Does Extension Work? Impacts of a Program to Assist Limited-Resource Farmers in Virginia

Ebere Akobundu, Jeffrey Alwang*, Albert Essel, George W. Norton and Abebayehu Tegene

Authors are respectively: Graduate Student, Professor, Virginia Tech, Professor and Extension Dean, Virginia State University, Professor, Virginia Tech, and Economist, Food and Rural Economics Division, ERS.

*Corresponding author. 215 I Hutcheson, Virginia Tech, Blacksburg, VA 24061-0401. Tel.: 540-231-6517; FAX: 540-231-7417; e-mail: alwangj@vt.edu

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Introduction

Historically Black Land-Grant Colleges and Universities (HBCUs), including the 1890 institutions, have made significant advances in carrying out their tripartite mission of teaching, research, and extension. Despite limited resources compared to their 1862 counterparts, and virtually no research funding until the 1970s, they have played an important role in conducting and extending the results of research on problems confronting limited-resource farmers, households, and rural communities[1].

In recent years, the USDA loan and technical assistance program called the Small Farm Outreach Program (2501) has strengthened efforts by the 1890 institutions to assist limited-resource farmers. In Virginia, this federally funded program is administered by Virginia State University (VSU), Virginia's 1890 institution. The goal of the 2501 program is to provide technical, management, and other income-enhancing information services to limited-resource farmers. In Virginia, the program currently reaches approximately 400 limited-resource farmers in the state, many of them minority farmers. There are approximately 1200 minority farmers in Virginia, and many of them are limited-resource farmers.

The federal government has provided the bulk of the funding for this small-farm outreach program with supplemental funds provided by the Commonwealth of Virginia. However, in a period of scarce funds and increased demand for accountability from funding agencies and other stakeholders, institutions charged with implementing extension and outreach programs are challenged to "develop meaningful outcome measures that allow for adequate determination of their effectiveness and returns to

public investment in these programs" (Essel *et. al*., 1999). In addition to helping justify levels of public investments, quantitative information about the benefits derived from extension programs can guide program design and resource allocation within a program.

Despite these challenges, there has been little systematic effort to date to quantitatively link public investments in 1890 colleges such as VSU to program outcomes. This paper's main objective is to empirically evaluate the economic impact on participants in the Virginia Small Farm Outreach, Training, and Technical Assistance Program as administered by VSU (and funded in part by the 2501 program). This evaluation provides guidance about how to structure subsequent programs targeted at limited resource and minority farmers. Such guidance is especially timely as the USDA revises its programs to assist minority farmers in response to the consent decree signed in January 1999. This decree effectively settled a class action lawsuit against the USDA by thousands of African-American farmers.

The economic impact of the program is measured in terms of the program's effect on the incomes of limited-resource participant farmers in Virginia compared to their net farm incomes had they not participated. The measurement method employed corrects for potential biases resulting from individual and household-level heterogeneity. Such heterogeneity leads to endogenous correlations between program participation decisions and farm incomes. Without correcting for this endogeneity, estimates of benefits of participation may be biased. We use measures of access to extension services to identify the impact of the (endogenous) participation and intensity of participation decisions on net farm income. The logic of these instruments is that access to such services has no

impact on farm income except as felt through program participation and intensity of program participation.

The paper is organized as follows. In the next section, we present background on the 2501 program and discuss what is known about program impacts. Following this, we develop a conceptual framework showing net farm income as a function of participation and intensity of participation in the Small Farm Outreach Program. Data and results are then presented, followed by a discussion of the results and conclusions.

Background on 2501 Program

USDA initiated the Small Farm Outreach, Training, and Technical Assistance Program during fiscal year 1983. Its dual goal is to limit historical trends toward reductions in ownership of farmland by African Americans and to support HBCUs. Between FY 1994 and 2001, some $37 million has been allocated to the national program by USDA and since 1983, more than 8000 farmers have participated in the program. Qualitative assessments of the program indicate that it has been successful in ensuring the long-term sustainability of African-American farms (Hargrove, 2002).

The Virginia program provides educational programming in 35 counties in the state. It assists farmers with filling out loan applications for FSA loans, record keeping and budgeting, preparing farm and home plans, developing marketing plans, and developing high-value alternative enterprises and activities. These program activities are designed to ultimately improve the farmers' financial viability and this paper quantitatively investigates whether the program is meeting its goal.

Conceptual Framework and Empirical Specification

The model we employ examines decisions to participate in the program, intensity of participation and impacts of these variables on net farm income. Limited-resource farmers find themselves in one of two possible states: either they have participated in the Small Farm Program or they have not. Let Y_P represent net farm income if the farmer participates in the Small Farm Program and Y_{NP} represent income following non-participation. Earnings in each case may be specified as:

$$(1) Y_{P_i} = X_i b_P + u_{P_i}$$
$$(2) Y_{NP_i} = X_i b_{NP} + u_{NP_i}$$

where X_i is a vector of determinants of farm income and the subscript i denotes the individual (farmer) in question. The expected gain from participation is denoted $E(\Delta) = E(Y_P - Y_{NP})$. The individual is assumed to decide to participate in the program if expected gains from participation, net of participation costs, exceed zero. Define:

$$(3) I_i^* (= E(\Delta) - Costs) = Z_i g + e_i$$

where Z_i is a vector of factors representing the determinants of participation, g is a vector of parameters and e_i is an error term. I_i^* is unobserved. A person is assumed to participate if I_i^*>0 and we observe the binary outcome I_i=1. Otherwise, I_i=0. If the program only affects earnings through the first element of b (an intercept shifter), the model of program participation's effect on income may be rewritten as:

$$(4) Y_i = X_i b + a I_i + U_i,$$

where I_i is a dummy variable representing program participation. The effect of the program on the dependent variable is measured through a. The dummy variable cannot,

however, be treated as exogenous if the decision to participate is based on individual self-selection (i.e. as shown in equation 3). Such conditions might arise because the program may purposefully target more disadvantaged farmers, or because farmers with certain unobserved characteristics might be more eager to participate. Endogeneity of participation in (4) means $Cov(U_i, e_i) \neq 0$, and if it is ignored and equation 4 is estimated using OLS, the resulting parameters will be biased and inconsistent. One such solution is use of instrumental variables techniques (Robinson, 1989; Heckman, 1997).

In addition to simple participation in the 2501 program, increased intensity of participation may also raise farm incomes. We measure intensity of participation through the number of visits by outreach agents associated with the program to the farm in question. This count of events may be modeled using Poisson regressions. Denote the incidence rate for the ith farmer as R_i and let this rate be:

$$(5) R_i = \exp(X_i d + j_i),$$

where j_i is the regression error. Now, examine the impact of R_i on net farm income by rewriting equation 4 as:

$$(6) Y_i = X_i b^* + a^* R_i + h_i$$

Intensity of participation can affect income in the same way as participation in the 2501 program. As intensity of participation is also likely to be endogenous to the income generating process $Cov(h_i, j_i) \neq 0$, instrumental variables can also be used to estimate 6. This procedure is similar to those used in other studies of participation in programs such as the Food Stamp Program or other social welfare programs (Levedahl, 1995; Capps and Kramer, 1985;McLean-Meyinsse, *et. al*, 1994). In all these studies, the authors find that income plays a significant explanatory role in the participation decision. Indeed, a recent

study of farmer participation in the U.S. Farm Programs found that "income is the best predictor of farmer's attitudes and behaviors (Thomas and Thigpen, 1996)." These findings indicate that the mechanism that determines the income levels of limited-resource farmers also determines who participates and with what intensity.

Data Collection

Data were collected using a mail survey followed up by a phone call in the case of a non-response. VSU provided a list of 400 farmers to form part of the database for the analysis. The Virginia Agricultural Statistics Service (VASS) was instructed to select a group of 400 farmers whose racial composition, asset positions and farm income situations mirror those of the group data supplied by VSU. Like the VSU group, the VASS group is composed of farmers whose gross annual sales do not exceed $150,000. The control group is constructed using the non-participants from both VASS and VSU data sets.

A Virginia State University extension agent together with one of this paper's co-authors pilot-tested the questionnaire during fall 2000. Then, VASS mailed the revised questionnaire to the 800 farmers during winter 2001. Overall, non-responses were a major problem, resulting in only 205 usable questionnaires. The major sub-categories of non-responses included non-farmers who responded to the survey (135), and deceased, absent, or otherwise unavailable farmers. Once these were omitted, the remaining major sub-categories of non-responses were income-related, asset related, or related to the distance to extension and FSA offices.

It is not surprising that farmers filling out the survey would omit questions about their financial situation. What is more telling is that a substantial number of farmers do not know the distance either to their FSA or their Extension office. Either they are not visiting the office enough to determine this distance or they do not visit the office at all. As the estimation results in the next section bear out, if the non-response is due to a lack of awareness about the proximity of the office, this could have an adverse effect on the farmer's income level.

Table 1. Variable Descriptions and Summary Statistics.

Variable	**Definition**	**Means (standard dev)**	
Dependent Variables		**Participants (N=73)**	**Non-participants (N=132)**
FINC	Average net farm income, past 3 years	14383.56 (25626.8)	10852.27 (23333.4)
PART	Dummy variable=1 if farmer recently participated in the 2501 program	1	0
NOVISIT	Number of visits by 2501 agents	5.1644 (5.2255)	NA
Independent Variables			
ACRE	Acreage	225.10 (209.0)	181.71 (164.6)
OFINC	Average non-farm income, past 3 years	37739.73 (24983.2)	37935.61 (25730.7)
ASSETS	Value of household and farm assets	171849.3 (75591.4)	162367.4 (76554.7)
RACE	Dummy variable=1 if farmer is black	.6438 (0.4822)	.4394 (0.4982)
EXPER	Years in farming	29.8356 (17.6084)	26.2197 (17.2699)
SCHOOL1	Dummy variable=1 if farmer completed high school	0.3288 (0.4730)	.3712 (0.4850)
SCHOOL2	Dummy variable=1 if farmer attended or completed college	0.3973 (0.4927)	0.4242 (0.4961)
HHSIZE	Number of household members	2.4932 (1.0425)	2.6364 (0.9103)
BEEF	Dummy variable=1 if primary farm income earner is beef cattle	0.3014 (0.4621)	.3485 (0.4783)

DISTF	Miles to nearest FSA office	12.1699 (5.8382)	12.5568 (6.1177)
NOLOAN	Dummy variable=1 if farmer has been turned down for a farm-related or bank loan	.2192 (0.4166)	.1591 (0.3671)
PRVISIT	Dummy variable=1 if farmer was visited by 2501 agent before 1990	.2603 (0.4418)	.0909 (0.2886)
DEBT	Value of household debts	67602.74 (71426.97)	56912.88 (69468.99)

Variable definitions and summary statistics are presented in table 1. The dependent variable in equations 4 and 6, is computed as the dollar value of the previous three-year average of net farm income. The other income variable (OFINC) is computed similarly as an average of three years' prior income. Participants in the 2501 program are more likely to be black, have higher incomes, farm larger acreages and have slightly higher asset values than non-participants (table 1). Participants, however, have lower levels of schooling and have higher debt loads. Twenty-seven percent of participants did not finish high school while 80 % of non-participants finished high school or attended college. Participants are also more likely to have been turned down for a loan (one of the targeting criteria for the 2501 program) and are more likely than non-participants to have been visited in the past by an extension agent.

Among all respondents to the questionnaire, 69 percent received no visits from agents associated with the Small Farm Outreach program, nine percent received one visit, ten percent two to four visits, eight percent five to eight visits, three percent nine to 15 visits, and one percent 16 to 20 visits.

Estimation Results

Equations 4 and 6 were first estimated without treating participation and intensity of participation as endogenous to the farm income-generating process. The purpose of this exercise is to understand how estimates of program impacts are affected by self-selection. Neither participation variable is found to have a significant impact on farm income (see annex table 1 for details). The regression results are similar regardless of whether the participation variable (PART in column 1) or the number of farm visits by agents (NOVISIT in column 2) is included as a regressor. However, if these variables (as we suspect) are endogenous to farm income generation, then all the parameters will be biased and inconsistent (see Robinson, for a discussion of this bias). In both cases, participation in the program did not have a statistically significant impact on net farm income. However, as noted above, self-selection and endogenous participation are likely to contribute to a downward bias on these estimated parameters. To examine this bias, we use a two-stage procedure to estimate the structural parameters in equations 4 and 6.

The first-stage estimates express the probability of participation and number of visits by agents as a function of all exogenous variables in the system. These equations are estimated using a probit and a poisson regression, respectively. The structural estimates of the impact of probability of participation and number of visits on farm income are identified in the second stage using the variables PRVISIT, NOLOAN, DISTF, and DEBT (see table 1 for a description) as identifying instruments. Each of these variables is expected to affect participation and intensity of participation in the program, and only affect farm income through their impact on participation and intensity. They are logical candidates for use as identifying instruments.

The first-stage estimates of participation and number of visits are presented in table 2. The probit model for program participation shows that only race and prior visit by an extension agent are significant determinants of current participation in the Small Farm program. Black farmers and those that received assistance from extension prior to 1990 were both more likely to participate in the program. Farm size, level of earned income off the farm, farm financial position and household characteristics all had no significant impact on program participation. Oddly, the fact that a person was turned down for a loan (NOLOAN) is insignificant in the participation probit. This factor is supposed to be one of the targeting criteria for the Small Farm Program.

Table 2. Regressions for determinants of program participation

	Probit	**Poisson**
Variable	**Dependent Variable: PART**	**Dependent Variable: NOVISIT**
INTERCEPT	-.8868 (0.5616)	-1.382689 (0.8097)
ACRE	.0004 (0.0006)	.0000487 (0.0008)
OFINC	4.60e-07 (4.38e-06)	-5.41e-06 (6.36e-06)
ASSETS	1.68e-06 (1.56e-06)	2.41e-06 (1.98e-06)
RACE	.6251 (0.2125)	1.312008 (0.3383)
EXPER	.0020 (0.0067)	.0071337 (0.0086)
SCHOOL1	-.0454 (0.2710)	-.1152515 (0.3373)
SCHOOL2	-.0938 (0.3005)	.0114593 (0.4527)
HHSIZE	-.0781 (0.1023)	.0975982 (0.1557)
BEEF	-.1711 (0.2098)	-.7671276 (0.3469)
DISTF	-.0064 (0.0166)	.0150847 (0.0313)
NOLOAN	-.0724 (0.2468)	.0786343 (0.3566)
PRVISIT	.7462 (0.2602)	.8944181 (0.2892)
DEBT	6.99e-07 (1.48e-06)	3.83e-06 (1.80e-06)
Pseudo R^2	0.0894	.210

Note: Robust standard errors in parentheses

Efforts to understand the determinants of number of visits by the agents were slightly more satisfactory (see column 2 in table 2). The pseudo R^2 for this regression is above .2 and an additional 2 variables (the dummy variable for beef production and the farm debt variable) were statistically significant at the 5% level. Farmers with higher debt loads were likely to receive more visits from the agents, and beef producers, though they were no more or less likely to participate, received fewer visits, conditional on program participation. The regression results from table 2 were used to generate predicted values of the propensity to participate and numbers of visits. These predicted values were used in the second-stage regressions.

The second-stage estimates of the structural determinants of farm income are presented in table 3. The parameter estimates for the determinants of net farm income are similar regardless of whether participation or intensity of participation was modeled. Higher values of off-farm income are associated with lower net farm income, and more financial and human (in the form of the household size variable) assets are associated with higher farm incomes. Land assets were not significant contributors to farm income in either regression, although the parameter estimates are positive, as expected. Higher off-farm incomes mean less specialization in agriculture in Virginia, where more than 95 % of farm operators report working off the farm and 40 % work more than 200 days off the farm (1997 Census of Agriculture). Less specialization, in turn, is associated with lower net-farm incomes, and limited-resource farmers often use farm expenses to offset off-farm earnings for tax purposes. The negative coefficient[2] for beef producers is further evidence that off-farm income is likely to substitute for on-farm income for part-time farmers; beef producers tend to be part-time farmers in Virginia. More financial assets

are clearly associated with higher farm incomes, and households with more members also show higher net farm incomes. This latter finding is attributable to a labor effect.

Table 3. Second-stage farm income regressions with endogenous participation

Dependent Variable: FINC		
Variable	**Equation 4**	**Equation 6**
INTERCEPT	-5656.75 (5898.72)	-711.13 (5168.93)
ACRE	15.1061 (9.1139)	13.7525 (9.3797)
OFINC	-0.2521 (0.0730)	-0.2264 (0.0721)
ASSETS	0.0746 (0.0244)	0.0768 (0.0234)
RACE	-9788.42 (4376.19)	-10590.93 (3652.59)
EXPER	131.56 (108.10)	142.31 (103.55)
SCHOOL1	-6865.79 (4344.85)	-7453.70 (4195.70)
SCHOOL2	-6038.90 (4468.08)	-6917.68 (4520.35)
HHSIZE	4193.25 (1279.32)	3342.41 (1269.11)
BEEF	-5750.94 (2849.86)	-3459.23 (3072.6)
PART*	26317.21 (16143.33)	
NOVISIT*		2982.75 (1385.13)
R^2	.290	.307

Note: Robust standard errors in parentheses.
*Endogenous variables

The regression results indicate that participation in the small farm program alone is not enough to increase farm income. As shown in the results for equation 4, simple participation[3] in the program does not raise farm incomes significantly (although the sign of the coefficient is positive). As intensity of participation increases, however, the effect of the program on farm income increases and becomes significant. The coefficient on number of visits (second column) indicates that each additional visit of an agent is associated, holding everything else constant, with nearly a $3000 increase in annual net

farm income. The significance of the number of visits is robust to alternative specifications of the model and provides evidence of a substantial positive impact of the program on farm incomes. The modal number of visits to participants in the program by the 2501 agents is four.[4]

Intensity of participation's impact on net farm income is mediated through two paths. First, farmers who participate intensely in the 2501 program are assisted in receiving loans from a variety of sources. The low rate of rejection for loans for program participants may reflect 2501 program efforts to enhance loan applications. While debts on participant farms exceed those of non-participants, debt-to-asset ratios are lower, indicating evidence of more efficient use of borrowed funds. Second, more intense participation leads to fuller interactions between agents and the farmer. These interactions allow the farmer to trouble shoot problems in their early stages. They can lead to better timing of farm operations, more active efforts to solve on-farm problems, improved farm planning and quick referrals for problem solutions. More intense participation exposes the farmer to a wide means of improving farm operations; this exposure helps raise incomes.

Comparing the results from the annex table with those presented in table 3 provides evidence of the bias created by the endogeneity of program participation. A formal test of endogenity of participation and intensity of participation was performed (Davidson and MacKinnon, 1993)[5]. This test produced a p-value of .114 and .065, respectively, for equation 4 and 6. In the former case, there is only weak evidence that endogeneity of program participation is a problem. Part of this result may be due to the weak fit of the probit reduced-form used to generate the predictions. The number of

visits by Small Farm Program outreach agents in equation 6 is clearly endogenous to the income generation process.

Conclusion

The Small Farm Program for limited-resource farmers in Virginia appears to significantly increase participant's net farm income, provided there is sufficient intensity of participation. Limited contact between agents and farmers, as measured by a single visit by an agent, has no significant effect on income. This finding is consistent with those of more qualitative analyses which show that the most successful 2501 programs are those that recruit participants, assist farmers in obtaining loans, establish cooperatives and introduce farmers to alternative enterprises (Hargrove, 2002). The results demonstrate that a successful program will involve multiple contacts with individual farmers.

Assuming a linear relationship between frequency of visits and benefits, aggregate benefits of the program may approach $5 million per year (for a cost of a few hundred thousand dollars). The importance of accounting for endogeneity of participation is clear in the analysis. Lower resource farmers self select into the program, which would bias the results unless it is accounted for in the model.

The findings clearly suggest a rationale for deepening the intensity of participation before broadening the program to include non-participants. Without such deepening, in the form of multiple farm visits by program agents, the program's impact will be lessened—active and intense participation makes the program work.

Endnotes

[1] According to data from the National Science Foundation, the 100+ HBCUs receive slightly more than 1 percent of total R&D funds allocated to all Colleges and universities. Comparatively small funding occurs in part due to limited state matching funds for 1890 institutions compared to 1862 institutions. States match federal funds to 1862s roughly $6 for every $1 received, but for 1890s they match less than $1 for every $1 received.

[2] Not significant in equation 6.

[3]The relevant survey question asks whether the respondent has received, in recent years, any assistance from an agent of VSU's Small Farm Outreach Program.

[4] One could use the average number of visits (four) and the $3000 impact per visit to calculate an overall $12,000 impact of the program per farm or $4.8 million aggregate impact, a number that significantly exceeds the cost of the small farm outreach program. However, the impact per visit may not be linear and therefore this extrapolation could be misleading.

[5] Davidson and MacKinnon suggest using an augmented regression where the predicted value of the suspected endogenous variable is included in a regression of the dependent variable on its determinants

References

Capps, O. Jr. and R. A. Kramer. "Analysis of Food Stamp Participation Using Qualitative Choice Models." *American Journal of Agricultural Economics*. 67(1): 49-59. (1985).

Davidson, R. and J. G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. New York: Oxford University Press.

Essel, A., W. Clarke, and A. Tegene. "Defining Outcomes and Measurable Indicators for 1890 Land Grant Programs." Paper presented at the ERS/USDA-1890 Workshop on Enhancing the USDA-1890 Partnership, September 1-2, 1999.

Green, William H. *Econometric Analysis*. Upper Saddle River: Prentice Hall. 1997.

Hargrove, Tasha Monique (2002). "A Case Study Analysis of the Implementation Process of the Small Farmers Outreach and Technical Assistance (2501) Program, 1994-2001: Implications for Agricultural Extension Education Targeting African American Farmers." Unpublished PhD. Dissertation, Iowa State University, 177 pp.

Heckman, James. 1990. "Varieties of Selection Bias," *American Economic Review*. 80(2): 313-318.

Heckman, James. 1997. "Instrumental Variables. A Study of Implicit Behavioral Assumptions Used in Making Program Evaluations," *Journal of Human Resources.* 32(3): 441-462.

Levedahl, J. William. "How much Can Informational Outreach Programs Increase Food Stamp Program Participation?" *American Journal of Agricultural Economics*. 77(2): 343-52. (1995).

McLean-Meyinsse, P.E., J. Hui, and R. Joseph Jr. "An Empirical Analysis of Louisiana Small Farmer's Involvement in the Conservation Reserve Program." *Journal of the Agricultural and Applied Economics*. 26(2): 379-85. (1994)

Pitt, Mark and Shahidur R. Khandker. 1998. "The Impact of Group-Based Credit Pograms on Poor Households in Bangladesh: Does the Gender of Participants Matter?" *Journal of Political Economy.* 106(5): 958-996.

Robinson, Chris. 1989. "The Joint Determination of Union Status and Union Wage Effects: Some Tests of Alternative Models," *Journal of Political Economy.* 97(31): 639-667.

Thomas, J. K. and J. Thigpen. "A Social Exchange Explanation of Participation in the U.S. Farm Program." *Southern Rural Sociology*. 12(1):1-23. (1996)

Table A.1. Net farm income regressions without accounting for endogeneity of program participation

Variable	Equation 4	Equation 6
INTERCEPT	-1821.35 (5537.02)	-1340.45 (5379.43)
ACRE	21.2296 (9.5680)	19.61339 (9.3480)
OFINC	-0.2460 (0.0734)	-.2405489 (0.0738)
ASSETS	0.0900 (0.0248)	0.0873 (0.0238)
RACE	-4458.87 (3270.90)	-5767.96 (3051.10)
EXPER	150.89 (105.91)	149.82 (103.06)
SCHOOL1	-6976.61 (4377.28)	-7110.35 (4294.00)
SCHOOL2	-6313.69 (4473.06)	-6484.55 (4540.49)
HHSIZE	3486.021 (1285.33)	3413.60 (1301.61)
BEEF	-6797.41 (2790.05)	-5984.71 (2778.74)
PART	1788.073 (3121.99)	
NOVISIT		777.50 (520.83)
R^2	.279	.293

Note: Robust standard errors in parentheses