THE IMPACT OF LOCAL LABOR MARKET CONDITIONS ON THE OFF-FARM EARNINGS OF FARM OPERATORS

Lewell Gunter and Kevin T. McNamara

Abstract

Local labor market characteristics are theoretically relevant to the determination of off-farm earnings of farm operators, but the empirical analysis of these effects has been hindered by a lack of appropriate data. This study employs the new census public use micro-data sample, PUMS-D, to investigate the effect of local labor market characteristics on off-farm earnings of farm operators. The PUMS-D data allow local characteristics to be defined on a labor market area basis, rather than on a political boundary basis. For a sample of Georgia farm operators, local labor market size, unemployment rates, and industrial structure were found to have significant impacts on off-farm employment and earnings.

Key words: off-farm earnings, farm labor, labor markets, rural development.

The importance of off-farm income to farm families has grown dramatically over the past 25 years. In 1960, 42 percent of farm family income came from nonfarm sources. This amount had grown to 72 percent in 1983 (USDA 1984). Clearly, income from nonfarm sources is having a significant impact on the economic well-being of farm families and farm communities.

Access to off-farm earnings can have several beneficial effects on farm families. Off-farm income offers a means of stabilizing farm family income and reducing the impact of agricultural income risk on household expenditures. Off-farm income also provides a valuable income source for small farm operators to supplement limited farm income (Johnson). Off-farm income opens opportunities for new entrants to agriculture (Simpson and Kapitany; Lyson). New farmers can utilize off-farm income to help manage the high capital investments associated with establishing a viable farming operation.

The benefits of off-farm earnings to farm families and the importance of off-farm earnings to farm family income suggest the major role that these earnings play in the viability of farms and in the structure of American agriculture. While many of the factors that influence off-farm earnings are undoubtedly specific to individuals, such as human capital, it is plausible that community characteristics also play a role in the ability of farm operators to gain access to off-farm earnings. To the extent that the local economic environment affects the capacity of a farm operator to realize off-farm earnings, the potential may exist for state or Federal policy to enhance the off-farm earning capacity of farm operators. Because most of the benefits of commodity programs accrue to large farm operators and land owners (USDA, 1986), rural development efforts to improve off-farm earning potential may represent a more efficient method of assisting small farm operators than commodity programs.

The feasibility of impacting off-farm income through policy actions depends first on the existence of a relationship between local economic structure and off-farm earnings. The general purpose of this research is to test empirically whether local economic structure does impact off-farm earnings. Further, the research attempts to elucidate the structure of these effects through the identification of local economic characteristics that are likely to influence off-farm earnings and through econometric analysis of these influences. While local labor market effects have been alluded to and cursorily addressed in previous research on off-farm earnings (Sumner; Simpson and Kapitany; Huffman), these effects are the primary focus of this analysis. This empirical model examines the determinants of off-farm earnings of Georgia farm operators.

THEORETICAL BACKGROUND

The theoretical basis supporting past analysis of off-farm earnings of farm operators (Bollman; Huffman; Sumner; Thurmeier; Simpson and Kapitany; Johnson) is neoclassical labor supply theory. The farm operator is assumed to make time allocation decisions among farm work, off-farm work, and leisure activities to maximize his utility. The optimal allocation of time is achieved when the marginal values of time devoted to all of these activities are equal (Sumner). Many factors, including personal

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characteristics, farm structure, family characteristics, and local labor market conditions, are assumed to influence the value of a farmer's time in these different uses. Empirical analyses of off-farm work are designed to measure the impact of these factors on the allocation of time to off-farm work.

Theoretical support for the effect of local economic conditions on off-farm earnings of farm operators is related to the off-farm employment opportunities available to operators. Because off-farm work opportunities of farm operators are geographically restricted by mobility barriers such as commuting costs and commuting time, similar operators located in different areas may face different off-farm work opportunities. Local labor market characteristics that affect off-farm wages and employment opportunities also affect the relative marginal utility of time spent in off-farm work and the off-farm earnings of farm operators.

Regional variations in general factors such as unemployment rates and wage levels have a clear potential to impact off-farm earnings. However, other local labor market characteristics may also impact opportunities for individual suppliers of labor (Killingsworth, p. 46). For example, if farm and off-farm work are to be combined, constraints related to timing of work affect a farm operator's opportunity set. Given biological factors in agricultural production, the number and timing of hours available for off-farm employment in a given period may be constrained significantly. The inflexibility of farm labor requirements may not impose a major constraint to off-farm employment in areas with diverse and flexible off-farm employment opportunities, but a more limited labor market may preclude or severely limit off-farm employment. These considerations suggest that local labor market characteristics, such as industrial structure and labor market size, may impact off-farm earnings of farm operators.

Figure 1 shows the labor-leisure allocation decision for a farm operator with off-farm employment opportunities. This graphical approach to labor supply decisions (Killingsworth, p. 1) assumes that an individual's utility depends on his tastes, on the amount of consumer goods, C, and on the hours of leisure time, L, that he consumes per period. Leisure time is indicated by distance along the X axis from the origin, and labor time is indicated as the distance from the total available time endpoint, T, toward the origin. Consumption of a composite consumer good is measured on the Y axis. Indifference curves, U, and U_2 in Figure 1, reflect the individual's tastes and preferences for various combinations of leisure and consumption.

Utility attainment is limited by a budget constraint for a given individual. In the case of an individual with one job, at a constant wage rate W, the budget constraint is given by:

(1) $PC = WH + V$,

where P is the price of the composite good, C is consumption, H is hours devoted to wage work, and

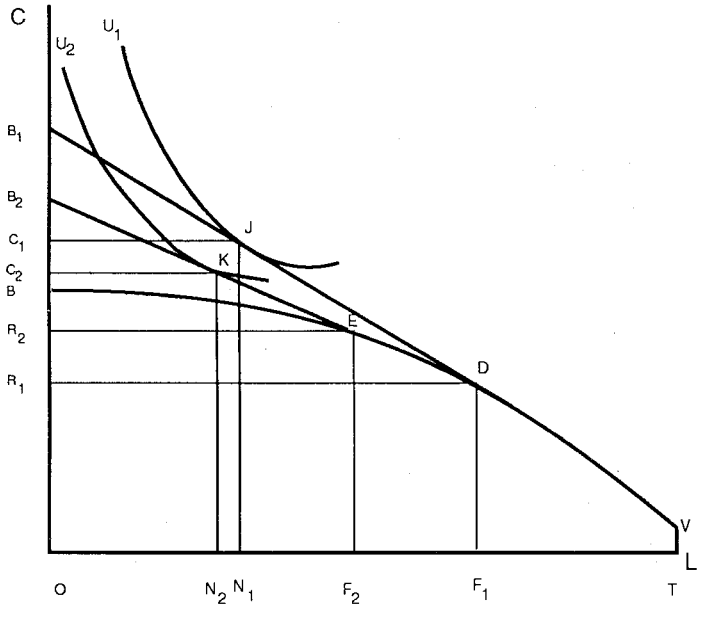

Figure 1. Effect of Off-Farm Wage Rates on Off-Farm Earnings.

V is property income. The opportunity cost of a unit of leisure is W, and the combination of work and leisure hours exhaust the total time available to the individual, H + L = T. The budget constraint may be rewritten in terms of real wages and property income as:

$$(2) \quad C = \left(\frac{W}{P}\right)H + \frac{V}{P}.$$

The constant wage budget constraint in (2) is adequate to represent the off-farm earnings of a farm operator working for a fixed hourly wage. Marginal returns to on-farm labor, however, are expected to change as different amounts of operator labor are combined with fixed farm resources. If other farm inputs are held constant, operator farm returns are a declining function of hours devoted to farm work. If W_N and H_N are defined as the constant off-farm wage and off-farm work hours, respectively, and W_F and H_F are the farm wage and work hours, where $W_F = w(H_F)$, the budget constraint for combined farm and off-farm work is:

$$(3) \quad C = \left(\frac{W_N}{P}\right)H_N + \left(\frac{W_F}{P}\right)H_F + \frac{V}{P}.$$

The effect of different local off-farm wage levels on farm and off-farm earnings is shown in Figure 1. The operator faces a farm labor budget constraint of TVDEB. Marginal returns to farm labor are equal to the negative of the slope of the farm labor budget constraint, and the marginal returns decline as the operator allocates more time to farm work. The high constant off-farm wage situation is represented by the line segment DJB_1. For this off-farm wage, the marginal returns from off-farm work exceed the marginal returns from farm work when hours of farm work are greater than TF_1. Given the consumption-leisure preferences described by the utility curves in Figure 1, the marginal utilities of farm work, off-farm work, and leisure are equal when TF_1 hours are devoted to farm work, F_1N_1 hours are spent in off-farm work, and N_1 0 hours are devoted to leisure.

If the farm operator in Figure 1 has a lower off-farm opportunity wage due to local labor market conditions, the optimal allocation of the operator's time changes. The lower off-farm wage in Figure 1 is equal to the negative of the slope of the line segment EKB_2. The marginal returns from off-farm work do not exceed the marginal returns to farm work in this situation until TF_2 hours are spent in farm work. Equal marginal utilities in this case are achieved with the allocation of TF_2 hours to farm work, F_2N_2 hours of off-farm work, and N_2 0 hours to leisure. Because of the lower off-farm wage and the resulting smaller number of hours of off-farm work, real off-farm earnings are reduced from R_1C_1 in the high wage case to R_2C_2.

Restrictions to access to off-farm work are modeled graphically in Figure 2. The budget constraint for farm work is VDB. The budget constraint for combined farm and off-farm work when access to

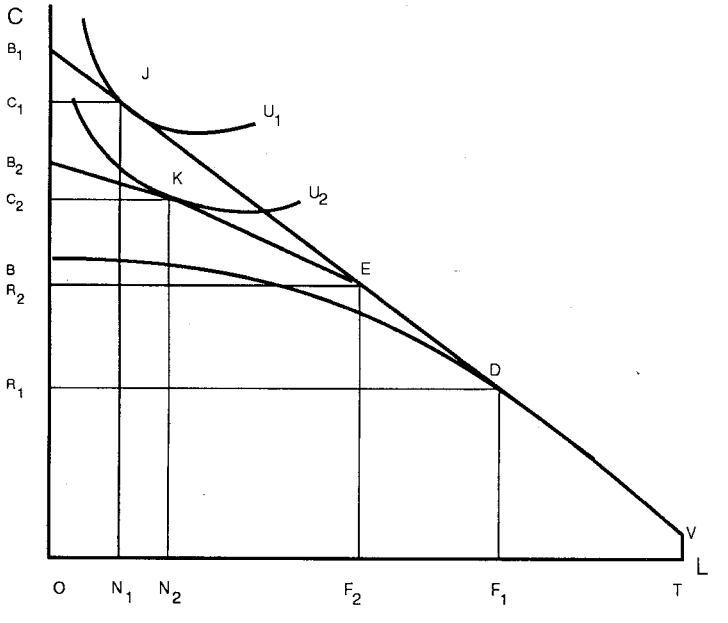

Figure 2. Effect of Off-Farm Hours Constraint on Off-Farm Earnings.

off-farm work is not constrained is represented by $VDEJB_1$. At the off-farm wage in Figure 2, the operator would prefer to perform TF_1 hours of farm work and F_1N_1 hours of off-farm work.

If off-farm work opportunities are limited to a maximum of F_1F_2 hours due to local labor market conditions, however, the combined farm/off-farm budget constraint becomes $VDEKB_2$. The construction of this budget constraint reflects the operator's switch to off-farm employment when the returns from off-farm work exceed the returns from farm work, after TF_1 hours of farm work. Because off-farm work is assumed to be limited to F_1F_2 hours, however, returns from any additional hours of work above TF_2 are those that are available from additional farm work, shown as the EKB_2 segment of the budget constraint. Real off-farm earnings fall from R_1C_1 when off-farm work is not constrained to R_1R_2 when off-farm work is constrained. Farm work increases from TF_1 hours in the unconstrained case to TF_1 plus F_2N_2 hours in the constrained case.

The theoretical impacts of local labor market characteristics on off-farm labor supply and earnings are clear. These effects have been treated lightly in previous empirical work. Huffman included dummy variables for the state of residence in his labor supply equations, noting that "Interstate differences in off-farm labor supply may be due to differences in labor market conditions and state specific effects not captured by other included variables" (p. 18). Sumner included the distance of the operator's farm from a city or town to represent local labor market factors and geographic location dummies because of their possible effects on the marginal value of the operator's time in different activities (p. 503). Although these controls for local labor market effects were rather limited, Sumner (p. 507) concluded that off-farm factors may be especially important in determining the off-farm work pattern of farm operators.

AN EMPIRICAL MODEL OF THE OFF-FARM EARNINGS OF GEORGIA FARM OPERATORS

Ideally, an empirical analysis of off-farm work would include any factors that affect off-farm employment opportunities and wages, the utility function of the operator, and the shape of the farm earnings function. To our knowledge, a data set that would permit a complete treatment of all of these factors does not exist. The studies cited above employed data that were relatively strong with respect to personal, family, and farm characteristics but lacked information on local labor market characteristics. Given the emphasis of our research, data used in this study were chosen for strong information content related to local labor market characteristics. These data were also rich in information on farm operators' personal and family characteristics, but limited in information on farm characteristics.

The data used in our analysis were derived from the recently released public use micro-data sample D from the 1980 Census of Population and Housing (PUMS-D). PUMS-D is a 1 percent sample of long-form census data. The novel aspect of the D sample is that its geographic identification of individuals is by labor market areas (LMAs), rather than by states, Standard Metropolitan Statistical Areas, or census divisions, as was the case in the three previous public use files. LMAs for the D sample were based on a cluster analysis of commuting patterns (Tolbert and Killian). Many of the 382 LMAs identified for the U.S. cross state lines. The theoretical orientation of the PUMS-D geography toward regional labor markets makes it a particularly attractive data set for an analysis of the effect of local labor market conditions.

Our analysis focused on farm operators residing in the 19 LMAs that include at least one Georgia county. A total of 583 households in these LMAs were classified as farm households according to the census definition of a farm as a place with gross agricultural sales of $1,000 or more in 1979. The farm operator in each farm household was identified by farm income reported on individual family member records. Off-farm work hours and wages were not reported in the census data, so an off-farm earnings function was estimated. Off-farm earnings were calculated as the sum of wage and salary income and non-farm self-employment income of the farm operator. Of the 583 individuals identified as farm operators, 332 had positive off-farm earnings, and 251 had no off-farm earnings in 1979.

Personal and Human Capital Variables

The independent variables included in the off-farm earnings equation can be grouped into three categories: personal or human capital characteristics, family and farm characteristics, and local labor market characteristics. The personal or human capital characteristics used here are similar to those used in Huffman, Sumner, and other wage or earnings studies. Five personal and human capital variables were included in the empirical model: age, education, sex, race, and disability status. Education and age are common measures of human capital (Sumner; Huffman). Education was measured as last year of schooling completed, and higher educational attainment was hypothesized to increase the off-

farm wage and consequently the off-farm earnings of farm operators, *ceteris paribus*. Age is a proxy for the experience component of human capital. Linear and quadratic terms for age were included in the model to allow for a nonlinear age-earnings profile. Both Sumner and Huffman found positive coefficients for the linear age term and negative coefficients for the quadratic age term in their off-farm labor supply equations.

Sex, race, and work disabilities were included in the model as zero-one dummy variables with values of one indicating female, nonwhite, and the presence of a work disability, respectively. These are control variables included to account for systematic differences in off-farm earnings for operators in these groups resulting from such factors as discrimination or constraints on off-farm work or wages not captured by other variables in the model.

Family and Farm Characteristics

Family and farm characteristics require more discussion related to the construction of these variables from the PUMS-D data. Family income from sources other than the operator's off-farm work impact the utility of the operator's time allocated to work and leisure. Greater levels of family income should reduce the marginal utility of operator's earnings, *ceteris paribus*, and consequently reduce his allocation of time to work activities. Since family income needs are dependent on family size, the per capita value of family income excluding operator's off-farm earnings was included in the estimated model. The expected effect of per capita family income on operator's off-farm earnings was negative. Linear and quadratic terms for this variable were included to allow for a nonlinear response.

The greatest limitation of the PUMS-D data for this research is the paucity of information on farm characteristics. Farm information in the data is limited to the classification of the household as a farm (based on gross sales exceeding $1,000) and the net farm income of the operator in 1979. This precludes the simultaneous estimation of farm and off-farm income, as would be desired. Farm income was included in the estimation, as described below, resulting in an off-farm earnings equation that was conditional on farm and other family income. The simultaneous equation bias introduced by this limitation in the data is partially ameliorated because the farm/off-farm work allocation decision is not completely simultaneous, due to short-run fixity in many farm assets. The overriding reason for pursuing this research in spite of this limitation, however, is to take advantage of the strength of the PUMS-D data and to extend the off-farm earnings literature in the area of local labor market effects.

Farm characteristics directly affect the allocation of operator time to off-farm work in two major ways. Farm income impacts the marginal utilities of time spent in off-farm work and leisure, affecting the allocation of the operator's time between these two activities. For this reason, net farm income was included in the "other family income" variable discussed earlier. Higher other family income, including net farm income, was expected to reduce the marginal utility of time spent in work relative to time spent in leisure and to reduce off-farm earnings *ceteris paribus*.

Farm characteristics also impact off-farm work through their effect on the relative marginal utilities of time spent in farm and off-farm work. In general, the marginal utility of operator farm work decreases less rapidly for large farms than small farms. On larger farms the operator's labor is combined with greater levels of fixed resources, yielding a greater marginal product for a given increment of operator labor. Consequently, the optimization condition of equal marginal utility for farm and off-farm work will be reached at higher levels of farm work for operators of larger farms, and off-farm earnings are expected to be lower for operators of larger farms, *ceteris paribus*.

The only measure related to farm size in the PUMS-D data was net farm income. Noting the previously discussed caveat on treating farm size as exogenous, the absolute value of net farm income was included in the model as a proxy for farm size. The rationale for including the absolute value of net farm income, rather than the observed value, was to avoid the treatment of a farm with large losses as a small farm. The absolute value of farm income measures scale effects rather than income effects. If the largest farms generally experience the largest net profits and losses, and smaller farms experience both smaller profits and smaller losses (as appears reasonable), then the absolute value of net farm income is a better proxy for farm size than the observed value of farm income. Although the absolute value of net farm income may not accurately represent the scale of the farm operation when small losses occur on large farms, this value avoids classifying farms with the largest losses as the smallest farms, as would occur if the observed value of farm income were used as the measure of farm size. Linear and quadratic terms for the absolute value of net farm income were included in the estimation.

Local Labor Market Characteristics

The role of local labor market characteristics in the determination of off-farm earnings relates to their impact on off-farm employment opportunities and wages and the impact of these factors on the marginal value of time spent in off-farm work. Labor market conditions that limit the off-farm employment opportunities of farm operators or result in a low wage structure for a region are expected to result in lower off-farm earnings for farm operators, *ceteris paribus*. Individual records of all members of the civilian labor force in the PUMS-D sample living in the 19 subject LMAs were used to construct labor market characteristic variables for the LMAs.

Local labor market measures related to wage and industrial structure were included in the estimation. Wage rates were not reported in the long-form census data, but two variables theoretically linked to wages were available. A regional unemployment rate was constructed for each LMA as the percent of the civilian labor force that was reported as unemployed in the census. High unemployment was hypothesized to constrain off-farm employment opportunities for operators and to depress off-farm wage levels and was therefore expected to have a negative impact on off-farm earnings.

Previous research (e.g., Dickens and Lang) has found that average wages for urban workers are higher than those for rural workers, after controlling for other factors. This phenomenon is typically attributed to the higher cost of living in more urbanized areas. Although each LMA in the PUMS-D data includes a minimum population of 100,000 for confidentiality reasons, LMAs with large metropolitan areas and significant commuting from surrounding counties greatly exceed this population level. Given the effect of greater population density on wages, and the possibility that larger local labor markets may offer greater off-farm employment opportunities to farm operators, the employed civilian labor force was included in the model as a measure of labor market size. Labor market size was hypothesized to have a positive relationship with off-farm earnings.

Local labor market characteristics in addition to the unemployment rate and labor market size may impact off-farm employment opportunities for farm operators. Of particular interest was access to off-farm jobs with work hours that were compatible with farm work requirements. An industrial structure that includes more jobs with flexible work requirements or more seasonal job opportunities that coincide with periods when farm work requirements are low should offer greater off-farm employment opportunities for farm operators.

The PUMS-D data include 231 possible industry of employment codes for a given worker (U.S. Department of Commerce, 1983). The technical documentation aggregates these into 13 separate industry groups. Labor market structure measures were delineated by calculating the percent of employed persons in each LMA working in each of these industrial categories. Because these 13 categories are mutually exhaustive, multicollinearity among the industrial percentage variables increases as more of the categories are included in the estimating equations, and the inclusion of all 13 categories would result in perfect multicollinearity. Consequently, it was necessary to develop a method of identifying a small subset of the 13 classifications for inclusion in the analysis.

Given the focus of the study on multiple (farm and nonfarm) jobs of farm operators, emphasis was given to industrial categories that were important providers of part-time employment in the state as a whole. A sample including all 36,665 persons in the relevant LMAs who worked in 1979 was used in the identification of important part-time industries. In this sample, 31 percent of the respondents reported that they worked fewer than 1500 hours in 1979, and 48 percent reported that they worked fewer than 2000 hours. The data were examined to identify the most common industrial categories of those individuals working fewer than 1500 and 2000 hours in 1979. For both the 1500 and 2000 hour cutoff levels, four industries were the most common. These were Professional and Related Services, Manufacturing, Retail Sales, and Construction. These four industries accounted for almost 70 percent of the persons working less than 1500 or 2000 hours in 1979. Table 1 shows the industrial codes included in each of these categories and the number of part-time jobs each category provided statewide in 1979 in the sample.

Variables measuring the percentage of employed persons in each LMA working in each of these four industries were included in the estimating equations. Given that these industries were identified as the most important providers of part-time work statewide, our hypothesis was that off-farm earnings of farm operators would be higher in local labor markets with higher concentrations of jobs in these industries.

ESTIMATION AND RESULTS

Data on off-farm earnings of farm operators are censored in that off-farm earnings cannot fall below zero, and the value of off-farm earnings is clustered

Table 1. Industrial Classifications Providing The Most Part-Time Jobs In Georgia In 1979.

Industry	Census Industrial Codes[a]	Number of Workers in PUMS-D	
		Less Than 1500 Hours	Less Than 2000 Hours
Construction	60	778	1325
Retail Sales	580-691	2678	3508
Manufacturing	100-392	1951	3609
Professional Services	812-892	2422	3751
Total Workers, All Industries	10-932	11,378	17,710

[a]Source: Census of Population and Housing, 1980: Public-Use Microdata Samples Technical Documentation. U.S. Department of Commerce, March 1983.

at zero for operators in this sample with no off-farm work. Since operators decide whether or not to participate in off-farm work, the censoring of off-farm earnings results from a self-selection process by farm operators. Heckman examined the econometric implications of self-selectivity in an omitted variable framework and suggested a two-stage estimation technique (Heckman; Judge *et al.*, p. 780) for problems with self-selection bias. This estimator is less restrictive than the tobit model often used for censored data problems (Heckman, p. 155). The two-step estimator suggested by Heckman can be developed for the off-farm earnings problem as follows. Assume that:

$$(4)\quad OFE_i = x_i'\beta + \varepsilon_i \text{ if } OFE_i > 0$$
$$= 0 \quad \text{otherwise,}$$

where x_i' is a vector of personal, farm and family, and labor market characteristic variables for operator i, and OFE_i represents the off-farm earnings of operator i.

Assume that the sample of operators is ordered such that of N total observations, the last OFE_is are zero and that OFE_i is positive for i= 1,..., N-s. The regression function for the operators with positive off-farm earnings is

$$(5)\quad E(OFE_i \mid x_i,\ OFE_i > 0) = x_i'\beta + E(\varepsilon_i \mid OFE_i > 0),\ i = 1,...,N\text{-}s,$$

If operators with OFE>0 are a random sample of all operators, then the conditional expectation of the error term in (5) is zero, and least squares regression on the N-s observations will provide an unbiased estimate of β. However, because operators decide whether to engage in off-farm work based on the relative marginal utilities of farm work, off-farm work, and leisure, and these relative marginal utilities are related to x_i, operators with OFE>0 are not a random sample of all operators, and the expectation of the error term in (5) is not zero. Consequently, least squares estimation of (5) without the conditional expectation of the error term for operators with OFE>0 will yield biased estimates. If the ε_i for all operators are independent and normally distributed random variables, with mean zero and variance σ^2, then

$$(6)\ E(\varepsilon_i \mid OFE_i > 0) = E(\varepsilon_i \mid \varepsilon_i > -x_i'\beta) = \sigma\tau_i,$$

where

$$(7)\quad \tau_i = \frac{f(\Omega_i)}{[1 - F(\Omega_i)]} = \frac{-x_i'\beta}{\sigma},$$

and $f(\cdot)$and $F(\cdot)$are, respectively, the density and CDF of a standard normal random variable evaluated at the argument.

The regression function, estimated from observations for which OFE>0, is

$$(8)\ E(OFE_i \mid x_i, OFE_i > 0) = x_i'\beta + \sigma\tau_i,\ i=1,...,N\text{-}s.$$

The first step of the two-step procedure is to estimate a probit equation using all observations, with the dependent variable taking a value of one if OFE> 0 and zero otherwise. The inverse Mill's ratio from the probit equation provides an estimate of τ , and this is included in the least squares estimation of (8) for observations with OFE>0. Selectivity bias is indicated if the coefficient of τ in the second stage equation is significant. LIMDEP (Greene) was used for the model estimation. Means and standard deviations for the variables used in the estimation are reported in Table 2.

Probit results are reported in Table 3. The probit model correctly predicted whether the operator had off-farm employment for 75 percent of the observations. Ten coefficients and the intercept were statistically significant at the 10 percent level, and the Cragg-Uhler R-square (Maddala, p. 40) was .423. Coefficients of two of the dummy variables, representing female operators and operators with work disabilities, were statistically significant in the probit estimation. If all continuous variables are evaluated at their means, the estimated probability

of off-farm work is .731 for a male operator with no disability, .523 for a female operator with no disability, and .538 for a male operator with a work disability. Race had no significant effect on the probability of off-farm work.

Table 4 reports the estimated probability of off-farm employment associated with various levels of the significant continuous independent variables. Table 4 was calculated for a male without a disability, and probabilities for each individual independent variable were calculated under the assumption that all other continuous independent variables were at their means. The ranges of values for the independent variables in Table 4 approximate their ranges in the sample.

Probit results indicate that the probability of off-farm employment increases with age and then declines, *ceteris paribus*. For the ages reported, the highest probability of off-farm employment occurred at age 40. The largest decline in probability of off-farm employment occurred between the ages of 60 and 70, where the probability fell from .609 to .363. The probability of off-farm work increased with educational attainment, although the impact of additional years of schooling fell slightly as the level of schooling increased. An increase in grade completed from six to eight increased the probability of off-farm work by .025, while an increase in grade level from 14 to 16 increased the probability by .021. The probit coefficients for age, age squared, and operator education were similar to those found by Sumner for a sample of Illinois farm operators, with values of .088, -.001, and .034, respectively here, and corresponding values of .095, -.0011, and .036 in Sumner.

The absolute value of net farm income, our proxy for farm size, had a strong relationship to off-farm work. For the set of assumptions in Table 4, the probability of off-farm employment declined from a high of .871, when net farm income was zero, to

Table 2. Means And Standard Deviations Of Variables In Estimated Models.

Variable	Mean	Standard Deviation
Off-farm Income (000's)		
All Observations	6.85	9.51
Nonzero Observations	12.13	9.67
Sex	0.16	0.37
Age	51.83	15.70
Grade	12.55	3.81
Race	0.08	0.26
Disability	0.21	0.41
Other Income Per Family Member (000's)	4.40	5.22
Absolute Value Farm Income (000's)	3.90	7.83
Unemployment Rate	6.30	1.06
Employed Civilian Labor Force (10,000's)	18.63	23.63
Percentage of Jobs In Selected Industries		
Construction	6.54	1.04
Retail Sales	14.50	1.92
Manufacturing	27.69	7.52
Professional Services	18.18	2.35

Table 3. Probit Estimation Results.

Variable	Coefficient	Standard Error
Constant	-4.231	1.934**
Sex	-0.558	0.163***
Age	0.088	0.026***
Age Squared	-0.001	0.25E-03***
Grade	0.034	0.019*
Race	-0.145	0.234
Disability	-0.520	0.160***
Other Income Per Family Member	0.004	0.028
Other Income Squared	-0.756E-03	0.001
Farm Income	-0.138	0.019***
Farm Income Squared	0.002	0.0004***
Unemployment Rate	-0.133	0.075*
Civilian Labor Force	0.19E-04	0.30E-04
Construction	0.032	0.061
Retail Sales	0.078	0.062
Manufacturing	0.052	0.016***
Professional	0.083	0.032***
Log-likelihood		-288.12
Chi-Squared (16)		220.68
Percentage 0 Observations Correctly Predicted		63
Percentage 1 Observations Correctly Predicted		84
Total Percentage Correct		75
Number of Observations		583.00

***Significant at .01 level
**Significant at .05 level
*Significant at .10 level

Table 4. Effect Of Independent Variables On Probability Of Off-farm Employment.

Variable	Probability of Off-Farm Employment[a]	Variable	Probability of Off-Farm Employment[a]
Age		Grade	
20	.678	6	.652
30	.777	8	.677
40	.798	10	.701
50	.749	12	.725
60	.609	14	.747
70	.363	16	.768
Farm Income (000's)		Unemployment	
(Absolute Value)	.871	4	.822
0	.466	5	.785
10	.167	6	.744
20	.065	7	.699
30	.042	8	.651
40	.054	9	.601
50			
Professional And Related Services		Manufacturing	
14	.607	15	.484
16	.668	20	.586
18	.726	25	.683
20	.778	30	.769
22	.824	35	.840
24	.863	40	.895

[a]Assumes white male, without disability, all other variables at mean values.

.042, when the absolute value of net farm income was $40,000. This represented the largest range of probabilities for off-farm work associated with any independent variable.

Three of the labor market characteristics had significant impacts on the probability of off-farm work. The probability of off-farm work declined with increasing unemployment rates, falling from a probability of .822 for an unemployment rate of 4 percent to a probability of .601 with an unemployment rate of 9 percent, *ceteris paribus*. Increases in the percentage of jobs in an LMA in the Professional and Related Services industrial classification and the Manufacturing classification were associated with increases in the probability that a farm operator engaged in off-farm work. As the percentage of jobs in Professional and Related Services rose from 14 to 24 percent, the probability of off-farm work increased from .607 to .863, *ceteris paribus*. As the percentage of jobs in Manufacturing rose from 15 to 40 percent, the probability of off-farm work increased from .484 to .895.

Results from the second stage off-farm earnings estimation are reported in Table 5. These results show the effect of the independent variables on the off-farm earnings of farm operators who engaged in off-farm work in 1979. The inverse Mill's ratio was statistically significant in the second stage equation, indicating that selectivity bias was present in the sample of farm operators. Coefficients of dummy variables identifying operators who were female, nonwhite, or disabled were negative and statistically significant, indicating lower expected off-farm earnings for operators with these characteristics. The estimated decrease in annual off-farm earnings associated with being female, nonwhite, and having a work disability were $9,091, $3,945, and $9,932, respectively.

Off-farm earnings followed a quadratic age pattern, peaking at approximately 43 years. Higher educational attainment was associated with higher off-farm earnings, with each year of additional education adding approximately $872 to annual off-farm earnings, *ceteris paribus*. Although farm

Table 5. Off-farm Earnings OLS Results

Dependent Variable: Off-farm Earning ($000's)		
Variable	Coefficient	Standard Error
Constant	-82.418	29.896***
Sex	-9.091	2.987***
Age	1.830	0.531***
Age Square	-0.021	0.006***
Grade	0.872	0.207***
Race	-3.945	2.255*
Disability	-9.932	2.803***
Other Income Per Family Member	-0.288	0.296**[a]
Other Income Square	-0.006	0.013**[a]
Farm Income	-0.822	0.605
Farm Income Square	0.510E-03	0.008
Unemployment Rate	-0.669	0.916
Civilian Labor Force	0.715E-03	0.305E-03**
Construction	-0.172	0.614
Retail Sales	1.192	0.634*
Manufacturing	0.488	0.243**
Professional	0.953	0.435**
Inverse Mill's Ratio	17.331	7.572**
Adjusted R-Squared		0.239
F-Statistic		7.111

***Significant at .01 level
**Significant at .05 level
*Significant at .10 level
[a]Jointly significant at .05 level.

income was an important determinant of whether or not an operator participated in off-farm work, this proxy for farm size had no significant impact on the off-farm earnings of those operators who performed off-farm work.

The linear and quadratic terms for per capita other family income were jointly significant in the off-farm earnings equation. A test of the restriction that these coefficients were both equal to zero (Kennedy, p. 65) yielded a calculated F statistic of 4.22, compared with the 5 percent critical value of F, with 2 and 314 degrees of freedom, of 3.0. As per capita other family income increased, estimated off-farm earnings declined. Increasing per capita other family income from zero to its mean level for operators with off-farm work, $3,274, decreased estimated off-farm earnings by $1,003.

Coefficients of four of the six local labor market variables were statistically significant at the 10 percent level in the off-farm earnings equation. Higher off-farm earnings were associated with larger local labor markets. Annual off-farm earnings of an operator were estimated to be $715 higher for each additional 10,000 members of the employed civilian labor force in an LMA. Excluding the Atlanta LMA, this would represent a difference in estimated annual off-farm earnings of $1,805, comparing the smallest to the remaining largest LMA. Comparing the Atlanta LMA to the smallest LMA results in an estimated difference in annual off-farm earnings of almost $7,000.

Increases in the proportion of jobs in the local labor market in the Retail Sales, Manufacturing, and Professional and Related Services industrial classifications had significant positive impacts on estimated off-farm earnings. The estimated increase in earnings associated with a 1 percent increase in employment percentage was $1,192 for Retail Sales, $953 for Professional and Related Services, and $488 for Manufacturing. Neither the local unemployment rate nor the percentage of jobs in construction significantly affected the off-farm earnings of farm operators who engaged in off-farm work.

SUMMARY AND CONCLUSIONS

This study analyzed the effects of local labor market conditions on the off-farm earnings of farm operators. Theory suggests that local labor market conditions may have significant impacts on off-farm employment and earnings, but the empirical analysis of these effects has been very limited. Where commonality existed between this study and earlier ones, such as in the inclusion of human capital variables in the probit equation, the results were consistent with previous research.

The new findings from this analysis relate to the impact of specific labor market characteristics on off-farm work of operators. Measures of the local unemployment rate, the size of the local labor market, and the proportion of local jobs in four industrial sectors that are important providers of part-time employment in Georgia were included in our analysis. The local unemployment rate and two of the industrial structure variables were found to impact significantly the probability of an operator engaging in off-farm work. Higher local unemployment decreased the likelihood of off-farm work. A greater proportion of jobs in the Professional and Related Services and the Manufacturing industrial classifications increased the likelihood of an operator working off-farm.

In addition to affecting the probability of off-farm work, local labor market conditions also impacted the level of off-farm earnings of operators who engaged in off-farm work. Local labor market size had a positive and significant impact on off-farm earnings. This is possibly due to higher wages or better opportunities to work additional hours in more populous labor markets. Higher proportions of jobs in the Retail Sales, Manufacturing, and Professional and Related Services sectors also were associated with higher off-farm earnings of farm operators. Retail Sales had the greatest impact on off-farm earnings, followed by Professional and Related Services and Manufacturing. Since retail sales is generally one of the lowest wage sectors (U.S. Department of Commerce, 1985, p. 417), the large impact of Retail Sales is apparently due to a greater flexibility or availability of hours in jobs in this sector.

The primary finding of this study is that local labor market conditions do influence off-farm earnings of farm operators. Therefore, economic development policies have a potential to impact farm family income and the viability of farms. With respect to development strategies, policies to enhance off-farm earning opportunities for farm operators, in many respects, do not differ from general economic development policies. Although attracting industries that provide part-time jobs may be especially beneficial to farm operators, reducing unemployment rates and attempting to attract industry should enhance the economic well-being of both those within and outside of agriculture. Two general points stand out. Rural economic development has the potential to improve the economic status of farmers as well as other rural residents, and this benefit should be recognized when assessing the benefits and costs of policies to promote development. Further, rural development efforts should be

considered along with commodity programs as a means of assisting farmers and stabilizing farm family income. This has added significance considering the high costs of commodity programs and the historical difficulty of targeting commodity program benefits to assist low income farmers.

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