmark reports. The attributes are additive so that we estimate that the average NASS respondent would be willing to pay a total of $524/year for a farm cash/accrual system ($242/year) with technology support ($269/year) and benchmark reports provided ($13/year). One reason that farmers might not adopt, for example a farm cash/accrual system, is that they place a value on that information provided that is less than the cost of the system (Howard *et al.*, 1996). The fact that systems providing that set of attributes are often much more expensive than that price is likely a primary reason that most farmers in that group did not have a system of that type. In terms of a one-time, up-front investment, the NASS farmers indicated a willingness to part with $1,411 for a farm cash/accrual system that includes on-farm setup and technology support relative to a simple cash system without setup or support. The NASS respondents did not view general cash/accrual financial record-keeping systems as more valuable than simple cash systems. The NASS respondents were not willing to pay additional fees to have $1.50/min technology support available. They also did not consider agricultural knowledge-based support as valuable.

Given the difference in the university and agribusiness client groups relative to the general farm population represented by the NASS sample, it should not be surprising that those groups were willing to pay substantially more for farm record systems with support and agricultural knowledge. In particular the university clients, the majority of whom used a farm cash/accrual computerized system with setup, technology support, agricultural knowledge and benchmark reports generally had very high values for these attributes. Adding up the annual fees for a farm cash/accrual system with on-farm setup, technology support and agricultural knowledge results in an estimated WTP of $3,444/year for the average university client. This value far exceeds the current cost of the university system. However, private consulting and accounting firm charges can total this amount – or even more – for similar systems so perhaps the value is to be viewed as more of an upper bound. University extension personnel may find it disappointing that the university clients did not significantly value the benchmark reports. This may reflect a situation where the clients are not sufficiently aware of the utility of the information in the reports for farm financial performance appraisal and management decisions. In this case, education programs could assist to inform and highlight the role of the reports.

With respect to the agribusiness clients, they demonstrated similar patterns in WTP for farm financial system attributes to the university group in terms of annual fees. However, relative to the university clients, agribusiness clients were not willing to pay for as many attributes in terms of their initial investment.

Conclusions

This research examined the financial record-keeping systems used by Michigan farms and estimated WTP for attributes utilizing a choice experiment. A random sample of Michigan farms was compared to a survey of university and agribusiness farm financial system clients. Results revealed that university and agribusiness clients operated larger farms and were much more likely to be using farm cash/accrual financial record systems.

A choice experiment was utilized to examine the value of attributes of farm financial record systems. The results suggest that all three groups of farmers were willing to pay significantly more for a farm cash/accrual system than a simple cash farm financial system. On-farm system setup and tech support were also considered valuable by all three sets of farmers. Only the university and agribusiness clients were willing to pay more for having agriculture-specific knowledge in the tech support.

University and agribusiness clients were willing to pay much more for almost all attributes than the random farm population represented by the NASS sample. The large differences in WTP for attributes across the three groups suggest that the market is segmented. In particular, the university and agribusiness systems have seemingly found their clients who value many of the attributes offered. This is not surprising in a free-market setting but it is not encouraging for future growth of the client base in specialized systems. Because we were interested in valuing the attributes, we forced a choice between alternative systems in the choice experiment so our WTP results must be viewed in light of those that are actually in the market for a new system. Future research might consider what factors relate to how big the market actually is with an option to not purchase among the choices.

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