IDENTIFICATION OF BONA FIDE FARMERS

Fred C. White and Ivery D. Clifton

INTRODUCTION

Georgia's General Assembly considered differential assessment legislation in 1976, but rejected the final proposals on the last day of the session. Last minute efforts to develop an acceptable legislative proposal concerned the issue of what farmland should be eligible for differential assessment. One proposal considered a single criterion—the proportion of income derived from farming. This proposal stated that operators who derive more than 50 percent of their income from farming should be considered bona fide farmers and their land eligible for differential assessment. While all landowners qualifying as bona fide farm operators would benefit from a reduction in their tax bills, others would probably pay higher taxes than without differential assessment legislation. Consequently, it is important to evaluate criteria used to designate bona fide farm operators.

Using the State's proposed criterion—50 percent of income from farming—to distinguish between farm operators who would receive a tax benefit and those who would not, results in exclusion of many low income farmers. The majority of Georgia's farm operators with less than 50 percent of their income derived from farming earned less than $15,000 in off-farm income.[1] In fact, 43 percent of these ineligible farm operators earned less than $7,500 from nonfarm sources. We believe this proposal (had it been adopted) may have inadvertently exempted many low-income farmers from needed tax relief. They would have been exempted largely because only a single criterion was considered in identifying bona fide farm operators. Although the proposed criterion may be useful in helping to identify bona fide farm operators, no single criterion is likely to be adequate when used alone.

During earlier attempts to implement differential assessment legislation, several states extended tax benefits to all farmland and made no effort to distinguish bona fide and non-bona fide farm operators. However, many people believed that investors or speculators holding land for development took undue advantage of these laws. To avoid this criticism, differential assessment laws defining types of operations regarded as agricultural were generated. A great deal of difference continued to exist among states as to which land would be eligible for differential assessment. In addition, the extent to which these laws specified criteria for determining bona fide operations differed considerably. For example, Florida legislation provided that "agricultural purposes shall include only lands being used in bona fide farming, pasture, or grove operation" [8]. In some cases, the state department of taxation issued regulations to help local tax assessors determine whether a particular farm operation could be classified as bona fide. Maryland regulations specified that tax assessors should consider 29 factors in determining bona fide farm operators [5].

Several other criteria have been used to identify bona fide farm operators. The income approach is the most widely used criterion [4]. With this approach, a specified proportion of income must be derived from farming. In other cases, states require a minimum amount of gross farm income per acre. Frequently, land had to produce this amount for a specified number of years. Other requirements used to classify land as bona fide include minimum acreage, sales and productivity criteria.

Fred C. White is Associate Professor and Ivery D. Clifton is Assistant Professor, Agricultural Economics, University of Georgia.

[1] For the data sources used to characterize Georgia farmers see [7, pp. 13-14].

The overall objective of this study is to develop a systematic approach that can be used to consider the multitude of factors distinguishing bona fide and non-bona fide farm operators. Results, which are exploratory in nature, are expected to be helpful to policymakers in creation and implementation of effective differential assessment legislation. First, the paper identifies variables which can be used to discern bona fide farm operators. Relevant economic theory is relied on to identify variables. Secondly, the paper discusses methodology deemed appropriate to classify bona fide farm operators into homogeneous groups. Thirdly, an empirical application will be demonstrated for Georgia. Results presented may have empirical relevance for other states as well. Finally, limitations of the methodology used will be discussed with implications for further research.

THEORY AND METHOD

Economic analysis of bona fide farmers is based on theories of the firm and income determination. Firm theory provides a basis for postulating relevant farm variables that might be useful as criteria in identifying bona fide farm operators. As mentioned, farm related factors previously proposed as discriminating criteria vary substantially in length and content from state to state. In addition, the theory of income determination can be drawn on to identify possible nonfarm variables that appear to have merit as part of the desired discriminating criteria. Therefore, the task is one of determining which factors would be useful to policymakers in deciding who should be eligible for preferential tax treatment. To be effective, it would appear that such criteria should be easily comprehended, relevant in content and multivariate in nature.

The Automatic Interaction Detection (AID) Model [9] is used in the study to derive criteria for identifying bona fide and non-bona fide farmland owners. Recently, this analytical technique has been widely used [1, pp. 46-53; 3, pp. 93-100; and 6] in agricultural research. This approach appears to be well-suited for prediction and classification where nonlinearities, nonorthogonality and interaction are expected in the data.

This analytical technique is implicitly formulated as:

$$Y = f(A_1 \ldots A_n, B_1 \ldots B_m) \qquad (1)$$

where

Y = dependent variable

A_i = farm discriminators (independent variables) and

B_j = nonfarm discriminators (independent variables).

The objective criterion in AID is to subdivide a given population into a series of nonoverlapping subpopulations in order to divide optimally the variation of the dependent variable. "Optimal" partitioning of the set of explanatory variables is said to exist when defined categories explain a larger share of variation in the dependent variable than is possible with any other set of subpopulations. The split of each population is chosen to maximize the between sum of squares (BSS) for the ith group, so that:

$$BSS_i = (n_1 \bar{y}_1^{\,2} + n_2 \bar{y}_2^{\,2}) - N \bar{Y}^2 \qquad (2)$$

where

n_i = size of group split

N = size of total sample ($N = n_1 + n_2$)

$\bar{y}_i$ = mean of the explanatory variable for the split group and

$\bar{Y}$ = mean of the explanatory variable for the total sample.

Two AID Models were formulated for use in the study. In Model I, a small number of variables that have been widely proposed as criteria for identifying bona fide farmers were specified. It was felt that legislators may favor results of Model I as having greater applicability due to its simplicity. However, a substantially larger set of variables was specified in Model II. The latter variables may be broadly categorized as agricultural productivity, farm size and urbanization. It was hypothesized that Model II should provide better criteria than Model I in terms of variation explained.

VARIABLES AND DATA SOURCE

Net farm income was used as the dependent variable in both Models I and II. Choice of the dependent variable was based primarily on income tax provisions. Federal and state income tax codes provide special treatment for farm income [2]. First, ordinary income in some cases can be converted into long-term capital gains which would be subject to a lower tax rate. Secondly, costs can be deducted before associated income is realized.[2] These deductions can be used to generate a tax loss and thus offset income from other sources. To take advantage of the special tax treatment given to farm income,

[2]The Tax Reform Act of 1976 makes it more difficult for many high income taxpayers to deduct costs before associated income is realized.

many taxpayers with large nonfarm incomes make farm investments to generate artificial losses. Exclusion of these taxpayers from differential assessment benefits would be consistent with proposed legislation which extends tax benefits only to bona fide farmers. There is, however, a problem with using tax loss farming to distinguish between bona fide and non-bona fide farmers. Namely, many taxpayers with low incomes from both farm and nonfarm sources take advantage of tax laws. Also, other farmers who do not normally pursue tax loss farming may experience low and possibly even negative profits as a result of crop failure, unusually high input prices or unusually low product prices.

Explanatory independent variables are shown in Table 1. As seen, some variables were not used in either Model. They were omitted to avoid introducing multicollinearity into the model.

A stratified random statewide sample of Georgia farmers for 1972 was selected for the analysis. Total sample size was 1,213, with samples in each county proportionate to the county's farm income.[3] Data for the analysis were obtained from two sources: state income tax and property tax records. Information on sales, operating expenses, net taxable farm income, nonfarm income and state income taxes were obtained from state income tax records. Farm real estate acreage owned was obtained from property tax files.

TABLE 1. VARIABLES USED TO HELP IDENTIFY BONA FIDE VERSUS NON-BONA FIDE FARM OPERATORS

Symbol	Variables[1]	Number of Classes[2]	Variables Used in Model I	Variables Used in Model II
	Dependent			
Y	Net farm income		x	x
	Independent			
X_1	State income taxes paid	4		x
X_2	Off-farm income	6	x	x
X_3	Interest expense	6		x
X_4	Off-farm/gross farm income	7	x	
X_5	Economic size class	6	x	
X_6	Acres operated	6	x	x
X_7	Gross farm income/acres	7	x	x
X_8	Hired labor expenses	8		x
X_9	Land rent	6		x
X_{10}	Dummy (Beef farm)[3]	2		x
X_{11}	Dummy (Swine farm)[3]	2		x
X_{12}	Dummy (Poultry farm)[3]	2		x
X_{13}	Dummy (Dairy farm)[3]	2		x
X_{14}	Dummy (Tobacco farm)[3]	2		x
X_{15}	Dummy (Peanuts farm)[3]	2		x
X_{16}	Dummy (Fruits & Nuts farm)[3]	2		x
X_{17}	Property taxes	6		x
X_{18}	Income taxes paid/off farm income	6		
X_{19}	Interest/gross farm income	7		
X_{20}	Depreciation	6		

[1] Data relate to a sample of individual farm operators.

[2] A basic requirement of the AID Model is that each independent variable be entered as interval codes (i.e. taxes paid is entered) as: Code 1 = $0, Code 2 = less than $500, Code 3 = $500-$1,000, and Code 4 = greater than $1,000 for a total of four classes.

[3] Major source of farm income designates farm type.

AID ANALYSIS

Results of the AID algorithm can be depicted in the form of a decision tree (Figure 1). The tree diagram shows graphically characteristics (criteria) associated with each homogeneous group. Interpretation of the decision tree may be made as follows: Initially, there are 1,213 farm operators with an average net farm income of $2,907 (Group 1). Group 1 is then split into two subgroups (2 and 3) according to state income taxes paid. Farm operators in Group 2 paid less than $500, while those in Group 3 paid over $500. Each of these groups were further divided according to off-farm income. Further divisions resulted in nine final groups (designated by Δ). Each final group can be characterized by looking at the splits or divisions leading to that group. For example, Group 11 consisted of 38 farm operators with average net farm income of $30,103. These individuals paid more than $1,000 in state income taxes and earned less than $15,000 in off-farm income.[4] Evaluation of the criteria used to define membership in each group along with its mean level of net farm earnings provided some indication of whether particular groups are comprised mainly of bona fide farm operators. This diagram should be useful to policymakers in understanding implications and difficulty of developing sound criteria for determining tax exempt status of farmers.

PRINCIPAL DISCRIMINATING CRITERIA

Five variables were specified (Table 1) in Model I as primary discriminators of bona fide and non-bona fide farmers. However, Model I results, as shown in Table 2, indicate that only three of the variables were

[3] To protect against biasing the sample in favor of counties producing high value commodities, the sampling procedure used two samples—crop and livestock farms. Final distribution of sample farms by income and farm type were not statistically different from Census distributions [7].

[4] Examination of group divisions leading to Group 11 reveals that they were first split at $500 of state income taxes and later at $1,000 of income taxes. Hence, the $500 division becomes redundant when characterizing Group 11.

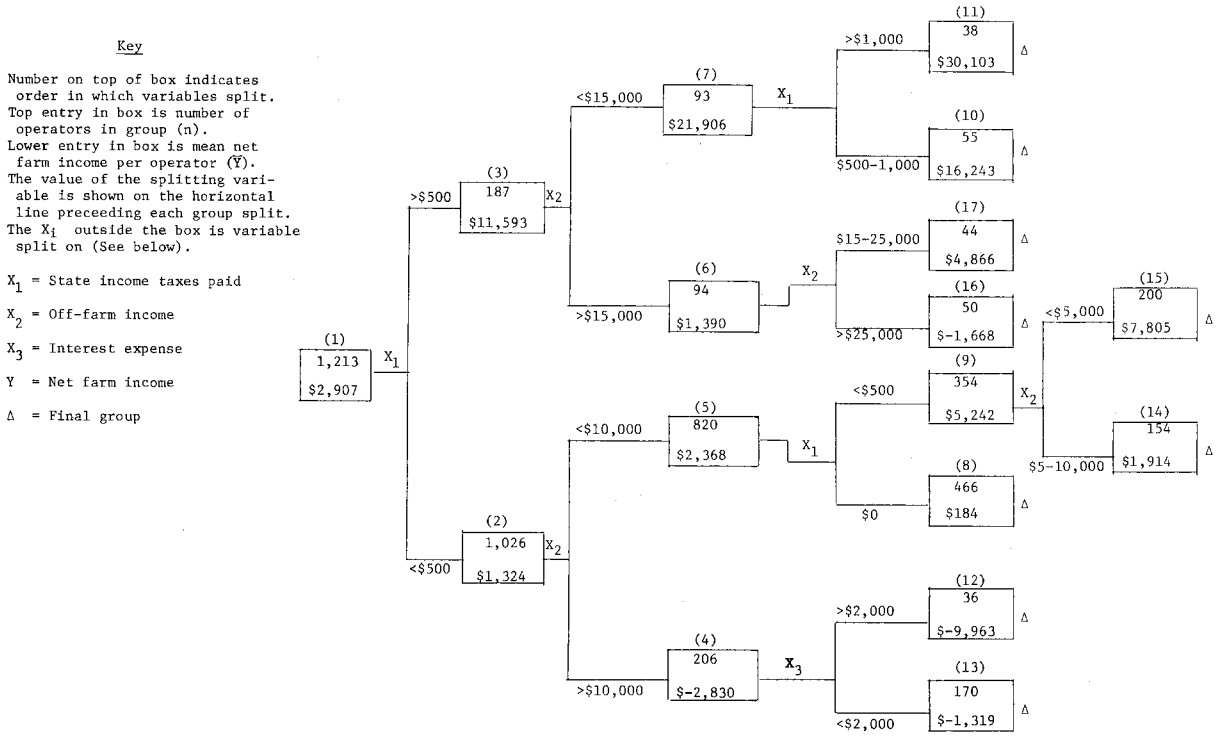

FIGURE 1. MONOTONIC AID TREE USED TO HELP IDENTIFY BONA FIDE VERSUS NON-BONA FIDE FARM OPERATORS (MODEL II)

TABLE 2. A MULTIVARIATE CRITERIA FOR DISTINGUISHING BETWEEN BONA FIDE AND NON-BONA FIDE FARM OPERATORS IN GEORGIA

Group[1]	Economic Size Class	Off-Farm Income	State Income Taxes Paid	Interest Expense	Ratio of Off-Farm to Gross Farm Income	Net Farm Income	Observations
		----------(Dollars)----------			(Acres)	(Dollars)	(Number)
			Model I				
5	I	<10,000				11,222	221
4	I	>10,000				5,517	57
11	II	5-15,000			<75	4,302	174
10	II	>15,000			<75	1,624	342
8	II-VI	>25,000			>75	5,494	47
9	II-VI	<25,000			>75	843	372
Marginal R^2	.20	.04			.025	$\bar{Y}$=2,907 R^2=.27	N=1,213
			Model II				
11		<15,000	<1,000			30,103	38
10		<15,000	500-1,000			16,243	55
17*		15-25,000	>500			4,866	44
16*		>25,000	>500			-1,668	50
15		<5,000	<500			7,805	200
14*		5-10,000	<500			1,914	154
8		<10,000	<500			184	466
12*		>10,000	<500	>2,000		-9,963	36
13*		<10,000	<500	<2,000		-1,319	170
Marginal R^2		.30	.27	.03		$\bar{Y}$=2,907 R^2=.60	N=1,213

*Potential non-bona fide farm operators.

[1] Group numbers correspond to final groups identified by the AID Model.

found to be important.[5] They were: (1) economic size class of the operating unit, (2) ratio of off-farm to gross farm income and (3) off-farm income. Off-farm income measures have practical implications in distinguishing between groups of farmers to be given tax relief. Special tax rates, when combined with high levels of nonfarm income, permit deferral of income taxes on nonfarm incomes. It is speculated that such favorable tax provision may actually encourage tax-loss farming on the part of some farm and particularly nonfarm landowners.

Economic size of the operating unit, which reflects level of gross sales, was the most important criterion accounting for 20 percent of total variability in net farm income. The ratio of off-farm to gross farm income, which measures relative importance of farm and nonfarm sources of income, ranked second in importance among discriminators identified. This variable explained approximately four percent of total variation. Off-farm income ranked third in importance as a discriminating criterion, accounting for slightly less than 2.5 percent of total variation in net farm income.

Although the variables identified in Model I appear plausible, it is evident from the low coefficient of determination ($R^2 = .27$) that others are needed to develop a more satisfactory criteria. Thus, Model II was specified to include 15 independent variables (Table 1). Results in Table 2 and Figure 1 show again that only three variables were important. In order of primary importance, these were (1) off-farm income (30 percent), (2) state income taxes paid (27 percent) and (3) interest expenses (three percent).[6] These three criteria accounted for 60 percent of variability in net farm income in Georgia and are used in the following section to classify farm operators.

DESCRIPTION OF BONA FIDE AND NON-BONA FIDE FARMER GROUPS

Nine final groups of farmers were classified by Model II (Figure 1 and Table 2). These final groups are designated by triangles in Figure 1. Thus, the question can now be raised as to what are the intrinsic characteristics of bona fide operators. Of course, any response to this question is necessarily subjective in nature. However, criteria identified do appear to provide a fundamental basis for developing a useful definition of a bona fide farm operator.

Bona Fide Farm Operators

At least four of Model II's final groups—11, 10, 15 and 8—described in Figure 1 appear to be comprised of primarily bona fide farmers.[7] For example, group 11 consists mainly of operators who paid more than $1,000 in state income taxes and who earned less than $15,000 in off-farm income. Farmers in group 11 accounted for three percent of the sample with mean net farm earnings of $30,103.[8] Farmers in group 10 differ from those in group 11 only in that the former paid slightly less taxes ($500—$1,000). Mean net earnings for group 10 was $16,243. Similarly, group 15, comprised of those operators paying less than $500 in state taxes, with less than $5,000 in off-farm earnings, had a mean net farm income of $7,805. This group accounted for about 17 percent of the sample. The largest group (38 percent of the sample) appears to have been small farmers averaging less than $200 in net returns. Typically, these are operators with little tax liability (less than $500) and whose off-farm earnings averaged less than $10,000. Based on these characteristics, no indication that these groups do not represent bona fide operators is seen. However, the same is not quite true for remaining groups.

Non-Bona Fide Farm Operators

Value of discriminating characteristics and reported level of net earnings of groups 17, 16, 14, 12 and to some extent 13 appear to suggest that they are not bona fide farm operators. For example, operators falling into group 17 are typically those who paid above $500 in state taxes but who earned between $15,000 and $20,000 in off-farm income. However, in comparison to group 10 (bona fide), the latter group reported substantially less net earnings $4,866). Of greater interest than group 15 is group 16. The primary difference between these two groups is that the latter earned more than $25,000 in off-farm income but lost an average of $1,700 in net earnings. Group 12 is comprised of those operators paying less than $500 in taxes, more than $2,000 in

[5] The term "important" is used in AID to denote variables possessing the explanatory power of reducing variation around the dependent variable by a predetermined amount. A factor of two percent was used in the analysis to control entry of variables. Since AID employs a heuristic algorithm, use of the term "significance" is inappropriate [9].

[6] Percentages in parentheses represent amount of total variation in net farm income explained by each variable.

[7] Order sequence of the groups is predetermined by the algorithm and has no special meaning in the study.

[8] This interpretation is derived by following along the uppermost branch of the AIR tree. As seen, the algorithm first split the sample on X_1 into intermediate groups 2 and 3. Group 3 subsequently split on X_2 into intermediate groups 6 and 7. Finally group 7 split into final groups 11 and 10 on the basis of X_1. In this case, the first split on X_1 becomes redundant, yielding the characteristics for group 11 reported in the text. This procedure is to be followed in interpreting characteristics of each final group.

interest expenses, earning upward of $10,000 in nonfarm employment, and who lost nearly $10,000 per operator. This group represents about three percent of the operators and appears to be definitely non-bona fide farmers. On the other hand, group 13 farmers which differ from group 12 in that they incurred less than $2,000 in interest expenses is questionable as a non-bona fide group. Perhaps the negative earnings of this group is more descriptive of unsuccessful bona fide farm operators. Criteria and related characteristics of each group derived using Models I and II are summarized in Table 2.

CONCULSIONS AND IMPLICATIONS

The AID technique increased understanding of characteristics which influence various levels of net farm income. Of particular importance to policymakers is the fact that no univariate criterion is likely to be sufficient to identify bona fide farmers. Instead, multivariate criteria consisting of relevant farm, economic and other behavioral characteristics are needed for this task.

In addition to defining characteristics which optimally distinguish one group of farmers from another, the model suggests that discovery of where particular breaks or cutoffs should occur is equally important in devising classification criteria. For example, setting the cutoff on off-farm income at less than $25,000 is substantially different (in terms of farmers affected) from setting it at $10,000.

The low R^2s obtained in both models were not surprising, since we are currently unable to account adequately for individual behavior even though we can segment the population into groups displaying widely different behavioral means. The analysis needs to be extended to include noneconomic data as well. Improved data describing more fully the economic and social environment of the farm operator could result in development of more meaningful classification criteria. A larger sample and the use of time series data would strengthen analysis results. In addition, a composite index may be more appropriate than net farm income (dependent variable) in identifying bona fide farmers.

Major criticisms of differential assessment as applied to other states include: (1) land was converted to nonagricultural use even though it was under differential assessment, and (2) some land entering the program would have been converted to nonagricultural use even though it was not under differential assessment. Consequently, the conversion process is an important factor to consider when developing differential assessment programs. Conversion of a particular tract of land probably depends on landowner characteristics as well as the tract itself. Information characterizing landowners as presented in this paper, coupled with information on potential conversion of particular land tracts, could clearly aid policymakers. Although other approaches should not be ruled out, further research on the conversion process might utilize methodology similar to that presented in this paper. In that case, land tracts and not landowners would be the unit of analysis.

Another potential criticism of the study is the practicality of administering a multivariate criteria (formula) to determine apriorally who should be tax exempt. Such criteria will no doubt impose some added administrative cost and burden to assessors and others charged with its implementation. Yet, it is our opinion that implementation of such a system could lead to a more equitable taxing process and reduced rate of farmland conversion. Thus, the long run benefits to society will likely exceed the cost of implementing a differential assessment program based on multivariate criteria.

REFERENCES

[1] Barrows, R. L. and D. W. Bromley. "Employment Impacts of the Economic Development Administration's Public Works Program," *American Journal of Agricultural Economics*, Volume 57, February 1975, pp. 46-54.

[2] Carlin, T. A. and W. F. Woods. *Tax Loss Farming*, U.S. Department of Agriculture, ERS-546, Washington, D.C., April 1974.

[3] Clifton, I.D. "Using the Automatic Interaction Detection (AID) Model to Obtain Homogeneous Classifications of Farmland Markets," *Agricultural Economics Research*, Volume 27, July-October 1975, pp. 93-100.

[4] Hady, T. F. and A. G. Sibold. *State Programs for the Differential Assessment of Farm and Open Space Land*, EDD, ERS, U.S. Department of Agriculture, Agricultural Economic Report No. 256, Washington, D.C., April 1974.

[5] Hady, T. F. and T. F. Stinson. *Taxation of Farmland on the Rural-Urban Fringe*, ERS, U.S. Department of Agriculture, Agricultural Economic Report No. 119, Washington, D.C., September 1967.

[6] Lins, D. A. and T. R. Donaldson. "Explaining Farmland Operator Debt: An Application of the Automatic Interaction Detector (AID) Technique," Contributed Paper, American Agricultural Economics Association Annual Meeting, Pennsylvania State University, University Park, Pennsylvania, August 15-18, 1976.

[7] Logan, Charles A. "Analysis of the Tax Burden for Commercial Farmers of Georgia," Unpublished Thesis, University of Georgia, 1974.

[8] Poole, A. T., J. P. Marshall and W. L. Gibson. *Use-Value Assessment: A Study Based on Loudoun County, Virginia*, Virginia Polytechnic Institute, Research Division Bulletin 55, Blacksburg, Virginia, July 1970.

[9] Sonquist, J. A., et.al. *Searching for Structure*, Survey Research Center, Institute for Social Research, University of Michigan, 1973.