OFF-FARM WORK BY FARM FAMILIES: SOME EMPIRICAL RESULTS AND POLICY IMPLICATIONS*

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1. Introduction

The welfare of farm families, even those with large farms, is not determined solely by their incomes from the farms they operate (USDA 1976, p. 62). The share of personal income of the farm population from nonfarm sources has steadily increased from 27 percent in 1950 and 35 percent in 1960 to 50+ percent in the 1970's, except for 1973-74 when net farm income rose so dramatically.[1] Moreover, approximately 70 percent of the income from nonfarm sources is wage and salary income.[2] Thus a large and growing share of the income of farm families is not from farming.

During the past 25 years there has been a greater than 65 percent net decline in the farm population and a striking increase in the integration of farm and nonfarm labor markets. The sources of integration are (1) an increasing percentage of the farm population in the labor force has nonfarm jobs, and (2) an increasing percentage of those who work on farms reside elsewhere. Only the first of these changes, however, is addressed in this paper.[3] The reported occupations of resident farm males and females show some of the change. In 1950, 75.4 percent of the farm resident males and 41 percent of farm resident females in the civilian labor force reported their occupation (of the census week) as one of the two farm occupations, farmers and farm managers or farm laborers and farm foreman (U.S. Dep. Commerce).[4] In 1970, these percentages had dropped to 50 percent for males and 10 percent for females. Therefore, nonfarm occupations have shown a dramatic increase in frequency of reported occupation of the farm population.

Reported off-farm work by farm operators and their wives shows another aspect of this change. Nationally the percentage of farm operators reporting any off-farm work during the census year rose steadily from 39 percent in 1950 to 54 percent in 1969 (U.S. Dep. Commerce 1973, p. 178). Operators working 100 days or more off their farms increased from 23 to 40 percent during the same period. Perhaps surprisingly, all regions, except the Northeast, show a similar rise in the participation rates of farm operators in off-farm work. Only in the North Central region, however, did the number of farmers participating in off-farm work actually increase as the total number of farm operators declined. For farm wives, the nonfarm labor force participation rate increased from 16 percent in March 1959 to 26 percent in March 1971 (U.S. Dep. Labor).

This paper reports on an economic analysis of off-farm work, which is a relatively new topic. Lee has sketched a model for allocating farm resources between farm and nonfarm uses, and Polzin and MacDonald have published estimates for a naive off-farm labor supply model. Some other studies are in unpublished form. In this paper, a labor supply model provides the theoretical framework for the determinants of off-farm labor supply of farm family members. The model is similar to one sketched by Lee. Empirical results are reported from fitting off-farm labor supply functions for farmers to 180 pooled observations of state averages of farm households grouped by age of farm operator. The results yield implications for agricultural, rural development and manpower policies.

Section 2 presents the labor supply model. The data, empirical measures of the variables and empirical results are presented in section 3. Section 4 contains some policy implications.

2. A Labor Supply Model

The labor supply decisions of farm household members are viewed most simply as the result of household utility maximization subject to a human time constraint and to an endogenously determined income constraint. Household members are assumed to receive utility or welfare directly or indirectly (Michael and Becker) from a vector of members' human consumption time (L), a vector of goods purchased in the market (Y_1) and a vector of factors exogenous to current household consumption decisions (Y_2) -- age and education of household members and number of household members. The utility function is represented as the strictly concave function:

$$(1)\quad U = U(L,Y_1;Y_2),\quad (U_i = \partial U/\partial i > 0, i=L,Y_1).$$

In maximizing utility, the household faces three constraints. First, a vector of human time endowments of family members (T^o) is allocated between farm work (X_1), off-farm work (T_{of}) and consumption time (L) for each member:

$$(2)\quad T^o = X_1 + T_{of} + L.^5$$

Second, household income received from members' off-farm work at wage rates W_{of}, net farm income ($PQ - W_2X_2$) and other household income (V) is spent on market goods:

$$(3)\quad W_{of}T_{of} + PQ - W_2X_2 + V = P_1Y_1$$

where P is the price of farm output Q, W_2X_2 is the total variable cost of producing farm output, and P_1 is the price vector for Y_1. The analysis assumes that flexible work schedules persist in off-farm labor markets, and a family member's off-farm wage rate is exogenous to his current quantity of off-farm work, i.e., that there is a perfectly elastic demand for his labor.[6] Third, the properties of the input output relation of the farm output production function restrict the potential size of the income-expenditure constraint. Farm output is produced from two vectors of inputs, a vector of family members' farm labor inputs (X_1) and a vector of other variable inputs (X_2). The production function is represented as the strictly concave function:

$$(4)\quad Q = F(X_1,X_2),\quad (f_i = \partial Q/\partial X_i > 0, i=1,2).$$

Equation (4) can, however, be eliminated after it is substituted into equation (3) to create the new combined constraint:

(5) $W_{of}T_{of} + PF(X_1,X_2) - W_2X_2 + V = P_1Y_1$.

Conditions for the optimal quantity of off-farm work (T_{of}), of the two variable inputs into household consumption (L and Y_1) and of the two inputs into farm output production (X_1 and X_2) are obtained by maximizing equation (1) subject to (2) and (5). For an interior solution, the time of each household member must be allocated such that the marginal value of farm work, of consumption time and of off-farm work are equal (i.e., $Pf_1 = U_L/\lambda = W_{of}$ where λ = the marginal utility of income).[7]

The quantity of off-farm work by household members can be viewed as a residual by subtracting the quantity of consumption time and of farm work from the human time endowment:

(6) $T_{of} = T^o - L - X_1$.

But the quantities that the household demands of L for household consumption and of X_1 for farm production (and of the other endogenous variables) are functions of the exogenous variables of the model W_{of}, P_1, P, W_2, V and Y_2,

(7) $L^* = d_L(W_{of},P_1,P,W_2,V,Y_2)$ and

(8) $X_1^* = d_1(W_{of},W_2,P)$,

$$(\partial X_i^*/\partial W_i < 0, \partial X_i^*/\partial P > 0).$$

After substituting equation (7) and (8) into (6), the off-farm labor supply function is:

$$(9)\quad T_{of}^* = T^o - d_L(W_{of},P_1,P,W_2,V,Y_2) - d_1(W_{of},W_2,P)$$
$$= S_w(W_{of},P_1,P,W_2,V,Y_2) - d_1(W_{of},W_2,P)$$
$$= S_{of}(W_{of},P_1,P,W_2,V,Y_2).$$

But the labor supply function (farm and nonfarm) is just $T^o - L^*$ ($=T_w^*$), so the off-farm labor supply function is also the difference between the labor supply function and the demand function for family farm labor, i.e., an excess supply function (line 2 of equation 9).[8] More generally, the off-farm labor supply function collapses to line 3 of equation (9).

Although equation (9) summarizes the functional nature of the off-farm labor supply function, the equation does not yield a priori unambiguous signs for directional effects of the exogenous variables on off-farm labor supply. The primary reason is the a priori ambiguous directional effects of the parameters in the demand function for consumption time (or the supply function of labor). A change in the off-farm wage rate causes pure substitution effects in both household consumption and farm production and an income effect that may be opposite in sign. A change in the price of other variable farm inputs, e.g., wage rate for hired farm labor, causes a pure substitution effect in farm production and in income effect in household consumption that also may be opposite in sign. A change in the price of farm output, or of household nonlabor income, causes an income effect that depends on the sign of the income elasticity of demand for consumption time.

Graphical determination of the quantity of off-farm labor supply is seen most clearly by considering the intersection of the supply and demand curves for an individual's labor. The demand curve is the horizontal summation of the farm and off-farm demand curves for his labor, and it has a kink at the point where these two curves intersect. For example, if the farm demand curve for labor is d_od_o' in figure 1 and the off-farm demand curve for labor is $W^o_{of}d'_{of}$, the total demand curve is the kinked demand curve $d_oAd'_{of}$. If the total supply of labor curve is S_oS_o', equilibrium time allocation occurs at e_o where the wage rate is W^o_{of}; the total quantity of labor supplied is Ot^o_w; the quantity of farm work is OX^o_1; and the quantity of off-farm work is $X^o_1t^o_w$. Thus, the individual is a multiple job holder at one self employed job and one wage job.

Alternatively, if the farm demand curve for labor shifts to d_1d_1' owing say to a rise in the expected price of farm output and the off-farm demand curve remains at $W^o_{of}d'_{of}$, the total demand curve is $d_1A'd'_{of}$, and it intersects the total supply curve S_oS_o' at e_1, assuming a zero income elasticity of labor supply. Equilibrium occurs at a marginal value of labor of W', which is above the off-farm wage rate W^o_{of}, and the total supply of labor Ot'_w is allocated to farm work. At e_1 the individual is a self-employed "full-time" farmer, and the marginal value of his time is endogenous to the model, i.e., it is not determined by the wage rate in the off-farm labor

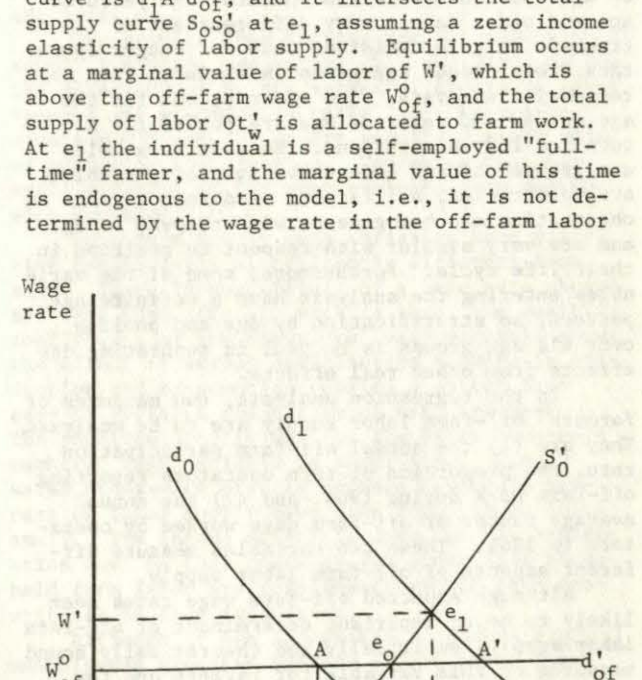

Figure 1. Labor supply and demand.

market. Thus a ceteris paribus shift to the right (left) of the demand curve for an individual's farm labor reduces (increases) the probability and quantity of his off-farm work. (Note a reduction occurs only when the quantity of off-farm work is initially positive.)

3. The Empirical Analysis

In the empirical analysis, farmers' off-farm labor supply is measured by two variables, the annual participation rate and the annual average days of off-farm work. Empirical measures of variables suggested by the labor supply model as being important determinants of off-farm labor supply are derived and used in the empirical analysis.

The Data

The primary data source is the 1964 Census of Agriculture (mainly state table 19). The study area is the United States. The 48 contiguous states are collapsed into 45 states by combining New Hampshire and Vermont, Connecticut and Rhode Island, and Delaware and Maryland. The observations are state averages per farm household for farm households grouped by age of farm operator. There are five different age groups in the census: <35, 35-44, 45-54, 55-64 and ≥ 65 years of age. Because the farm operators 65 years of age and older face a very different set of retirement related decisions than do younger operators, this oldest age group is excluded from the regression analysis. The observations for the age groups <65 years of age are pooled for a total of 180 observations. Because households are grouped by age before averages of variables are constructed, all farmers used to construct an observation are homogeneous with respect to age and are very similar with respect to position in their life cycle. Furthermore, some of the variables entering the analysis have a definite age pattern, so stratification by age and pooling over all age groups is helpful in separating age effects from other real effects.

In the regression analysis, two measures of farmers' off-farm labor supply are to be analyzed. They are (1) the annual off-farm participation rate, the proportion of farm operators reporting off-farm work during 1964, and (2) the annual average number of off-farm days worked by operators in 1964. These two variables measure different aspects of off-farm labor supply.

Although expected off-farm wage rates seem likely to be an important determinant of off-farm labor supply, empirically and theoretically sound measures of this variable for farmers and for other farm household members are scarce. One possibility is the marginal expected net (of taxes, commuting costs and job related expenses) off-farm wage rate. But these data do not exist. A more readily available measure is a state average off-farm wage rate of an age group obtained by dividing aggregate off-farm wage and salary income by aggregate days worked.[9] With this wage variable, labor markets are equal in size to a state. It is true, however, that these average wage rates really apply only to persons who have wage jobs. For those household members who do not hold wage jobs, the marginal value of their time could be either higher or lower than the average measured wage for the group. Also, part of the interstate wage rate variation is due to labor quality differences, e.g. to education and wage-work experience. Problems with quality differences are made less serious when education is included as a separate explanatory variable and when observations are grouped by age before constructing variables.

There is also the choice between measured and imputed average wage rates. A wage equation could be estimated, then imputed wage rates used as instrumental variables. Data on the characteristics of only those household members who work at wage jobs do not exist. Furthermore, when wage functions are fitted to the available data, the low R^2's for aggregate data suggest that a relatively large amount of useful wage variation may be lost by using imputed wage rates. Thus off-farm wage rates for farm operators and for other farm household members are derived as measured average wage rates. The two different farm family wage variables are used in an attempt to capture in the empirical analysis interdependencies in time allocation between operators and other household members.

In addition to farm labor performed by other farm family members, hired farm labor is an important substitute in farm production for (much of) operator farm labor. This latter substitution possibility is incorporated into the empirical analysis through the wage rate for hired farm labor. The wage rate for hired farm labor is the state average daily wage rate, without board and room, for hired farm labor (USDA 1965). The problem of interstate wage variation because of labor quality differences is more serious for hired farm labor than for farm household labor because education of hired labor is not included in the analysis.

In cross-sectional data there is little meaningful variation in farm output price(s) to explain shifts in the off-farm labor supply function; but there is large variation in farm output, and the size of farm output is extremely important for determining the quantity of operator labor demanded for farm work. Thus in the empirical analysis, farm output, measured as the value of farm products sold, replaces the farm output price as a shifter of the off-farm labor supply function. A potential deficiency of measured farm output is the simultaneous equation bias of its coefficient caused by the joint determination of actual farm output and hours of off-farm work. When more data are collected on the farm inputs, this problem can be resolved by using imputed output as an instrumental variable for farm output.

Other (nonwage and nonfarm) household income includes income received from nonfarm businesses and professions; social security, pensions, veterans and welfare payments; and rent from farm and nonfarm property, interest and dividends. The variable has most of the usual deficiencies of such nonwage income variables. Some income components are contingent on household member's decisions about work. Other income components are a return to both labor and nonhuman capital. Current asset income is determined by past saving, type of investment and labor supply decisions.[10] These deficiencies of the other household income variable will cause its estimated coefficient to be biased.

In addition to the effects of education on off-farm labor supply through its effects on off-farm wage rates and on the level of farm production, education can affect off-farm labor supply through its effect on the efficiency of human time use in farm and household production and perhaps on preferences about time allocation to different major activities. The education of farm operators and other household members is measured as the average number of years of schooling completed by operators and by other farm household members 25 years of age and older, respectively. Young children place restrictions on the allocation of time to different activities, especially for wives, and older household members tend to be quite income (or market goods) intensive in their consumption. These family size and composition effects are expected to affect off-farm labor supply. Thus two family size variables are derived, the number of children less than 5 years of age and the number of persons 5 years of age and older.[11]

Summary statistics for the variables of the sample and for the five age groups are presented in table 1. A comparison of mean values of variables across age groups of farm operators shows that farmers in the group 65 years of age and older possess extreme sample values. Also, retirement decisions weigh heavily on behavior at this time. Thus the sample is made more homogenous and compatable with the labor supply model by excluding the farm operators 65 years of age and over. The table also shows definite life-cycle patterns for the CHILD and OFAM variables and a definite "vintage" effect for the two education variables.

The Econometric Model and the Empirical Results

In the econometric model, different functional forms are used to represent the relationship between the two measures of off-farm labor supply and the explanatory variables. The logistic functional form was chosen for the participation rate equation after some experimentation:[12]

$$(10)\quad R_i = 1/[1 + \exp(-\alpha_o - \alpha_1 \ln X_{1i} - \alpha_2 X_{2i} - \mu_i)],\ i=1,\dots, 180;$$

$$E\mu_i = 0;\ E\mu_i^2 = \sigma_1^2;\ E\mu_i\mu_j = 0,\ i\neq j$$

where μ's are random disturbances that have an independent identical normal distribution with zero mean and common variance σ_1^2. It is transformed into the logit function, which is linear in the unknown coefficients and the disturbance, for estimation:

$$(11)\quad \ln[R_i/(1 - R_i)] = \alpha_o + \alpha_1 \ln X_{1i} + \alpha_2 X_{2i} + \mu_i.$$

Although the participation rate R_i is bounded between 0 and 1, the new dependent variable in equation (11), the natural logarithm of the odds in favor of off-farm work participation, is a monotone increasing function of R_i and is bounded between $\pm\infty$.[13] In equation (11), α_1 is an elasticity, the percentage change of the odds due to a 1 percent change of X_1, and α_2 is the percentage change of the odds due to a marginal change in the level of X_2.

A mixed geometric and exponential functional form was chosen for the days of off-farm work equation:

$$(12)\quad OFDAYS_i = \beta X_{1i}^{b_1} e^{b_2 X_{2i} + \varepsilon_i},$$

$$i=1,\dots, 180;\ E\varepsilon_i = 0;$$

$$E\varepsilon_i^2 = \sigma_2^2;\ E\varepsilon_i\varepsilon_j = 0,\ i\neq j,$$

where ε_i's are random disturbances assumed to have an independent and idential normal distribution with zero mean and common variance σ_2^2. The $\log_e$ transformation is performed on equation (12) to obtain an equation that is linear in the unknown coefficients and the disturbance:

$$(13)\quad \ln(OFDAYS) = b_o + b_1 \ln X_{1i} + b_2 X_{2i} + \varepsilon_i.$$

In (13) coefficient b_1 is the elasticity of OFDAYS with respect to X_1; b_2 gives the percentage change of OFDAYS due to a one unit change in the level of X_2.

The results from fitting the two off-farm supply functions, equations (11) and (13), to the 180 observations by the method of classical least squares are reported in table 2.[14] Regression equation (1) and (2) report results for the odds of participation equation. Variables that have small t-ratios in (1) were excluded from regression equation 2.[15]

Both farm family wage variables have positive coefficients significantly different from zero. Since income effects of a wage rate change are zero when off-farm work is zero, the positive coefficient of the operators' wage variable shows the effect of strong substitution effects in production and consumption causing a switch from zero to positive quantities of off-farm work. The positive coefficient for the other household members' wage variable is surprising. Compensated cross-wage effects between household members on labor supply have been found to be quite small. The income effect is zero, so the explanation must be that operator and other farm household farm labor are complements rather than substitutes in farm production.

Although it was impossible to derive a priori unambiguous expected effects of the hired farm labor wage rate and of farm output on the odds of off-farm work, the negative and statistically significant coefficients of these variables are quite appealing. Increasing the wage rate of hired labor, which increases the cost of hired labor relative to operator farm labor (and other farm household member's farm labor), causes a substitution of operator farm labor for hired farm labor given that farm output is held constant and decreases the odds (probability) of operators' off-farm work. The strong negative coefficient of farm output reflects the over-

Table 1. Sample Means for Whole Sample and for Different Age Groups of Farm Operators - U.S., 1964

Symbols	Variable description	Sample (Age groups <65 years)	Age groups of farm operators <35 yrs.	35-44	45-54	55-64	≥65
R	Annual participation rate in off-farm work - farm operator	0.545 (0.13)[1]	0.621	0.607	0.538	0.415	0.146
	(Regions:) Northeast		0.550	0.569	0.534	0.440	0.180
	North Central		0.568	0.534	0.471	0.354	0.128
	South		0.689	0.683	0.587	0.450	0.138
	West		0.632	0.608	0.548	0.417	0.155
OFDAYS	Annual days of off-farm work - farm operator (da/yr)	97.1 (35.8)	112.3	113.1	95.9	67.2	17.7
	(Regions:) Northeast		106.5	114.7	104.5	78.9	22.1
	North Central		86.6	84.5	70.5	47.2	14.9
	South		131.4	134.4	109.0	75.0	16.4
	West		118.0	114.4	100.4	71.0	19.8
WAGEF	Off-farm wage rate - farm operator ($/da)	18.9 (5.4)	19.2	19.6	18.8	17.8	15.6
WAGEO	Off-farm wage rate - other farm household members ($/da)	14.6 (4.6)	15.9	13.8	14.2	14.6	15.0
WAGEH	Farm wage rate for hired farm labor ($/da)	8.9 (2.1)	8.9	8.9	8.9	8.9	8.9
Q	Value of farm products sold ($/yr)	15,524.0 (12,479.1)	15,389.6	17,893.4	15,921.6	12,891.3	7,552.7
OI	Other realized household income ($/yr)	1,031.0 (393.1)	782.6	1,087.8	1,145.1	1,108.4	1,658.0
EF	Education - farm operator	10.1 (1.4)	11.2	10.5	9.7	9.0	8.2
EO	Education - other adult household members	10.6 (1.0)	11.1	10.8	10.4	10.0	9.4
CHILD	Children < 5 years of age	0.41 (0.39)	1.00	0.45	0.14	0.07	0.04
OFAM	Other family members (all persons ≥ 5 yrs. of age)	3.52 (0.68)	3.24	4.47	3.62	2.74	2.32

[1]Standard deviations of variables are in parentheses.

whelming effect of added farm output on added operator farm labor demand when wage rates are held constant. This negative effect of added farm output through farm operator labor demand outweighs any positive effect of added net farm income on total and off-farm labor supply of farm operators.

Both education variables have coefficients significantly different from zero in regression equation (2), positive for operators' education and negative for education of other adult household members. Furthermore, the large size of the estimated coefficients implies that the odds of off-farm labor force participation are quite elastic to the direct effects of education. For example, a 1-percent change of operators' education causes a 5-percent change in the odds of operators' off-farm labor force participation. But this is not the full story for education. A change in the level of education can be expected to change the odds of off-farm work through its effects on wage rates and farm output. Since education is expected to have a positive effect on these variables, the education induced wage effects will be positive, and the farm output effects will be negative.

The results show strong age and regional effects. The odds in favor of off-farm labor force participation are ceteris paribus lowest for the

Table 2. Estimates of Off-Farm Labor Supply Functions of U.S. Farm Operators: Odds of Participation and Days Worked - 1964

Variables	ln[R/(1-R)] (1)	(2)	ln(OFDAYS) (3)	(4)
ln WAGEF	0.336 (2.60)	0.336 (2.67)	-0.308 (-2.59)	-0.280 (-2.40)
ln WAGEO	0.341 (2.63)	0.360 (2.82)	0.637 (5.32)	0.645 (5.48)
ln WAGEH	-0.484 (-2.56)	-0.496 (-2.63)	-0.375 (-2.15)	-0.363 (-2.08)
ln Q	-0.449 (-7.89)	-0.451 (-8.78)	-0.192 (-3.66)	-0.165 (-3.47)
ln OI	-0.002 (-0.02)		0.097 (1.19)	
ln EF	5.727 (6.49)	5.898 (6.78)	6.157 (7.56)	6.119 (7.62)
ln EO	-2.782 (-2.37)	-2.863 (-2.44)	-5.128 (-4.73)	-5.082 (-4.70)
CHILD	-0.251 (-1.26)		0.146 (0.79)	
OFAM	0.479 (4.68)	0.500 (5.03)	0.397 (4.21)	0.370 (4.03)
AGE DUMMIES[2]				
A3 (<35 yrs.)	0.076 (0.34)	-0.151 (-1.60)	-0.396 (-2.08)	-0.315 (-3.60)
A34 (35-44 yrs.)	-0.311 (-2.23)	-0.417 (-3.76)	-0.414 (-3.22)	-0.352 (-3.44)
A56 (55-64 yrs.)	0.166 (1.36)	0.215 (1.86)	0.217 (1.92)	0.185 (1.73)
REGIONAL DUMMIES				
Northeast	0.073 (0.97)	0.061 (0.81)	0.302 (4.31)	0.300 (4.34)
South	0.701 (7.02)	0.735 (7.77)	0.655 (7.11)	0.655 (7.50)
West	0.204 (2.99)	0.202 (3.01)	0.337 (5.34)	0.350 (5.63)
Intercept (Age 45-54 and North Central region)	-4.890 (-3.24)	-5.234 (-3.56)	1.869 (1.34)	2.254 (1.66)
R^2	0.787	0.784	0.720	0.716
(s^2)	(0.0751)	(0.0749)	(0.0639)	(0.0639)

Note the observations are state averages per farm household for farm households grouped by age of farm operator. There are four different age groups for each of 45 "states" and observations on all age groups are pooled to make a total of 180 sample observations.

[1] t-ratios are in parentheses.

[2] Age and regional dummy variables take values of either 1 or 0. The reported intercept terms contain estimates of the effects of being in the age group 45-54 and in the North Central region. The coefficients of the dummy variables estimates changes in the intercept due to age and regional effects.

35-44 age group and highest for the 55-64 age group. The odds of participating for the less than 35 age group are higher than for the 35-44 age group but lower than for the 45-54 age group, although not significantly so. The labor force participation differences by age are consistent with young farmers using off-farm work as a means of acquiring resources for getting started farming.[16] After age 45, farmers start to exit farming or at least to diversify their allocation of working time.

Regionally, farmers in the South and West have significantly larger odds of participating in off-farm work than do farmers in the North Central region.[17] The odds of participating in the Northeastern region are also larger than in the North Central region, but this difference is not statistically significant. These regional differences undoubtedly reflect to some extent differences in the disequilibrium in farm labor markets during the late 1950's and early 1960's. The Northeast and North Central regions experienced lower rates of farm population decline than did the South and West (Huffman 1977).

Regression equations (3) and (4) report results from fitting equation (13), the equation for operators off-farm work days. Variables that had small t-ratios in (3) were excluded from the variable list for estimating (4).[18] The coefficient of the operators' wage variable is negative in the off-farm days regression equations. This is opposite from its sign in the participation rate regression. This can, however, be explained by recognizing that the impact of operators' off-farm wage rate on their days of off-farm work is determined by the difference between the wage rate's impact on their total work and on farm work. If the effect of WAGEF on total labor supply is sufficiently negative, then the days of off-farm work decline as WAGEF increases.

The estimated elasticities for the wage variables for other farm household members and for farm hired labor and for farm output and the coefficients of the two education variables have the same signs in the days regressions as in the participation rate regressions. Furthermore, the economic interpretation of the results is very similar, except that a larger income effect should be associated with WAGEO since the quantity of off-farm work is positive. The family size and composition variables have similar effects on the two off-farm labor supply variables. In both the participation rate and off-farm days regressions, the coefficient of the CHILD variable is negative, but it is not significantly different from zero. This result is consistent with other labor supply studies where the number of young children has not had a significant effect on husbands' labor supply. In both the participation rate and the off-farm days regressions, the coefficient of the older family size variable is positive and statistically significant. The strong performance of OFAM suggests that it impacts on operators' total work and farm work in opposite directions so that they reinforce one another.

The differential effects of age and geographic region on operators' off-farm days worked are quite similar to the age and regional differences on the odds of participation.

4. Implications

The share of farm family income from nonfarm sources is about 50 percent, and it has been increasing. This privately initiated type of diversification of sources of family income has reduced the vulnerability of farm family welfare to the wide swings in net farm income. The protection, however, is not equal across all farm sizes. If farm size is measured by sales and the dividing line between small and large farms in 1975 is set at \$10,000, the families that operated small farms received 89 percent of their income from nonfarm sources and those that operated large farms received only 31 percent (USDA 1965, p. 65). Thus nonfarm income provides greater protection from wide swings in net farm income to the families operating small farms.

Increasing nonfarm income has caused a dramatic rise in the level of income and the relative income position of families operating small farms. The index of prices received by farmers was approximately the same in 1960 and 1965, but it about doubled between 1965 and 1975, so let a farm be defined as small in 1960 and 1965 if it had sales of less than \$5,000 and in 1975 if it had sales of less than \$10,000. Between 1960 and 1965, nonfarm income in 1967 constant dollars of these farmers increased by 68 percent (from \$2,789 to \$4,652), and between 1965 and 1975 the increase was 69 percent (to \$7,862). Furthermore, this dramatic rise in nonfarm income of families operating small farms led to a sizable improvement in their relative income position. In 1960, the incomes of these families operating small farms was only 50 percent as large as for families operating larger farms. In 1975, the percentage was 66 percent. Thus as agricultural policies for small farmers are considered, they should be scrutinized to see if they encourage resource reallocation yielding a social rate of return that compares favorably with small farm families investing their capital and allocating their labor in nonfarm markets.

New welfare policy could reduce the dependence of poor farm families on non-farm income. In the Rural Income Maintenance Experiment, the farm families receiving transfers reduced their hours of off-farm work and increased their hours of farm work (U.S. Dep. Commerce 1976). Thus for these low income farm families, a negative income tax could reverse the trend toward greater dependence on nonfarm income.

The rising off-farm labor force participation of farm family members and an increasing share of supply elastic purchased inputs in farm production have increased the short-run elasticity of supply of farm output. The reason is that these people with off-farm jobs have low costs of adjusting labor supplies between farm and nonfarm labor markets. These farm families generally own unused farm machinery and building services and can respond quickly to changes in expected profitability of farming. This increasing elasticity of farm output may become a burden, since small errors in setting government support prices for farm output can be quite costly to consumers and to taxpayers.

Farm people who seek jobs in nonfarm labor markets have generally been disadvantaged by low levels of education and few marketable skills. Furthermore, with the large net migration out of agriculture that has occurred since 1950, many have experienced the effect of low nonfarm labor market skills. Others have felt some of these effects as they looked for off-farm jobs. Thus males and females who plan to enter farming should be encouraged to obtain training that raises their productivity of work at both farm and nonfarm jobs. Few farm families can expect to be fully employed in agriculture.

The study also says something about the potential labor force that a new industry locating in rural areas could expect to attract. Among farmers, a disproportinately large number would be older than 45 years of age, have higher than average education levels, and have larger than average family sizes. Also, off-farm participation rates by farmers are higher in the South than in other regions. This information could be combined with current demographic and other information to help new industries make projections of where they might obtain the largest rural labor supplies.

Footnotes

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[1]Personal income of the farm population refers to income received by all persons living on farms. It includes the families of hired farm workers who live on farms but it excludes farm operators and their families who have nonfarm residences. Only since 1960 are data available on the share of farm operator family income that is obtained from off-farm income. But this share shows the same increasing importance of nonfarm sources.

[2]Income from nonfarm sources also includes nonfarm business and professional income, rents from nonfarm real estate, dividends, interest, unemployment compensation and social security payments.

[3]The other change is discussed in Huffman (1977).

[4]Occupation is determined by where the individual spent the largest number of hours working during the census week. If he was unemployed, the occupation is the last one where the person was employed.

[5]Throughout this paper, work, farm and nonfarm, refers to the quantity of human time allocated to these activities. The intensity of effort is assumed to be constant.

[6]The level of the current wage rate is assumed to depend on the quantity of human capital accumulated during previous periods. Some of this capital is, however, a result of previous work experience.

[7]Nonmonetary aspects of jobs are not tractable with the available data. However, if the values of marginal net nonmonetary benefits at farm and off-farm work differ, the optional allocation of time will change, and different marginal wage rates are required to equalize net advantage from the two types of work.

[8]For some household members, farm work may be a residual. This will occur if institutional factors set similar rigid requirements on the working hours.

[9]In aggregate average data, reporting errors for days worked by individuals should not cause serious spurious negative correlation between their wage rate and days of off-farm work because the reporting errors across individuals in a group should cancel out. It is possible, however, that the average number of hours worked per day of off-farm work differs across age groups of farm operators. This is a potential source of measurement errors in the wage variables.

[10]There are also problems with nonreporting and missreporting of this type income.

[11]Husbands and wives make decisions on family size; but in this study, the number of children is taken as exogenous to labor supply decisions.

[12]The choice was based upon goodness of fit to the sample observations and size of t-values of the estimated coefficients.

[13]Theil (p. 332) discusses advantages of a logistic specification over a linear probility model.

[14]One might expect the residual variance of the fitted functions to differ significantly by age group of farm operator. This would signal a violation of the Gauss-Markov assumption of homoscedastic disturbances and the need for application of weighted least squares. The square roots of the residual variances for age groups <35, 35-44, 45-54, and 55-64 for regression equation (1) are .294, .285, .224, and .237, respectively, and for equation (3) are .273, .242, .192, and .251, respectively. Furthermore, application of weighted least squares by using these values as weights changes the results very little.

[15]A test of the composite null hypothesis that the coefficients of lnOI and CHILD are jointly zero cannot be rejected at the 5-percent significance level. The calculated F-value is 1.59, and the critical F-value at the 5-percent significance level and 2 and 164 degress of freedom is 19.49.

[16]Some of these young farmers may also be exiting from farming.

[17]White-nonwhite operator participation rate differences are reflected along with some other things in the coefficients of the regional dummy variables. In 1964, greater than 95 percent of the nonwhite farm operations in the United States

lived in the South.

18 Given a calculated F-value of 1.87 for the composite hypothesis that the coefficients of lnOI and CHILD are both zero and a critical value of 19.49 for 2 and 164 degrees of freedom at the 5-percent significant level, the null hypothesis cannot be rejected.

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