AN EVALUATION OF COST OF PRODUCTION INFORMATION USAGE BY COUNTY AGENTS

DeeVon Bailey, Douglas W. Eck, and Terrence F. Glover

Abstract

County agents receive cost of production information primarily from state extension services and then disseminate it to agricultural producers. A survey gathered data on agent usage of this information. A Poisson regression analysis using count data was performed to determine the factors influencing the number of times county agents directly referred to published cost of production (enterprise budget) information in a year. The agent's understanding of budget information use in management decisions, the availability of budgets, and his/her receiving the budgets in multiple forms (e.g., sheets, booklets, or software) had significant positive impacts on the use of budgets by the agent.

Key words: enterprise budgets, county agents, extension specialists, count data

The Cooperative Extension Service (CES) in almost every state estimates cost of production (COP) information and usually disseminates it in the form of crop and livestock enterprise budgets (Klonsky; Eck).[1] The CES gathers information relating to input and output coefficients for various enterprises and corresponding representative prices, constructs budgets, and publishes, disseminates, and updates the COP information. Budget information can be transmitted in several forms including printed material, computer software, or simply verbal communication from extension personnel to various types of clientele. Other agencies, including ERS USDA, also gather and disseminate COP information (McElroy; Morehart et al.). However, the state extension services remain the main source of this information for farmers and county agents (Klonsky).

While significant resources are devoted to developing enterprise budgets, very little information is available to measure the effectiveness of COP information delivery systems.

State CESs generally produce COP information that deals with costs and returns for producing raw agricultural commodities. This information is distributed either directly to agricultural producers and other groups or indirectly to these groups through county agents (Eck). Consequently, the county agent becomes an important distributional link for CES COP information in most states. Budget information can only be passed efficiently by county agents if they understand its potential use as a management tool and the assumptions and, hence, the limitations imposed on the information. For instance, county agents who understand how to use enterprise budgets to compare costs and returns for specific production or marketing alternatives can offer substantial support to producers attempting to maximize profit by optimally allocating resources among enterprises. Simple production questions relating to the cost of specific operations such as plowing or planting and to typical input coefficients (e.g., pounds of seeds per acre, calving percentage, etc.) could also be addressed by reasonably accurate COP information (Kay).

Because state CESs base their COP estimates on information gathered from individual producers or on expert opinion (Klonsky), the resulting estimates apply to particular types of farming operations. This information could provide valuable comparisons for producers concerned with the relative efficiency of their farming operations. Because the county agent is a critical link in disseminating COP information to the public in most states, an examination of the effectiveness of that link is appropriate.

Agents can use enterprise budget information, if they choose, in their educational activities with farmers and agribusinesses. The extent to which the COP estimates are used depends on the perceived value of the information by the public and the individual agent.

This study investigated the factors determining the level of use of enterprise budget information by

[1] The terms *enterprise budget* and *COP information* are used interchangeably in this study.

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county agents. Using Poisson regression techniques, count data were analyzed for the number of times agents used enterprise budget information in their programs in a 12-month period. The intrinsic value of the information as well as the county agent's understanding of how to use the information and the methods used by the CES to assemble and distribute the information appears to influence usage frequency. No previous study has examined information usage with regard to these considerations. The results reported in this study should help the state CESs reexamine the way they develop and distribute COP estimates to make the information more useful to county agents and, subsequently, to producers.

PROCEDURE AND DATA

Measuring the Demand for CES COP Information

Marketing and production information is available from both private and public sources. A number of private subscription services and public agencies provide information on prices and factors affecting supply and demand (e.g., weather, consumer trends, etc.). For example, USDA publishes vast amounts of information dealing with both current and projected supplies of most major agricultural commodities, average prices, utilization, exports and imports, etc. Enterprise budgets compiled by the CES represent another source of public information. They are unique, however, since they itemize average costs and returns for specific alternatives and are actually management tools for planning, implementing plans, and controlling a farm business (Olson et al.; Kay; Boehlje and Eidman).

Stigler (1970) has stated that firms will likely invest in information to the point where the "cost of search is equated to its expected marginal return" (p. 175). Consequently, a study of demand for enterprise budget information at the producer level would necessitate estimating producers' production functions to determine the value of the marginal product for enterprise budget information before any conclusion about the efficiency with which producers use enterprise budget information could be reached. However, this approach would not address questions about the delivery mechanism for budget information through county agents, i.e., what determines why one agent uses budget information more than another.

Because COP information developed by the CES is distributed in response to requests from farmers and other groups, the number of times a county agent chooses to use this source of information can serve as a proxy for the relative quantity of budget information used by the county agent and, hence, the agent's demand for the information.

Farmers are the largest group requesting this information from county agents (Eck). This implies the number of times the county agent uses the information is a function of the number of farmers in a particular county. Consequently, demand for budget information needs to be compared with the relative size of the clientele group, in this case farmers, who request the information.

The quality of the CES COP information is important in determining the level of its use. The relative quality of non-homogeneous goods is sometimes more important than relative prices in explaining demand for a good (Stigler 1987). COP information from different sources (i.e., CES, USDA, or self-generated) is a non-homogeneous good because it is produced for different purposes using different methods depending on the end user of the information (Rister et al.) Producers may rely solely on CES enterprise budgets to estimate production costs, or they could estimate production costs themselves if they believe CES estimates are inaccurate or inapplicable, or they may use the CES COP estimates as comparisons with their own estimates. In any of these cases, producers will only request the CES COP estimates if they believe them to be relatively accurate approximations of actual production costs for particular enterprises and/or operations.

While the quality of CES cost of production information relative to the accuracy of input and output coefficients and prices is not addressed in this study, the quality of the budget information as it relates to its adaptability is examined. The convenience or ease with which county agents and farmers can adapt published COP information to specific farm or business situations influences agents' level of use because adaptability determines the marginal cost, in terms of time, that the agent must expend to apply the information to local situations. Considerations that may make COP more adaptable to particular counties include: (1) the simple availability of enterprise budgets for major enterprises in the county, (2) the frequency with which input coefficients and prices are updated, (3) the geographic units such as states, sub-state regions, or counties used to develop COP information, (4) the variety of forms in which the information is distributed, and (5) the sources of information used to develop COP information.

Finally, the number of times the agents use enterprise budget information also depends on the agents' perception of the value of the information and their knowledge of how to use it. For example, county agents can use COP information to address ques-

Table 1. Explanatory Variables Used In Estimation of the Enterprise Budget Usage Model

Category	
Agent Characteristics	County and Budget Characteristics
1. Understanding of COP Information (SCORE)	1. Number of Agricultural Producers (AGPR)
2. Graduate Degree (GRAD)[a]	2. Percentage of Major Crops and Livestock Enterprises with Budgets (AVAIL)
3. Ag. Econ. Degree (AGECON)[b]	3. Frequency of Updating (UPDATE)[c]
4. Agent Involved in Providing Specialist Budget Information (PROVIDE)[e]	4. Use of Producer Panels (PANEL)[d]
5. Years as a County Agent (YEARS)	5. Geographic Units (GEO)[f]
	6. Distributed in Multiple Forms (MULTIPLE)[g]
	7. Number of Crop Enterprise Budgets Published in the State (CROP)
	8. Number of Livestock Enterprise Budgets Published in the State (STOCK)

[a] Binary variable; 1 if at least one graduate degree is held, 0 otherwise.

[b] Binary variable; 1 if at least one degree in agricultural economics is held, 0 otherwise.

[c] Binary variable; 1 if budgets are updated at least every two years, 0 otherwise.

[d] Binary variable; 1 if producer panels are used to assemble budget information, 0 otherwise.

[e] Binary variable;1 if agent is directly involved in providing information for budget construction to extension specialist, 0 otherwise.

[f] Binary variable; 1 if budgets provided for geographic units smaller than the state (e.g., county or sub-state region), 0 otherwise.

[g] Binary variable; 1 if budgets are distributed in more than one form (e.g., booklet, individual sheets, software), 0 otherwise.

tions relating to marketing alternatives, alternative crop or livestock enterprises, etc. without the information's having been explicitly requested. Consequently, the agents' educational background, years of experience, involvement in formulating COP information, and general understanding of COP information will influence the demand for enterprise budget information.

The next section describes how size of clientele, county agent characteristics, and the adaptability of CES COP information were incorporated in a model to explain the extent of use of budget information by county agents.

Model Explaining the Use of COP Information by County Agents

In a random survey, county agents were asked how many times they had directly referred to COP information in the previous 12 months (TIMES, Table 1). While this procedure does not provide a completely qualitative measure of agents' use of enterprise budget information, it does gauge the value of the information to the agents' overall program. For example, high levels of use imply the agent uses budget information in a broad range of activities in which he or she is involved. The variable, TIMES, represents a set of discrete values for the observed use of COP information by agents and is bounded below by zero. This type of discrete data is also referred to as count data.

The benchmark for the analysis of count data is the Poisson regression model, which restricts the variance of the data so that it will be equal to the mean conditional on explanatory variables (Maddala). The data $\{(y_i,X_i),\ i=1,2,3,...,N\}$ are independent across i, and, conditional on the K-dimensional vector of explanatory variables, X_i, the mean of the scaler dependent variable, y_i, is given by,

(1) $E[y_i] = \lambda_i = \lambda(\underline{X}, \beta)$

where λ_i is both the mean and variance of y_i and where β is estimated using maximum likelihood (Maddala; Agresti; Cameron and Trivedi 1986).

If the mean-variance equality property of the Poisson model is not exhibited empirically then overdispersion exists; overdispersion has consequences similar to those of heteroskedasticity in a linear regression model (i.e., variances for the parameter estimates are inconsistent, and hypothesis tests are invalid). Overdispersion can be tested using a regression-based test following Cameron and Trivedi (1990). Under the null hypothesis,

(2) $var(y_i) = \lambda_i$,

and the specific alternative hypothesis is that

(3) $\text{var}(y_i) = \lambda_i + \alpha\, g(\lambda_i)$,

where $g(\lambda_i) = \lambda^2$ is a scaler multiple of a function E[y]. Conditional on the covariates, $(y - E[y])^2 - y$ has an expectation of zero under the null hypothesis and an expectation equal to $g(\lambda_i)$ under the alternative hypothesis. From (3), the model under the alternative hypothesis gives the moment condition

(4) $E[(y_i - \lambda_i)^2 - y_i] = \alpha\, g(\lambda_i)$,

and the obvious test for overdispersion, if λ_i is observed as a t-test for $\alpha = 0$ in the auxiliary regression is

(5) $(y_i - \hat{\lambda}_i)^2 - y_i = \alpha\, g(\hat{\lambda}_i) + \varepsilon_i$

where $\hat{\lambda}$ is obtained from the Poisson model estimates, and ε_i is the heteroskedastic error term.

The maximum likelihood estimates of the parameters of the model described in equation (1) were found. The regression-based test for overdispersion was conducted and revealed that significant overdispersion existed (i.e., the auxiliary regression gave an estimate of $\alpha = 0.751$ with a t-value of 11.113, indicating overdispersion).

The budget use model was then estimated by maximum likelihood based on the negative binomial model (Hausman et al.) imposing overdispersion of the form specified by the alternative hypothesis and assuming $g(\lambda) = \lambda^2$. A similar estimate for α(0.696 with a t-value of 5.212) was obtained. The t-values differ because the Poisson estimate is consistent under both the null and the alternative hypotheses, whereas the negative binomial estimate is efficient under the alternative hypothesis.

Data

Data were obtained by two telephone surveys during August and September, 1989. The first survey contacted extension specialists primarily responsible for constructing budgets in each of the 50 states. Information gathered from the specialists' survey included the data sources and methods used to construct enterprise budgets in each state, the number of budgets constructed, frequency of updating, geographic units used to construct budgets, and the form(s) in which the state CES distributes budgets. In addition, information relating to the specialists' years of service, sources of funding for enterprise budget construction, and number of full-time equivalents (FTEs) employed in gathering and constructing budget information were also obtained.

The second survey randomly sampled 100 county agricultural agents. The county agent survey was stratified by the number of agricultural producers in a particular geographic region. All counties in the County Agents Directory were included in the population from which the sample was drawn. Figure 1 presents the location of each county where a county agent was surveyed.

The county agent survey included questions to determine which five crops and three livestock activities were the major enterprises in the county during 1989. The county agents were then asked if they had CES budgets for these major crop and livestock enterprises. A variable measuring the relative availability of CES COP information was calculated as the quotient of the number of CES budgets available in the county for major crop and livestock enterprises and the number of these major enterprises (AVAIL, Table 1). The number of agricultural producers and the value of agricultural sales in each survey county were obtained in the Agricultural Census (U.S. Department of Commerce). The agents were also requested to explain their level of involvement in developing enterprise budgets. This included the agents' involvement in providing information (PROVIDE, see Table 1) and the type of information or assistance provided to extension specialists.

The county agents were also evaluated to ascertain if they understood how to use enterprise budget information to make management decisions. The agents were requested to respond to five questions relating to the effectiveness or ineffectiveness of budgets in (1) break-even price analysis, (2) price projections, (3) marketing alternatives, (4) production alternatives, and (5) feasibility of different production and/or processing alternatives. Responses were classified as being "correct" or "incorrect" based on the score assigned by the agents on a five-point Likert scale (Kinnear and Taylor, p. 313). Correct responses were assigned a value of one, and incorrect responses were zero. The sum of the five responses established the agents' relative level of understanding regarding the use of enterprise budget information (SCORE, Table 1).

Questions about the experience and educational background of the agents (i.e., years as a county agent, highest degree earned, or if at least one degree was in agricultural economics) helped to establish whether use was mainly determined by the type of formal education the agent had received or if agents commonly learn to use budgets over time (Table 1).

The following section reports the findings of the surveys and the parameter estimates for the model explaining the extent of agent usage of enterprise budget information.

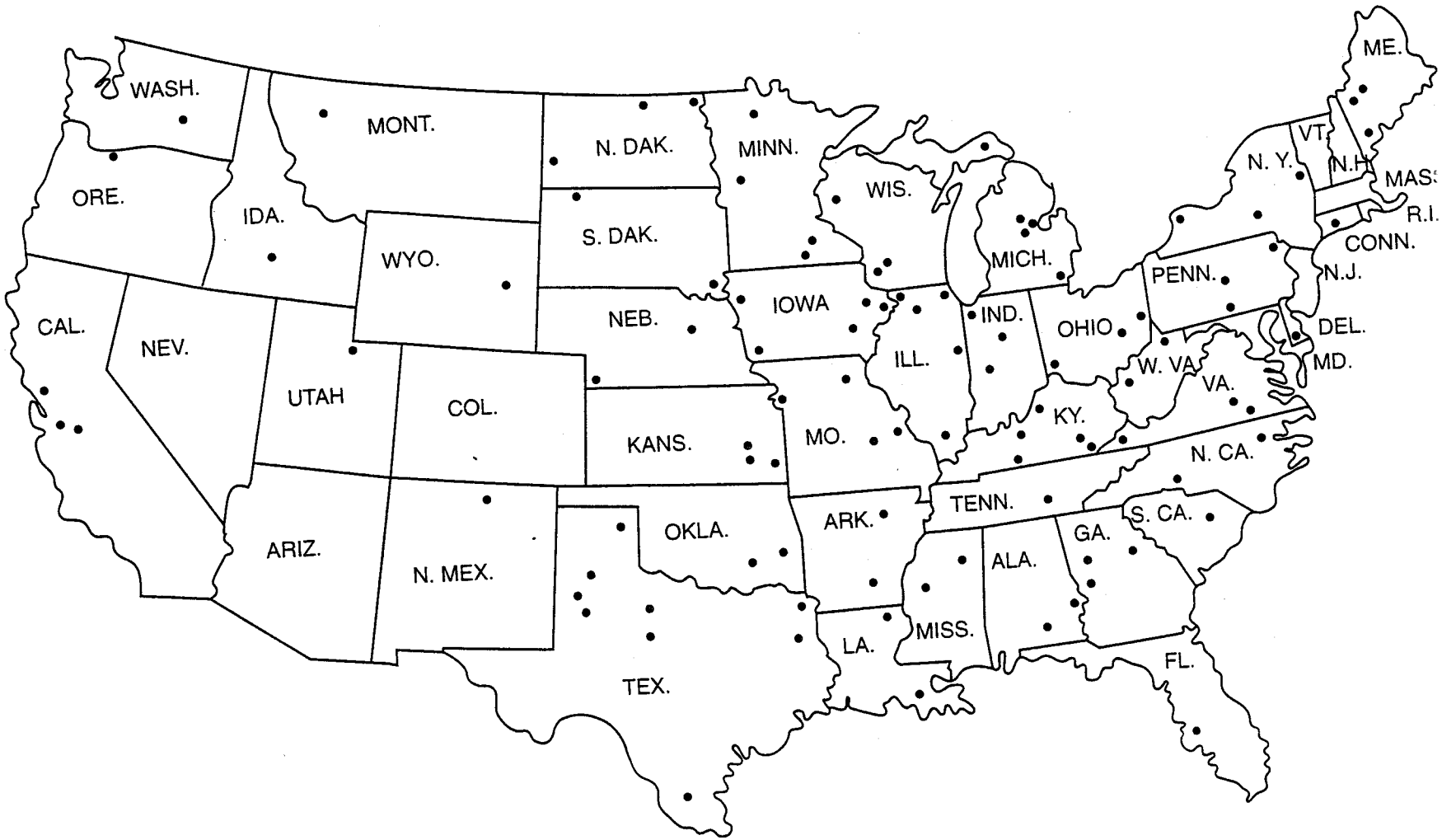

Figure 1. Location of County Agents Participating in the Survey (County Seat is Indicated by a Dot).

Table 2. Sources of Funding for Enterprise Budget Developing

Source	100% Funding	Partial Support	No Support
	----------Number of States[a]----------		
CES	22	13	11
Agricultural Economics Departments	6	6	34
Agricultural Experiment Stations	1	4	41
Grants from Private Industry	0	4	42
Fees	0	5	41
State Department of Agriculture	0	1	45

[a]Information from 46 states.

RESULTS

Survey Results

The CES is primarily or partially responsible for providing funding for enterprise budget development in most states, as shown in Table 2. Also, extension specialists constructed the enterprise budgets in almost every responding state. Approximately 75 percent of the specialists surveyed had a 50 percent or higher time commitment to Extension. Also, almost one-half of the surveyed specialists had worked in Extension 10 years or less.

Over 80 percent of the states updated their enterprise budgets at least every two years (Table 3). Half of the states used computer spreadsheets to construct budgets (Table 3). The use of spreadsheets likely indicates a decline in the use of budget generators.[2] One explanation for the decline in the use of budget generators could be that the costs of purchasing and updating them are prohibitive for some states. Another explanation could be that computer spreadsheets provide flexibility in customizing budget information for specific situations. Although most specialists constructing budgets use spreadsheets, only one of the states (Oregon) distributed budget information primarily as spreadsheet templates. However, eight other states (Alabama, Georgia, Louisiana, Minnesota, South Dakota, Massachusetts, Pennsylvania, and Tennessee) did distribute spreadsheet templates as secondary sources of budget information (Table 3).

Most specialists relied on local sources for price information, and agribusiness firms were a primary source of input information (Table 3). However, about one-third of the specialists relied on input information supplied by University sources (e.g. extension specialists, county agents, or agronomy departments). These results indicate that a substantial portion of the information used to develop budgets comes either internally from university sources or from agribusiness and not producers. The relatively low involvement for producers suggests that specialists find other sources of information more convenient (less costly in terms of time and resources) or that other sources are equally reliable or superior to producer input.

The average number of agricultural producers in each county survey was 590, and the average farm had sales of $102,250 (Table 4).[3] County agents said that they had referred to enterprise budgets slightly more than once per week during the previous 12 months, on the average (62.3 times per year). The states published an average of over 100 enterprise budgets each. However, the number of budgets published varied substantially across states, reflecting the different levels of economic activity associated with production agriculture among the states (Table 4). Also, some states place a high priority on enterprise budgets while others find them less important.

Only 12 percent of county agents surveyed held any degree in agricultural economics, 71 percent held at least one graduate degree, and 52 percent were engaged in providing budget information for published budgets. The respondents also had an average of 15 years of experience as county agents. The agents reported that, on the average, they had budgets in their possession for 82 percent of the major crop and livestock enterprises in their county.

Parameter Estimates

Table 5 presents the maximum likelihood parameter estimates of the negative binomial model. The

[2]Budget generators are "packaged" computer programs that generate enterprise budgets from inputed information in a given format. Computer spreadsheets, while having many of the same characteristics as budget generators, are usually customized for local conditions and, consequently, are somewhat more flexible than budget generators.

[3]An earlier analysis found the relative size of farms not to be a significant determinant of TIMES. Because of this and convergence problems, farm size (in terms of dollar sales per farm) was not included in the Poisson regression.

Table 3. Frequency of Enterprise Budget Updating, Method of Construction, Geographic Units, Distributional Form, and Sources of Price and Input Information (Reported as a percentage of States Using Each Method)[a]

Item	Percentage
Frequency of updating:	
Every Year	71
Every 2nd Year	11
Every 3rd Year	7
Every 4th Year	9
As Needed	2
Method of Construction:	
Spreadsheet	50
Budget Generator	38
Manually	12
Principal Geographic Units:	
State	56
Sub-State Region	42
County	2
Principal Distributional Form:	
Booklet	50
Individual Sheets	36
Software	2
Other	4
Don't Publish Budgets	8
Main source of Price Information:	
Extension Specialists	30
Private Forecasts	19
Producers	16
State Agencies	9
County Agents	9
Local Markets	9
USDA	3
Other	5
Main Source of Input Information:	
Agribusiness (Suppliers)	42
Producers	20
Extension specialists	20
County Agents	11
Agronomy Departments	2
Other	5

[a]Obtained from Specialists' survey.

Table 4. Descriptive Statistics for County Agent and Extension Specialist Surveys[ab]

Variable	Mean
AGPR	590 (462.5)
SALES ($1000)	102.25 (172.8)
Number of Times Budgets Used By County Agent Annually (TIME)	62.3 (83.5)
Full Time Equivalents Employed In Constructing Budgets (FTE)	0.91 (1.09)
PROVIDE (%)	52.0
AGECON (%)	12.0
GRAD (%)	71.0
SCORE	3.01 (1.12)
CROP	83.10 (111.41)
STOCK	23.0 (23.77)
PANEL (%)	35.0
GEO (%)	67.0
MULTIPLE (%)	35.0
YEARS	15.02 (10.12)
AVAIL (%)	82.0 (30.8)

[a] Standard deviations are in parentheses.
[b] Definitions of variables are given in Table 1.

county agent characteristics most likely to influence the use of COP information were the agent's level of understanding concerning budgets (SCORE), and the involvement of the agent in providing information to specialists preparing budgets (PROVIDE). This suggests that county agents will increase their use of enterprise budgets if they understand how to use the information when advising clientele regarding management decisions and also implies that agents are more likely to use the information if they are part of the process of gathering it. Consequently, if agents are trained to use enterprise budgets and are more integrated into the process of developing budget information, it can be expected that their use of budget information will increase.

The educational background of county agents was found to influence their use of COP information. If the agent had a degree in agricultural economics (AGECON), he or she was more likely to use enterprise budget information to help clientele make decisions. The significant negative coefficient for agents holding graduate degrees (GRAD) was not expected. However, these results may reflect the program emphasis of county agents with advanced degrees. That is, agents with higher levels of specialization may focus on certain program areas such as agronomy or animal science and place less emphasis on economic problems in their county. The fact that only 12 percent of the survey respondents had at least one degree in agricultural economics may help to explain this phenomenon.

The number of agricultural producers in a county (AGPR) had a significant impact on the employment of budgets by agents. This may be indicative not

Table 5. Maximum Likelihood Parameter Estimates for Model Explaining the Level of Use of COP Information by County Agents[a]

Explanatory Valuable	Parameter Estimate	Asymptotic t-Value
Intercept	-0.533	-0.545
AVAIL	1.690	4.356**
AGPR	0.001	3.612**
SCORE	0.242	2.143*
GRAD	-0.468	-1.692*
AGECON	0.846	2.411*
PROVIDE	1.132	3.432**
YEARS	0.011	0.852
UPDATE	0.338	0.497
PANEL	0.442	1.190
GEO	0.571	1.810*
MULTIPLE	0.594	2.185*
STOCK	0.010	1.283
CROP	-0.561	-2.584**
α	0.696	5.212**
Log - Likelihood = -403.04		

*denotes statistically different from zero at the 10 percent level.
**denotes statistically different from zero at the 5 percent level.
[a]Definitions of variables are given in Table 1.

only of a larger agricultural clientele in the county but also possibly of a more significant orientation toward agricultural programs on the part of the county agent.

The percentage of budgets available for major crop and livestock enterprises in the county (AVAIL) was a significant determinant of usage, indicating that agents were likely to use budgets if adequate budget information for their major enterprises is provided. Producer input (PANEL) and annual updating (UPDATE) did not appear to enhance the value of the budgets for county agents. This suggests that agents do not necessarily consider the source of input and cost information contained in budgets when communicating with clientele groups. The insignificant coefficient for UPDATE suggests that input coefficients change slowly over time, and that agents are willing to adjust input prices in outdated budgets by themselves because this can be done with relative ease. Consequently, agents may rely on COP estimates more for input coefficients than for input costs, which are relatively localized.

The parameter estimates indicate that distributing budgets in multiple forms (MULTIPLE) did increase their use by county agents. Publishing budgets based on sub-state geographic locations (GEO) also had a significant positive impact on the use of enterprise budget information by agents. These results indicate that agents desire flexibility and locale-specific information.

The total number of crop budgets published by a state (CROP) had a negative impact on the number of times county agents use COP information. The number of livestock budgets published by a state (STOCK) did not influence the level of use of COP information by county agents. Since AVAIL had a significant positive influence on use by county agents, agents were interested primarily in budgets for enterprises in their own counties. County agents appear to have a relatively narrow interest in budget information, and simply increasing the variety of budgets in a state will not increase general use by agents. Consequently, states may wish to drop old budgets and add new ones as new enterprises are developed rather than continuing to proliferate the number of budgets published by the state.

These results suggest that the CES can evaluate current methods for collecting and distributing COP information to enhance its use by county agents. They also suggest that many county agents find CES enterprise budgets valuable and will use them if they understand how to apply the information.

SUMMARY AND CONCLUSION

Most economists would agree that COP estimates are important information for decision makers and researchers. Some positive steps can be taken to improve how this information is being shared with county agents and, subsequently, with the public. These results demonstrate that the state CESs can improve their COP programs by involving county agents in the data gathering process, training county agents to use the information, and updating the methods used to disseminate COP information. Training agents to develop enterprise budgets for their own counties would involve agents in the data gathering process and provide enterprise budgets to the public based on smaller geographic units. This would yield useful locale-specific information.

A significant number of resources is devoted to developing enterprise budgets by the CES, and this information is disseminated to many important clientele groups. However, in most states, the county agent is either implicitly or explicitly a link in the process of distributing COP information to the public. This suggests that a renewed effort should be made to enhance the role of the county agent in this process. Increasing the involvement of county agents in COP information gathering as well as distribution is an important step in providing more

of this information to the public. This will result in more interaction between agricultural economists and decision makers and ultimately enhance the information/decision making process.

Enhancing the efficiency with which this information is disseminated from county agents should increase the economic information being received by farmers and other decision makers. New or expanded approaches to the dissemination of COP estimates could include alternative forms such as computer spreadsheets, individual sheets, and booklets.

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