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Fringe Benefits in Operator Off-Farm Labor Supply

Evidence From Mississippi and Tennessee

Helen H. Jensen
Priscilla Salant

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ABSTRACT

Off-farm work by members of farm households has become a well-established strategy for using farm-based labor resources. Such employment provides both cash income and fringe benefits. This report develops and tests a theoretical model of off-farm work by farm operators that explicitly includes fringe benefits. Evidence from the USDA Mississippi-Tennessee Family Farm Survey supports the hypothesis that fringe benefits increase operator off-farm labor supply.

Keywords: Off-farm labor, farm family income, fringe benefits.

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SUMMARY

Fringe benefits from off-farm employment are an important aspect of deciding to work off the farm. Benefits, as well as wages, have a positive effect on hours worked off-farm by farm operators. In treating off-farm work as an alternative use for farm-based labor resources, it is important to evaluate work off the farm in light of its full economic return.

Using health insurance as a proxy, this report explores the issue of fringe benefits from several perspectives. Whether a spouse receives health insurance is a significant factor in operator participation, although not in the expected direction. The industry in which the operator works is a significant determinant of whether he/she receives health insurance. The estimated probability of receiving health insurance positively affects how many hours an operator works off the farm.

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INTRODUCTION

Non-wage fringe benefits, that is, payments other than currently spendable cash, have become an increasing share of total compensation paid to workers in the last 30 years. However, the rapid growth of fringe benefits that occurred in the seventies has slowed, partially because employers recognize the magnitude of their contribution to total compensation. Fringe benefits currently represent almost 16 percent of total worker compensation (5).[1/]

Off-farm work increases farm household well-being via nonwage compensation. Therefore, concentration on the role of money wages in inducing farmers to work off the farm neglects the effects of additional sources of income in the form of fringe benefits. The importance of fringe benefits has been attributed to preferential tax treatment, growth in unionization, group savings in the purchase of insurance, and rising personal income (28). Tax and group rate advantages from fringe benefits become available to most farm households only through off-farm employment (16).

Off-farm work by members of farm households has become a well-established strategy for using farm-based labor resources. In 1983, 45 percent of employed farm residents worked solely or principally in nonagricultural industries, up from 34 percent in 1960 (27).

Fifty-five percent of all farm households reported off-farm employment by the operator and/or spouse in 1979 (26). Thus, a significant number of farm persons receive compensation for time spent in off-farm activities--which potentially increases and stabilizes household income through wages, and provides additional compensation in the form of fringe benefits.

This report develops a theoretical model of operator off-farm labor supply which explicitly takes into account fringe benefits. Parameters of the off-farm labor supply model are estimated from data in the 1981 U.S. Department of Agriculture (USDA) Family Farm Survey. This analysis contributes to understanding the role of fringe benefits in the labor supply decision.

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1/ Underscored numbers in parentheses refer to literature cited in the References section.

EARLIER STUDIES

A small, but growing, body of studies on off-farm labor supply use both aggregate data (4,12) and microdata (13,20,24,25). In general, the researchers find that the off-farm labor supply curve for the farm operator slopes upward with respect to money wages.[2/]

The distinguishing feature of farm operator off-farm labor supply models is that the operator's time spent in nonfarm market work competes directly with time spent working on the farm. (Likewise, literature on market work by married women recognizes competition with other household activities.) Thus, the important criterion for the off-farm labor supply decision is that the marginal return from time spent in off-farm work is greater than (or equal to) the marginal return from time spent in farm activities (or other household activities, including leisure). Factors which increase marginal productivity in off-farm work relative to farm or household work increase off-farm labor supply.

Less is known about the contribution of noncash benefits to labor supply. Nonwage compensation enhances income. Although its actual value to the individual may be less than the cost of providing the benefit, most employees can choose not to receive the benefit should the value be negative. Thus, increases in fringe benefits should lead to increased time spent in market work.

Studies of noncash benefits support the hypothesis that wage payments and fringe benefits are substitutes, particularly in the case of pension payments (7,8,28). Other job characteristics, such as working conditions, are weak substitutes for wages (1).

The effect of fringe benefits on labor supply is less clear, probably because labor market institutions affect not only the quantity but also the type of benefit compensation (2,23). For example, Allen found a weak positive association between fringe benefits provided and absenteeism. That is, cash wages increase labor supply, but holding wages constant, better fringe benefits were associated with decreased labor supply. He explained this finding in part by workers not forfeiting benefits by being absent--until the worker loses his or her job.

This report addresses whether fringe benefits affect off-farm labor supply, and thus broadens our understanding of the off-farm employment contribution to farm household well-being. By not focusing solely on money wages as a measure of returns to off-farm employment (as earlier off-farm labor studies have done) we account for other characteristics of market work that may affect labor allocation.

[2/] Huffman and Lange (13), in estimating husband and wife labor supply decisions jointly, find positively sloped supply curves when both husband and wife work off-farm, but negatively sloped curves when only the husband works off-farm.

SOURCE OF DATA AND OVERVIEW OF SURVEY AREA

Data used in the analysis come from the 1981 USDA Family Farm Survey. The survey was based on a stratified cluster sample design which yielded usable questionnaires from 1,087 farm families in 23 counties in north Mississippi and 6 counties in southwest Tennessee. (See 22 for more information on the sample design).[3/]

Roughly one-third of the farms were beef operations (primarily cow-calf), one-third were soybean farms, and 10 percent were cotton farms. The remainder consisted of cash grain farms, general crop farms, and other crop and livestock operations. The sample area typifies much of the South--a significant portion of the land was in farms, and small operations dominated agriculture.

The survey site contained no large metropolitan centers, although small- and medium-sized towns provided some employment opportunities for farm residents. Low population density in the survey area has not encouraged a strong service sector or generally diversified economic activities (6).

Off-farm employment and income contribute significantly to the economic well-being of farm families in the survey area (22). Sixty-two percent of the households reported off-farm work by the operator and/or spouse in 1980 (table 1).[4/] Off-farm work was most common among households that operated soybean farms and beef operations, both of which averaged lower sales than other farms in the survey area. Off-farm work was least common among households that operated cotton farms. In households that depended on farm-related sources for over half of their total income (37 percent of the households) spouses were more likely than operators to work off the farm.

Most people in farm households that worked off the farm held full-time wage or salary jobs (table 2). As is the case of employment in many rural labor markets (21), these were generally low-skilled jobs. The pay averaged about $5.60 per hour, but 14 percent of workers earned less than $3.10 per hour. The manufacturing industry accounted for 35 percent, and the service industry for 28 percent of all wage and salary employment. Fifteen percent of the persons working off-farm in 1980 were self-employed in nonfarm businesses.

3/ For purposes of this report, a farm is defined as a business that produced agricultural sales of at least $1,000 in 1980, or would have done so under typical growing conditions. Excluded from this analysis are 244 sample households that produced less than $1,000 in 1980 for reasons other than adverse weather. The farm operator was designated as the person responsible for major administrative and managerial functions, as well as for daily decisions on the farm.

4/ This is higher than the national average of 55 percent of all farm households reporting off-farm employment by the operator and/or spouse in 1979 (26).

Table 1--Farm households, by off-farm work and by farm type[1/]

Item	Total households	Farm type: Soybean	Cotton	Other crop	Beef	Other livestock
		Number				
All households	9,410	3,295	950	1,140	3,090	935
		Percent				
Households reporting off-farm work:						
Operator only	25	23	14	26	34	17
Spouse only	14	19	17	7	9	16
Operator and spouse	23	26	6	25	26	22
Households reporting no off-farm work	38	32	63	43	31	45

1/ Includes only households in which the operator was the household head. Population estimates based on expanded sample. (See 22).
Source: 1981 USDA Family Farm Survey.

Operators and spouses employed off the farm for wages or salary received paid vacation and/or sick leave (68 percent), health insurance (60 percent), retirement plans other than Social Security (46 percent), and life insurance (43 percent) (table 3). Of these four benefits, life and health insurance were most often received together. Thirty percent of all workers received all four benefits, 23 percent received three, 10 percent received two, 14 percent received one, and 23 percent received no benefits. Thus, 53 percent of workers received at least three of these benefits.

Younger workers and those with more formal education most commonly reported fringe benefits from off-farm employment (table 3). For example, 51 percent of those under age 35, and only 36 percent of those age 50 to 64 received life insurance. Fifty-six percent of workers with some college education received a retirement plan, compared with only 39 percent of those who completed less than 8 years of school.

The proportion of workers reporting each of the four major benefits varied by the characteristics of their off-farm work (table 2). Full-time workers (constituting 60 percent of all workers), those in durable goods manufacturing, production occupations, and those with higher wage rates were most likely to receive benefits. These findings are consistent with national level data (15).

A MODEL OF THE OFF-FARM WORK DECISION

While several studies have examined determinants of off-farm labor supply, their exclusive focus on money wages as a measure of return does not account for other characteristics of off-farm work which may affect labor allocation. The labor supply model developed below explicitly accounts for the role of fringe benefits in the decision to work off the farm. As in previous studies, off-farm labor

Table 2--Workers' employment, by benefits received

Item	Total workers[1]	Workers reporting benefits: Paid leave	Health insurance	Life insurance	Pension plan
		Percent			
Employment off-farm:[2]					
Intermittent	20	25	20	16	21
Part-time	20	65	55	40	56
Full-time	60	85	73	52	50
Wages per hour:					
Less than $3.10	14	41	31	24	24
$3.10-4.49	37	70	62	39	36
$4.50-5.99	15	77	69	49	43
$6.00-8.99	22	77	64	46	64
$9.00 or more	12	67	68	63	68
Industry:					
Manufacturing--					
Durable goods	18	93	85	74	60
Nondurable goods	13	80	72	43	41
Service	34	57	46	31	48
Trade	11	47	37	27	11
Other	24	65	60	42	49
Occupation:					
Production	28	86	79	59	53
Marketing, sales, and clerical	26	60	55	38	34
Administrative, professional, and technical	22	71	60	42	65
Construction, transportation, and mechanics	10	44	44	40	36
Other	14	53	32	20	23

1/ Includes only operators and spouses.
2/ Intermittent refers to less than 1,152 hours in 1980; part-time refers to at least 1,152 but less than 1,680 hours; full-time refers to 1,680 hours or more.
Source: 1981 USDA Family Farm Survey.

Table 3--Persons employed off the farm for wages or salary, by benefits received

Item	Total workers[1/]	Workers receiving-- Paid leave	Health insurance	Life insurance	Pension plan
		Percent			
All workers	100	68	60	43	46
Operator status:					
Operator	52	68	60	46	48
Nonoperator	48	69	59	40	43
Age:					
Under 35	18	74	60	51	55
35-49	38	67	66	50	47
50-64	40	73	58	36	45
65 and above	4	10	16	17	12
Years of school completed:					
Less than 8	14	66	55	28	39
8-11	17	68	55	44	40
12	40	70	61	47	41
13 or more	29	67	62	45	56

1/ Includes only operators and spouses.
Source: 1981 USDA Family Farm Survey.

supply is examined in the context of a decision to allocate time among (1) farm work, (2) off-farm work, and (3) leisure or other household production (12,14,25). Unlike other studies, the augmented compensation from off-farm work in this report includes both a wage and nonwage component.[5/] The model developed here assumes that at an observed point in time, the operator considers the spouse's opportunities as given. That is, the operator's off-farm work decision is separate from that made by the spouse. The model focuses on the operator's decision.

5/ The actual valuation of the benefits depends on the type of benefit considered. Examples in the literature include monetary valuation of insurance and pension payments (2,28), preference ranking of nonpecuniary benefits (1), and imputed valuation for nonpecuniary benefits (7).

The general form of the household's utility function is:

$$(1) \qquad U = U(T_h, Y_h; H_h, \bar{Z}_h)$$

where:

T_h = time in household activities,
Y_h = household goods purchased,
H_h = level of human capital (for example, education and vocational training) among adults in the household, as applied to household production, and
$\bar{Z}_h$ = a vector of fixed prices of household goods and other factors, including household composition.

The individual derives utility from a combination of T_h and Y_h (3).

Operators face both a time and an income constraint. For members of farm households, time in all three activities is available as:

$$(2) \qquad T = T_f + T_m + T_h$$

where:

T = total time available to the household,
T_f = time spent in farm work,
T_m = time spent in off-farm work (whether for wages or salary, or as a self-employed person), and
T_h = time spent in household production or leisure.

Total income available to the household (I) equals the sum of net farm income ($\bar{P}'\bar{F} - P_f'X_f$), off-farm employment income (W_mT_m), and unearned income (V_h; that is, income not dependent on time).

$$(3) \qquad I = \bar{P}'\bar{F} - \bar{P}_f'X_f + W_mT_m + V_h$$

where:

$\bar{P}$ = a vector of output prices,
$\bar{F}$ = a vector of outputs from farm production, as defined below,
$\bar{P}_f$ = a vector of prices of farm inputs, other than prices for labor,
X_f = a matrix of variable inputs (other than household labor) used for each type of output,
W_m = marginal return from off-farm work, and
V_h = unearned income.

The net return from farm work depends on the function describing the relationship between farm output and inputs.

Farm production is:

$$(4) \qquad \bar{F} = F(T_f, X_f; M_f, H_f, \bar{Z}_f)$$

where:

$\bar{F}$ = a vector of farm outputs,
X_f = a matrix of variable inputs to farm production (other than household labor),
M_f = fixed farm technology defined in terms of the mix of farm output,
H_f = level of human capital among adults in the household (including education, training, and health status) as applied to farm production, and
$\bar{Z}_f$ = a vector of farm specific characteristics that affect the technology employed, such as soil and climate.

In this report, based on cross-section data in a particular geographic area, prices for farm output and inputs are assumed to be fixed. Exogenous variables (M_f, H_f, and $\bar{Z}_f$) determine the efficiency of farm production. Technology (M_f) is defined in terms of farm output mix so that the effect of risk, as implied by varying degrees of specialization, may be included (25).

The farm operator allocates time among farming activities, off-farm work, and household production or leisure time to maximize his or her objective function. Time allocated to farm work yields an implicit return relative to the marginal value product of the labor input. Time allocated to off-farm employment is paid relative to the value of its marginal product--and compensated directly with wages or indirectly with fringe benefits. Other time is allocated to household activities, and is valued at its opportunity cost, which is equal to the (highest) value of alternative use.

Assuming there are off-farm employment opportunities, the farm operator will allocate labor to off-farm work as long as the marginal return (including wages and benefits) from off-farm work (W_m) is greater than the marginal return from farm work (W_f). The latter is evaluated at the optimum amount of farm work when no off-farm work is allowed (25). Thus, the augmented return from off-farm work incorporates the contribution of fringe benefits associated with off-farm labor supply.

The decision to work off the farm ($T_m > 0$) implies that the marginal value of time at home and in farm activities with no off-farm work is less than the net, or augmented, market wage. Operators who work only on the farm allocate their time optimally by choosing T_f and T_h so that the value of the marginal return to farm work equals that for other household activities. Exogenous factors affecting the operator's productivity in each of the two activities determine that allocation. On the other hand, operators who work off the farm allocate their time among the three activities. The amount of off-farm labor supplied is determined by all exogenous variables affecting the relative values of time in farm, off-farm, and household activities (14). The marginal value of T_m is observed as the augmented market wage for wage or salary employees.

Off-farm work generates a positive return in the form of money wages and noncash benefits. Commuting costs, as well as other negative job characteristics, detract from this return. Consider the net returns from off-farm work to be $W_m\ T_m$:

(5) $W_m T_m = W_s T_m + BT_m - C$

where, on a per hour basis:
W_m = the net return from off-farm work,
W_s = the money wage rate,
B = fringe benefits received, and
C = commuting costs.

The marginal wage or wage offer (W_s) is:

(6) $W_s = W_s(H_m, L_m, Z_m)$

where:
H_m = level of human capital, as applied to off-farm work,
L_m = local labor market characteristics, and
Z_m = other (for example, nonpecuniary) job characteristics.

The fringe benefits offer (B) is:

(7) $B = B(H_m, L_m, S_m)$

where:
S_m = other characteristics which affect the benefit offer; for example, degree of local unionization and predominant type of industry.

The benefits package depends on the level of human capital to the extent that more benefits are paid to more skilled and more experienced workers. It may be hypothesized that while firms give certain benefits to all employees, regardless of skill or experience, the total value of the benefit package, and the likelihood of receiving the benefit, increases with the worker's skill (although the relative share of compensation may decrease). That is, benefits may be used to retain workers with higher skills (8). In addition, employers respond to the perception that workers with higher levels of human capital are interested in benefits that may maintain or invest in that capital (for example, health insurance).

The level of benefits also depends on local labor market conditions and other institutional factors (15). Because different industries historically have different benefits practices, it is expected that in a rural labor market, characterized by small, dispersed places of employment, the type of local industry would be a determining factor in the benefits offer. Unionization in these areas is generally more prevalent among workers receiving higher levels of benefits. [However, unionization is not likely to have a significant impact in the area considered here, (21)].

Commuting costs also affect the net returns from off-farm work. These costs are related to the distance from the off-farm job.

In this manner, compensation for off-farm work, either through wages or benefits, is determined independently of hours worked. That is, the wage or benefit offer (or the commuting cost) does not depend on whether the individual works few, or many hours.[6/] This assumption is least realistic for benefits which may not be available to temporary or part-time workers. Treating benefits as independent of

hours worked assumes that the benefits offer is based only on exogenous worker characteristics and local industry institutions. The separate specification of money wages and fringe benefits recognizes the independent contribution of each type of compensation in hours of labor supply. Apart from a monetary value, benefits contribute access to group purchase of insurance, tax advantages, and reduced risk from loss of income, among other things.

ESTIMATION PROCEDURES

We estimated off-farm labor supply in four stages: first, the likelihood of off-farm labor market participation by the farm operator, second, the level of the off-farm wage rate, third, the likelihood of receiving fringe benefits, and fourth, the number of hours worked off-farm. Because we were interested in whether employer-furnished benefits induce more off-farm labor supply, we excluded operators who were self-employed in nonfarm businesses from our analysis.

Empirical Models

The initial estimation of whether or not the operator participates in off-farm work for wages, represented by a dichotomous dependent variable (0,1), uses the maximum likelihood technique to estimate a probit function. This allows for tests of sample selection bias in the later estimation procedure.

$$(8) \qquad \text{Prob } (T_m > 0) = \sum_{i=1}^{h} \alpha_i V_i + \epsilon$$

where:

V_i = exogenous variables affecting marginal value of time, and
ϵ = random error.

Participation is estimated from all observations in the sample (excluding the nonfarm self-employed). The model includes all exogenous variables that affect the marginal value of time in the three activities discussed above.

The empirical specification of the wage, benefits, and hours of off-farm work equations are:

$$(9) \qquad \ln W_j = \sum_{i=1}^{k} \beta_i X_{ij} + U_{1j}$$

$$(10) \qquad B_j = \sum_{i=1}^{m} \gamma_i S_{ij} + U_{2j}$$

6/ Rosen argues joint determination, in other words, wages are affected by the number of hours worked and, simultaneously, determine the hours of labor supplied (19).

$$(11) \qquad T_{mj} = \delta_1 \hat{\ln W}_j + \delta_2 \hat{B}_j + \sum_{i=3}^{s} \delta_i Z_{ij} + \xi_j$$

where:

j = 1, ... n individuals,
$\ln W_j$ = natural log of wage,
B_j = likelihood of receiving fringe benefits,
U_{1j}, U_{2j}, ξ_j = random errors,
X_i = exogenous variables affecting wages, i=1...,k,
S_i = exogenous variables affecting benefits, i=1...,m, and
Z_i = exogenous variables affecting hours of off-farm labor supply (T_m), including those that affect operator onfarm productivity, i=3....,s.

The off-farm wage equation (9) is directly estimated in log-linear form, using ordinary least squares (OLS) from observations of those operators working off the farm. The estimation includes a test for sample selection bias (10).[7] The benefits equation (10) is also estimated directly from observations of those working off the farm. Again, a test of sample selection bias is included.

The off-farm hours function (11) is estimated using OLS for operators working off the farm.[8] This function includes the estimated wage, the estimated benefits, and exogenous variables affecting labor supply, that is, those that affect the marginal value of time in farm and household activities. No correction for sample selection is included because we assumed that any censoring of the sample that occurs is accounted for in the estimation of wages and benefits. Variables used in the estimations are defined in table 4.

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[7] We are concerned that any estimates based only on observations of operators working off the farm will be biased because these operators may not provide random observations. Our sample may not be random because operators without off-farm jobs have been censored. The errors of the estimated functions on compensation are not independent of the errors in the sample selection criteria (10,17). That is, the regression function on wages is conditional on the criteria for selecting an operator working off the farm. The conditional regression function can be estimated and the significance of the sample selection bias can be tested. If sample selection bias is present (significant), it suggests that coefficients estimated without accounting for the sample selection will be biased.

[8] The OLS estimation is used for those working off the farm instead of the Tobit procedure for all workers in order to use information available on benefits determination. Because our interest is focused on the role of benefits in off-farm work, and because there was little labor market information for operators who did not work off the farm, we focus on describing the labor supply of those working, controlling for selection bias through the wage and benefits equation. Operators working off the farm represent 48 percent of the total sample.

Participation

Variables affecting participation in the reduced-form specification include the exogenous variables that determine the relative valuation of time in various activities, including the operator characteristics of age, education, the existence of a health problem, nonfarm vocational training, and race.

Possible nonlinear effects of age, expressed in quadratic form, represent the operator's life-cycle characteristics, as well as general experience and learning. In addition, age variables may control for attitude toward off-farm work, or the difference between desired and actual onfarm capital stock (4). It is expected that age is positively related to off-farm labor force participation at lower levels, and negatively related at higher levels.

Nonfarm vocational training is expected to increase participation as it enhances off-farm productivity, hence the return from off-farm work relative to that from farm work. The same is true of education, to the extent that it enhances productivity in off-farm work relatively more than in farm work. The effect of any health problem on participation depends on the relative effect on productivity in farm versus off-farm employment.

The effect of race on off-farm participation is unclear. To the extent that white operators have had higher "quality" education, or faced different, more desirable opportunities in the off-farm labor market, being white (race=1) would have a positive effect on participation.

Other household variables which affect participation include the operator's marital status (spouse present=1), the presence of children in various age groups, and spouse characteristics. Being married and having older children at home (18 years old and over) are both expected to have a positive effect on off-farm participation because work by a spouse or older child could substitute for operator labor on the farm. On the other hand, higher spouse's education should increase his or her off-farm earnings and reduce the probability that the operator would work off the farm. The presence of a spouse receiving health insurance, to the extent that this controls for the operator's need to work off the farm to obtain group coverage, should reduce the probability of operator off-farm participation. Unearned income is expected to reduce off-farm participation.

We constructed farm characteristic variables that represent technology and output mixes, which we assume to be fixed for the study year with respect to labor allocation decisions. These variables reflect degree of specialization, degree of capital intensity, susceptibility to risk, and seasonal variation. Their construction is similar to that used by Sumner (25), although they are particular to agriculture in the Mississippi-Tennessee survey area. Specialization is expected to induce operators to work off the farm in order to lessen their vulnerability to the risks associated with specialization. At the same time, however, operators with less seasonal operations, for example, dairy farmers, are expected to be less likely to work off the farm.

Goode (9) suggests that distance from employment centers is an important factor in the decision to work off the farm. However, the survey had no information on location or other geographic factors which might vary within the region and thus affect participation.

Table 4--Variable definitions and descriptive statistics[1/]

Variable	Whole sample	Off-farm workers
AGE	52.1	48.2
in years	(13.6)	(11.4)
AGESQ	1,898	2,462
$(AGE)^2$	(1,400)	(1,072)
EDUCATION OPERATOR	10.9	11.4
years of school completed by operator	(3.5)	(3.0)
NONFARM TRAINING		
"1" = job training program for	.04	.07
nonfarm-related occupation	(.20)	(.25)
HEALTH PROBLEM		
"1" = work-limiting health problem	.07	.04
lasting at least 8 weeks in 1980	(.26)	(.19)
RACE	.88	.90
"1" = white	(.33)	(.31)
HEALTH INSUR SPOUSE	.20	.32
"1" = spouse reported health insurance	(.40)	(.47)
EDUCATION SPOUSE	10.6	11.0
years of school completed by spouse	(4.3)	(3.9)
SPOUSE PRESENT	.90	.93
"1" = spouse present	(.23)	(.26)
CHILD1	.12	.17
"1" = children under age 6 present	(.32)	(.37)
CHILD2	.31	.42
"1" = children age 6-17 present	(.46)	(.49)
CHILD3	.19	.24
"1" = children age 18 or older present	(.40)	(.42)
UNEARNEDY		
nonfarm income from retirement funds,	2,110	793
transfers, interest, and other	(4,582)	(2,128)
COTPCT		
percent of harvested acreage in	.04	.05
cotton production	(.21)	(.17)
COTPCTSQ	.05	.03
$(COTPCT)^2$	(.18)	(.16)
CORNPCT		
percent of harvested acreage in	.13	.14
corn production	(.28)	(.31)

See footnote at end of table.

Continued--

Table 4--Variable definitions and descriptive statistics[1/]--Continued

Variable	Whole sample	Off-farm workers
CORNPCTSQ	0.09	0.12
$(CORNPCT)^2$	(.25)	(.30)
BEANPCT		
percent of harvested acreage in soybean production	.39 (.42)	.34 (.44)
DAIRY		
"1" if more than three dairy cows reported	0.5 (.20)	.01 (.09)
BEEFPCT		
percent of total livestock consisting of beef animals	.60 (.46)	.64 (.44)
BEEFPCTSQ	.57	.60
$(BEEFPCT)^2$	(.46)	(.46)
HOGPCT		
percent of total livestock consisting of hogs	.13 (.29)	.14 (.30)
WORKOFF		
"1" = operator reported wage or salary off-farm employment	.37 (.48)	1.00 (.00)
TRADE		
"1" = operator employed in wholesale or retail trade industry	--	.12 (.32)
CONSTRUCTION		
"1" = operator employed in construction industry	--	.10 (.30)
MANU-NONDURABLE		
"1" = operator employed in nondurable manufacturing industry	--	.10 (.30)
MANU-DURABLE		
"1" = operator employed in durable manufacturing industry	--	.24 (.43)
LNWAGE		
natural log of wage rate per hour	--	1.80 (.44)
OPINS		
"1" = operator reported health insurance	--	.60 (.49)
HOURS		
number of hours of off-farm work in 1980	--	1,767 (662)

-- not applicable.

1/ Means and standard deviations in parentheses.

Source: 1981 USDA Family Farm Survey.

Compensation

The wage and benefit equations contain variables which describe exogenous factors determining the wage and benefit offer, as well as the test for sample selection bias. Off-farm wage and benefit compensation is estimated from observations of operators working off the farm and is tested for sample selection bias.

Wages are measured in dollars per hour, before taxes and other deductions. Experience (measured as age) and education are expected to be predominant determinants of the wage offer. Other characteristics affecting the individual's productivity, and hence wage offer, include nonfarm vocational training and health. Any factor which increases marginal productivity in off-farm work would increase the wage offer. Race is included to control for potential discrimination in the setting of wage offers. The survey had no information on local labor market conditions that might have affected wage offers.

Certain factors determining the benefits offer are expected to be similar to those affecting wages, including age and education. Race is not expected to affect benefit offers. Other factors, including institutional considerations and historical practices within specific industries, are more likely to affect benefits than wages. It was assumed that in the rural labor market considered here (typified by small, dispersed places of employment), the individual worker accepts as given the benefit structure at the firm where he or she works. That is, he or she has little choice among places of employment. The type of industry in which the worker finds employment will affect the likelihood of receiving benefits. Therefore, the benefits offer depends on the industry. For example, we expect employment in the manufacturing industry to result in more benefits, while employment in the trade and construction industries will result in fewer benefits. Other factors, such as size of firm, were not available from the data.

Health insurance was selected as most representative of the four major fringe benefits. Because a continuous measure of the value of health insurance was not available, we chose a dichotomous variable, equal to 1 if health insurance was received, equal to 0 otherwise. This specification best represents the case in which operators know whether or not they have insurance, but do not know the dollar amount of their employer's contribution. The benefits equation was estimated using maximum likelihood estimation of the probit function.

Hours of Off-Farm Labor Supply

Hours of off-farm labor supply are estimated for operators working off the farm, using the estimated value of wages and the estimated probability of receiving health insurance as instrumental variables. Exogenous variables describing the marginal value of time in farm and household activities are also included. Wages and benefits are expected to be positively related to hours worked off the farm. The signs of the other variables should reflect the differences in the marginal values of time spent on off-farm work relative to farm work. The hours equation is estimated only for those currently working off the farm.

RESULTS

Tables 5-8 report the estimated coefficients for the set of four equations (equations 8-11). The critical value for level of significance was set at 0.20.

Findings of the labor force participation and supply models are generally consistent with earlier studies, taking into account particular farming and labor market conditions found in the Mississippi-Tennessee area.

Participation

Table 5 presents the coefficients for labor force participation from the estimated probit function. In general, their signs are as expected. Among operator characteristics, age had a nonlinear effect on participation--younger farm operators were more likely to work off the farm, and older farm operators were less likely. Education and nonfarm vocational training both had positive effects on participation. Having a health problem negatively affected participation. In this reduced form specification, white operators were less likely than black operators to work off the farm.

The presence of a spouse with health insurance had a positive and significant effect on operator off-farm participation.[9/] The positive sign was contrary to what was expected, and suggests that operators do not perceive their spouse's health insurance as a substitute for their own off-farm work. (Removing the spouse insurance variable had little effect on the other estimated coefficients.) As expected, the presence of older children increased the probability of operator participation, and unearned income had a negative effect.

As a group, the variables used to describe farm technology and specialization were significant in determining off-farm participation. As expected, specialization first decreased, then increased off-farm participation by cotton and corn producers. Dairy farmers were less likely to participate. Specialization in soybeans, which is the predominant type of crop farm in the area, reduced participation.

9/ It is important to note the construction of the spouse variables. A binary variable (spouse present = 1) controls for whether or not an operator was married. If he or she was not married, zero values were reported for the spouse characteristics, which include spouse's education and spouse receiving health insurance. The estimated coefficients reported in table 4 should be adjusted to account for the formulation as shown below.

If the underlying relationship is: $Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + E_i$ (where X_1 are operator characteristics and X_2 are spouse variables), using a binary variable δ (1 when spouse is present, 0 otherwise) yields the following relationship: $Y_i = \alpha + \beta_1 X_1 + \beta_2 \delta\ (1 + \gamma X_2) + E_i$, where γ are the "true" values of the spouse parameters. Hence, the estimated relationship is:

$Y_i = \alpha + \beta_1 X_1 + \beta_2 \delta + \beta_2 \delta \gamma X_2 + E_i$, and $\frac{\beta_2 \delta \gamma}{\beta_2 \delta} = \gamma$ yields the appropriate estimate of the spouse characteristics. To obtain the "correct" coefficients, divide the estimated coefficient on a spouse characteristic ($\beta_2 \delta \gamma$) by the estimated coefficient on spouse present ($\beta_2 \gamma$).

Table 5--Participation in off-farm work: Estimated coefficients from maximum likelihood estimation of probit function

Explanatory Variables	Expected signs	Estimated coefficients	Asymptotic standard errors
CONSTANT		-1.881***	0.794
AGE	+	.099***	.030
AGESQ	-	-.0012***	.0003
EDUCATION OPERATOR	+	.066***	.020
NONFARM TRAINING	+	.567***	.240
HEALTH PROBLEM	?	-.277*	.206
RACE	+	-.310***	.148
HEALTH INSUR SPOUSE	-	.261[1]/***	.127
EDUCATION SPOUSE	-	-.037[1]/*	.025
SPOUSE PRESENT	+	.394	.332
CHILD1	?	.165	.182
CHILD2	?	-.021	.119
CHILD3	+	.264***	.130
UNEARNEDY (000)	-	-.066***	.017
COTPCT	-	-3.310***	.683
COTPCTSQ	+	2.512***	.828
CORNPCT	-	-2.860***	.789
CORNPCTSQ	+	3.055***	.830
BEANPCT	?	-.653***	.148
DAIRY	-	-1.754***	.438
BEEFPCT	+	.144	.769
BEEFPCTSQ	-	-.264	.775
HOGPCT	-	-.002	.212

Dependent variable	WORKOFF (0,1)
Number of observations	843
Log of likelihood function	-431
-2 times log of likelihood ratio	245
Degrees of freedom for chi-square	24

Significance levels:
*** = Less than or equal to 0.05
* = Less than or equal to 0.20
1/ Unadjusted values. See footnote 9 of text.
Source: 1981 USDA Family Farm Survey.

Compensation

Off-farm compensation functions include estimates of both the off-farm wage and the probability of receiving health insurance benefits (tables 6 and 7). The market wage equation was estimated using OLS; the benefits equation using the maximum likelihood technique. The standard errors reported for the estimated adjusted for the presence of estimated variables in the equation. Thus, the standard errors are underestimated, although some evidence suggests the error may be slight (17, p. 238).

Table 6--Off-farm wage rate: Estimated coefficients from ordinary least squares regression

Explanatory variables	Expected signs	Estimated coefficients	Standard errors
CONSTANT		0.127	0.490
AGE	+	.054***	.019
AGESQ	-	-.0006***	.0002
EDUCATION OPERATOR	+	.042***	.010
NONFARM TRAINING	+	.087	.114
RACE	?	.100	.088
HEALTH PROBLEM	-	.098	.147
SAMPLE SELECTION		.005	.095
Dependent variable		LNWAGE	
Number of observations		298	
Adjusted R-squared		.13	

Significance level:
*** = Less than or equal to 0.05
Source: 1981 USDA Family Farm Survey.

Table 7--Health insurance fringe benefits: Estimated coefficients from maximum likelihood estimation of probit function

Explanatory variables	Expected signs	Estimated coefficients	Asymptotic standard errors
CONSTANT		0.913	1.358
AGE	+	-1.416	.053
AGESQ	-	.0001	.0006
EDUCATION OPERATOR	+	.030	.027
TRADE	-	-.293	.247
CONSTRUCTION	-	-.186	.270
MANU-NONDURABLE	+	.526**	.302
MANU-DURABLE	+	1.090***	.243
SAMPLE SELECTION		-.964***	.259
Dependent variable		OPINS (0,1)	
Number of observations		298	
Log of likelihood function		-169	
-2 times log of likelihood ratio		67	
Degrees of freedom for chi-square		8	

Significance levels:
*** = Less than or equal to 0.05
** = Less than or equal to 0.10
Source: 1981 USDA Family Farm Survey.

In estimating wages, age has the expected nonlinear effect and the effect of education is positive. Nonfarm vocational training is not a significant determinant of wages. There is no evidence of selection bias in the wage equation, indicating that the wage offer does not vary systematically with the operators having a higher- or lower-than-expected probability of working off the farm.

Neither age nor education is a significant determinant of the benefits offer (table 7). (The latter result is consistent with the hypothesis that similar benefits are offered to workers with different skill levels, ceteris paribus.)

The dichotomous variables representing employment in both the durable and nondurable goods-manufacturing industries are significant determinants of the benefits offer. Therefore, the historical tradition of the industry (and possible union spillover effects) may determine the benefits offer.

Selection bias was significant in the benefits equation.[10/] The negative sample selection coefficient indicates that operators who have positive errors in their predicted probability of off-farm work will have negative errors in their predicted benefits offer. In other words, the covariance of the errors, σ_{12}, is negative.

Hours of Off-Farm Labor Supply

Table 8 reports results of the off-farm labor supply estimation. Again, the estimated standard errors are reported from the usual OLS estimates. Both the estimated log of wage and the estimated benefits measure have positive and significant coefficients. The income effect, measured as the coefficient on unearned income, is negative and also significant. These three effects are consistent with expectations.[11/]

Effects of the other variables, holding estimated wages and benefits constant, are associated with relative valuations of time, as the operators choose to spend more or less time in off-farm work. More highly educated operators spend less time in off-farm work (holding compensation constant). The significant negative

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10/ Nelson (18) shows particular problems with efficiency in the two-step estimation procedure used here, although the correlation between the independent variables and the selection term in our analysis is relatively low ($R^2 = 0.36$). Thus, the problem of inefficient estimates is less severe. The significance of selection bias in the benefits equation and not in the wage equation may be because more efficient estimates of the effect of bias are observed in the maximum likelihood estimation of the probit function, and less efficient estimates are observed in the OLS wage equation.

11/ An alternative specification, in which we estimated benefits as a function of both hours and other factors, produced a positive and highly significant estimated coefficient on hours in the benefits equation; the other estimated coefficients were relatively stable. Holding hours constant at 1680 hours, we entered these estimated benefits into the hours equation (19). The coefficient on these estimated benefits was again positive, but not significant. The other coefficients remained unchanged, and the adjusted R^2 was essentially the same. Hence, we use the simpler estimation of benefits.

Table 8--Hours of off-farm work: Estimated coefficients from ordinary least squares regression

Explanatory variables	Expected signs	Estimated coefficients	Standard errors
CONSTANT		-2444.40*	1722.31
AGE	+	1/	1/
AGESQ	-	-.02	.06
EDUCATION OPERATOR	+	-47.34***	24.21
HEALTH PROBLEM	-	-21.79	191.04
RACE	+	110.67	134.30
EDUCATION SPOUSE	-	-13.12	19.27
SPOUSE PRESENT	+	410.51*	268.36
CHILD1	?	53.58	124.43
CHILD2	?	51.43	82.59
CHILD3	+	-118.12*	87.87
UNEARNEDY (000)	-	-.03**	.02
ESTWAGE	+	1012.95***	452.67
ESTOPINS	+	2609.00*	1647.41
COTPCT	-	-2314.38***	701.23
COTPCTSQ	+	2243.44***	778.24
CORNPCT	-	-188.68	599.22
CORNPCTSQ	+	302.20	624.50
BEANPCT	-	-129.29	102.37
DAIRY	-	-231.22	395.90
BEEFPCT	-	1043.91**	545.11
BEEFPCTSQ	+	-723.10*	540.91
HOGPCT	-	63.14	159.65
Dependent variable		HOURS	
Number of observations		298	
Adjusted R-squared		.22	

Significance levels:
*** = Less than or equal to 0.05
** = Less than or equal to 0.10
* = Less than or equal to 0.20

1/ AGE did not meet the tolerance test (= 0.01) and was not entered into the estimated model.

Source: 1981 USDA Family Farm Survey.

sign on education suggests that farmers with more education, wages held constant, are more productive in farm work than in off-farm work. The presence of a child at least 18 years old and specialization in cotton are other significant variables that decreased off-farm work. Having a spouse present increased off-farm work, while specializing in beef first increased, then decreased off-farm work.

CONCLUSION

Several problems arise in evaluating the role of benefits in operator off-farm labor supply. First, institutional variables (which are often hard to capture) may be important determinants of whether a worker received benefits. Such variables include unionization, regional practices, and part-time/full-time distinctions made by employers.

It is important to consider other problems as well. The appropriate measure of benefits received should be a dollar value. Such a value is difficult to determine both theoretically and empirically, and was not available in the data. As such, it was impossible to estimate a willingness to substitute fringe benefits for wages. However, this may be less important in labor markets with limited local opportunities. We have little information on the specific labor market that each operator faced.

In addition, the household decision-making process may involve joint decisions. By looking only at the operator decision, possible interdependence with the spouse's decision about off-farm employment and fringe benefits is lost.

Our analysis of the off-farm labor supply decision supports the household time allocation model. Human capital variables (age and education) are significant determinants of off-farm wage offers. Higher education levels increase wage offers. Farm operators respond to higher wage offers by supplying more off-farm labor.

The augmented, net compensation is important to consider as well. Industry characteristics apparently determine benefits, as measured by receipt of health insurance. This may reflect the differences among those in part-time versus full-time work. This study is consistent with others that found the institutions of the particular industry to be important in determining the compensation. The provision of benefits and their effect on labor supply may be better understood through more detailed observation of labor market institutions. Certain industries (manufacturing, for example) will increase income to farm households by more than observed wages; others do not offer this supplement.

Even though the analysis indicates that fringe benefits induce more operator off-farm labor supply, the operator may not be well informed about the value of benefits. Thus, any labor supply response to benefits is related to the operator's specific knowledge of the benefits' contribution to off-farm income. Further research is needed to sort factors related to the household decision. In particular, how benefits are valued, how members of the household jointly make decisions about off-farm work, and what factors determine the combined wage and benefits offer are relevant extensions of the model used in this report.

Finally, many fringe benefits available to workers are goods and services that protect human capital (such as health insurance or sick leave). Fringe benefits may protect or enhance human capital through in-kind provision of human-capital-preserving goods and services, independent of the direct money effect. In addition, they reduce the risk of extraordinary expenses (or loss of income). If this is the case, the fringe benefits enhance well-being both through their observed effect on increased income, and also through their unobserved effect on better health, other human capital, or reduced exposure to risk.

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