Regional Differences in the Contribution of Off-Farm Work to Income Inequality

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This paper uses the concept of the Gini Coefficient and data from the 1991 Farm Costs and Returns Survey (FCRS) to measure the role of off-farm income and that of other income sources in the size distribution of farm operator households' total personal income. Disaggregated FCRS data by region and by level of participation in off-farm employment show that nonparticipating farm operator households have, as a group, higher income inequality than participating households. The results also indicate that, irrespective of the off-farm work status of the farm operator household, the distribution of income among households in the North Central region is least unequal and that in the West is most unequal.

The increased reliance on off-farm income by U.S. farm operators has been documented in a number of studies (Sumner; Gunter and McNamara; Hallberg, Findeis, and Lass; Boisvert and Ranny; among others). Newly published data from the U.S. Department of Agriculture indicate that almost 90 percent of U.S. farm operator households receive some off-farm income from either earned or unearned sources (Ahearn *et al.*, 1993). The objective of this paper is to measure the role of all sources of off-farm income in the size distribution of total personal income of farm operator households based on their level of participation in off-farm work. Because of the differences across regions in the availability of off-farm job opportunities and the structure of agriculture, the importance of income from off-farm sources to the total incomes of these households and their distributional implications are assessed for all the U.S., and by region.[1] The paper includes in its income measure noncash items such as the value of home-produced goods which are consumed at home and the rental value of dwelling. Furthermore, the population for whom the size distribution of total personal income is being measured here differs than in some other papers in that it includes farm operator households who reside off the farm as well as on the farm.

Previous Work

In an attempt to examine the importance of income from off-farm sources to the distribution of total income of farm operators and their families, many studies have used the concept of the Gini coefficient. For example, using the 1984 Farm Costs and Returns Survey (FCRS) conducted by the National Agricultural Statistics Service (NASS) and the Economic Research Service (ERS), Ahearn

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[1] The regions considered in the analysis are the Northeast, West, South, and North Central as defined in the U.S. Bureau of the Census. Specifically, the Northeast region includes the New England (i.e., Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut) and the Middle Atlantic (New York, New Jersey, Pennsylvania) divisions; the West includes the Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada) and Pacific (Washington, Oregon, California) divisions; the South includes the East South Central (Kentucky, Tennessee, Alabama, Mississippi), West South Central (Arkansas, Louisiana, Oklahoma, Texas) and South Atlantic (Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida) divisions; and the North Central region includes the East North Central (Ohio, Indiana, Illinois, Michigan Wisconsin) and the West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas) divisions.

et al. (1985) applied this technique to U.S. farm operator households. Findeis and Reddy, and Reddy, Findeis, and Hallberg applied this procedure to families who lived on farms and included both an operator and spouse using the 1985 Current Population Survey both for all the U.S. and by region. Gould and Saupe extended this technique by applying it to Wisconsin panel data and by incorporating a measure of wealth in the analysis. Using money-income data of New York dairy farm families, Boisvert and Ranney used this technique along with a technique that accounted for the presence of negative incomes (as proposed by Chen, Tsaur, and Rhai). The conclusions of these studies pointed toward the significance of off-farm employment in reducing the income inequality among farm families, and hence the importance of rural development policies aimed at promoting greater off-farm job opportunities or higher non-farm wage rates.

This paper extends the previous research on the measurement of income inequality of farm operator households by using a method that improves the accuracy of estimates of Gini coefficient, particularly when the data are grouped as in most surveys including the one used in this paper. Furthermore, the paper improves upon the work of Boisvert and Ranney by considering the regional implications to income inequality and by using farm operator household's money and non-money income in the analysis (i.e., the value of home-produced goods which are consumed at home and the rental value of dwelling).[2] The inclusion of noncash items-which constitute nearly one-tenth of total household income (FCRS, 1991)—as part of a study of income distribution is essential since, as Larson and Carlin suggest, money income itself may not be an appropriate measure of economic well-being since it does not take account of the ability of a person to sustain a loss.

While a similar income measure was utilized by Ahearn *et al.* (1985), this paper extends their work in two ways. First, this paper uses an enhanced data set (FCRS, 1991) that includes a refinement of traditional data collection approaches to measuring farm income of households. Specifically, the paper excludes from the analysis those farm operator households associated with the 1 percent of farms organized as non-family corporations, cooperatives, or managed by an operator who did not share in the net income of the business.[3] Second, the data set used here benefits from NASS' systematic adjustment for the undercounting of small farms, those with total farm sales of $10,000 or less, as was the case in all FCRS data sets prior to 1991 (for a thorough discussion regarding the adjustment procedure, see Dillard). This should provide a significant improvement towards assessing the contribution of income from off-farm sources to the size distribution of households' total income as nearly 70 percent of all households in this sales category participate in off-farm employment, more so than in all other size categories (U.S. Department of Agriculture).[4]

In contrast to families living on farms from the Current Population Survey—the data base used in a number of studies—the FCRS data base includes farm operator households residing off the farm as well as on the farm. Ten percent of all U.S. farm operator households reside off their farms and excluding these households from the sample may cause the outcome of the analysis to be biased. This is particularly true considering the fact that this group of farm operator households produce nearly 20 percent of all the agricultural output in the U.S. They also average more money from participating in government programs, from farming, and from working off the farm than the group of households that reside on the farm (Ahearn *et al.* pp. 150–152, 1993).

In examining the contribution of income from off-farm sources to the size distribution of total personal income of farm operator households, it is important to note the relevance of some additional factors discussed in the literature. For example, a study by Gardner points to increases in the capital-labor ratio, the average level of schooling, and research and extension as factors that contribute significantly to the dispersion in farm income. The study also finds labor market adjustments to be influential in reducing short-run inequality. The

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[2] The farm operator total household income used in this study is defined as the sum of farm-related income, direct government payments, and income from off-farm sources. Farm-related income is the sum of the percent of the net farm income received by the household (i.e., gross farm income minus total expenses including depreciation), adjusted income from land rented to others, wages and salaries paid to operator and household members, and net income received by household from another farm business. Gross farm income, in turn, is defined as money income (i.e., crop and livestock sales plus net CCC loans; income from custom work and machine hire; and all other farm income) and non-money income (i.e., value of farm products used or consumed on the farm and gross imputed rental value of farm dwelling if the dwelling is located on the operation). Under this definition of total household income, all direct government payments are assumed to be received by the household, which may not be true in cases where more than one household share in the net income of the farm operation. However, Ahearn *et al.* (1993, p. 18) point out that ninety-five percent of the farm income of farm businesses that participated in government direct payment programs went to farm operator households.

[3] Following the Bureau of the Census, the FCRS defines a farm as any place from which $1,000 or more of agricultural products were produced and sold or would have been normally sold during the census year.

[4] Thanks are due to an anonymous reviewer for this insight.

positive relationship between average level of schooling and the inequality of income has also been noted by Chiswick. Mincer shows that, within regions, income inequality increases with higher levels of occupation, schooling, and age. Rice and Sale find that the larger the percentage of the population that is 65 years of age and over, the larger is the inequality measure. The study also suggests that the larger the percent of the total population that is classified as rural farm, the larger is the inequality index. Al-Samarrie and Miller find that states with a high degree of industrialization and a high per capita income tend to have more equal distribution of income than the relatively low income states. The authors also point to the industrial and occupational mix; resource endowments; the size, skill, age, sex, and race of the labor force; and to the rate of unemployment as being important determinants of income inequality. Schultz asserts that a large fraction of income inequality in a cross section is related to differences in amount of hours worked, and changes in these pattern of time allocation and not wage differentials account for most of the long-term variation in U.S. personal income inequality.

Measuring Income Inequality

Traditionally, the importance of off-farm income to the distribution of income among farm operator households has been measured using a method that allows for the decomposition of the Gini coefficient and that provides estimates of impacts of alternative income sources on income inequality (see Ahearn *et al.*, 1985; Findeis and Reddy; Reddy *et al.*; Gould and Saupe; and Boisvert and Ranny; among others).[5] This method was originally proposed by Pyatt, Chen and Fei and was later extended by Lerman and Yitzhaki (1985). According to Pyatt *et al.*, the Gini coefficient for each income source can be expressed as:

$$(1)\quad G(Y_k) = 2Cov[Y_k, F(Y_k)]/\bar{Y}_k = [2/n\bar{Y}_k][Cov(Y_k, \rho(Y_k))],$$

where $G(Y_k)$ is the Gini for income from the kth income source: $\bar{Y}_k$ is the mean of Y_k; $F(Y_k)$ is the cumulative distribution $\rho(Y_k)$ is the rank of observations by the kth source of income; n is the number of observations; and $Cov(.)$ is the covariance between Y_k and $\rho(Y_k)$. Equation (1) implies that the estimator of $F(Y_k)$ is the rank of the variate Y_k (i.e., $\rho(Y_k)$) divided by n, which is a valid assumption as long as the underlying sample is a random sample.

The Gini index of total income Y, denoted as $G(Y)$, is computed as follows:

$$(2)\ G(Y) = \sum_{k=1}^{k} G(Y_k)R_k\phi_k, \qquad 0 \le G(Y) \le 1$$

where

$$(3)\quad R_k = \frac{Cov(Y_k, \rho(Y))}{Cov(Y_k, \rho(Y_k))}, \qquad -1 \le R_k \le 1$$

and

$$(4)\qquad \phi_k = \bar{Y}_k/\bar{Y}.$$

In equation (3), R_k is the "Gini correlation" between the kth income source and the rank of total income, and $\rho(Y)$ and $\rho(Y_k)$ denote the rank of observations by total family income and by the kth income source, respectively.[6] In equation (4), ϕ_k is the kth income component's share of total household income. It should be noted that inspection of equation (3) suggests that R_k will be unity if $\rho(Y)$ and $\rho(Y_k)$ are equal.

Pyatt *et al.* and Lerman and Yitzhaki developed a number of relative measures that are important to studies of households' income distribution. One such measure is the "proportional contribution to inequality," denoted as P_k. It is determined by the ratio of the contribution of the kth income source to the total Gini index.

$$(5)\qquad P_k = \frac{G(Y_k)R_k\phi_k}{G(Y)}$$

Lerman and Yitzhaki (p. 153) have developed an income elasticity measure which shows how income inequality changes due to a marginal change in Y_k, the income from the kth source. This measure, which is denoted as M_k, is obtained by first taking the partial derivative of the overall Gini in-

[5] The Gini coefficient is based on the Lorenz curve which is obtained by plotting the relationship between the cumulative percentage of total income corresponding to the cumulative percentage of the population. This index is defined as the area between the Lorenz curve and a diagonal which represents perfect equality of income as a proportion of the total area under the line of equality. A zero value for the Gini coefficient suggests an equal distribution of income while a value of one indicates perfect inequality.

[6] For $\rho(y_k)$ and $\rho(y)$ in equation (3) the observations are ranked in ascending order. Data points exhibiting ties are given the average value of the consecutive ranks that would have been otherwise assigned.

dex with respect to a small change (ϵ_k) in income source k:

$$(6)\qquad \frac{\partial G(Y)}{\partial \epsilon_k} = \phi_k[R_k G(Y_k) - G(Y)].$$

Dividing equation (6) by $G(Y)$ yields:

$$(7)\qquad M_k = \frac{\left[\dfrac{\partial G(Y)}{\partial \epsilon_k}\right]}{G(Y)} = P_k - \phi_k$$

As Lerman and Yitzhaki point out, the sum of the k elasticities equals zero. This implies that if all sources of income are multiplied by ϵ, the overall Gini coefficient will be left unchanged.[7]

In a later article by Lerman and Yitzhaki (1989), the authors point out a potential bias in the estimation of the Gini coefficient based on equation (1). The potential for bias originates when the underlying sample comes in a weighted form where each observation represents a certain number in the population. According to the authors (p. 44), when the weights are not the same for each observation, the mere multiplication of values for the observations on the data file by the weight for each individual or family will cause equation (1) to yield the sample Gini and not the estimate of the population Gini. Accordingly, in a weighted sample, any potential bias can be minimized if the estimator of $F(Y_k)$ is computed as a mid-interval of $F(Y_k)$ or:

$$(8)\quad \hat{F}_i(Y_k) = \sum_{j=0}^{i-1} w_j + w_i/2 \qquad \text{where } w_0 = 0,$$

and where w_i denotes the weight that corresponds to the ith family such that $\Sigma w_i = 1$ ($i = 1, \ldots, n$). Equation (8) requires that families be ranked so that the values of each Y_k are in non-decreasing order. Once the values of $F_i(Y_k)$ are estimated from equation (8), this allows for the direct estimation of the weighted covariance between Y_k and $F(Y_k)$. Where the data are grouped, as in this paper (see also Ahearn *et al.*, 1985 and Findeis and Reddy), the ith Y_k is the mean of the kth income source within group i. Consequently, the Gini coefficient for weighted data is

$$(9)\quad G(Y_k) = 2\left[\sum_{i=1}^{n} w_i(Y_{i,k} - \bar{Y}_k)(\hat{F}_i(Y_k) - \bar{F}(Y_k))\right]/\bar{Y}_k,$$

where $Y_{i,k}$ is the income of the ith family from the kth source, $\bar{Y}_k$ is the weighted mean of Y_k, $\bar{F}$ is the mean of the estimates of F_i, and [.] is the weighted covariance between Y_k and $F(Y_k)$. Because equation (9) thus allows for the estimation of a more accurate Gini when data are grouped, it is used instead of equation (1). Similarly, equation (8) is used to estimate the weighted covariance between Y_k and $F(Y_k)$, and consequently, in the estimation of the Gini correlation (R_k). Equations (5) and (7) which are used to compute the proportional contribution to inequality (P_k) and income elasticity (M_k) require no correction other than incorporating the Gini coefficient computed for weighed data and its corresponding Gini correlation.

The advantage of using the method as outlined by Pyatt *et al.* and by Lerman and Yitzhaki (1985, 1989) to compute the Gini coefficient is that the resulting Gini can be decomposed by income sources, and the elasticities of the income components can be derived analytically.[8] However, a major drawback is that when the incidence of negative incomes is substantial, the $G(Y_k)$ and $G(Y)$ as defined in equations (1) and (2) (corrected for grouped data as in equation (9)) may become overstated and may even cause their values to exceed unity, hence making comparisons of income inequality across populations problematic. Similarly, negative incomes may also affect M_k, the elasticity of income inequality (equation (7)). Aside from the potential for bias in the values of $G(Y)$ and M_k, the procedure outlined by equations (1) through (9) in the text remains applicable, as Pyatt *et al.* suggest, as long as the average value of the particular source of income is positive for the entire sample.

To correct for the problems associated with negative incomes, Chen, Tsaur, and Rhai developed the concept of "adjusted" Gini coefficient, $G^*(Y)$, in which $G(Y)$ is normalized in such a manner so that the upper bound on the Gini coefficient is now unity. The "adjusted" Gini coefficient, which was further developed by Berrebi and Silber, and applied by Boisvert and Ranney to measure income inequality among farm families in New York, is computed as:

[7] This is also known in the literature as Dalton's 'principle of proportionate change' which along with other principles have come to be accepted as "basic" properties of measures of inequality, and as such serve to reduce the number of allowable measures. For a thorough discussion on this principle and other underlying axioms of inequality measures, see Foster.

[8] It should be noted that no consensus has been reached in the literature on the proper way to decompose inequality indices. Shorrocks (1982, 1983) has discussed this issue very succinctly and has evaluated the performance of different decomposition rules including those relevant to the Gini coefficient.

$$(10) \qquad G^*(Y) = \frac{(2/n)\sum_{j=1}^{n} jy_j - \frac{n+1}{n}}{\left[1 + (2/n)\sum_{j=1}^{m} jy_j\right] + (1/n)\sum_{j=1}^{m} y_j \left[\frac{\sum_{j=1}^{m} y_j}{y_{m+1}} - (1 + 2m)\right]}$$

$$(11) \quad y_j = Y_j/n\overline{Y} \quad \text{and} \quad \overline{Y} = \sum_{j=1}^{n} Y_j/n > 0$$

In equation (11), n is the number of families, j denotes the j^{th} family and as such stands to denote the rank number of each family in the sample, y_j is the income share of the j^{th} family, Y_j is j^{th} family's total income where $Y_1 \leq \ldots \leq Y_n$ with some $Y_j < 0$, and m is the size of the subset of families whose combined income is zero with $Y_1 \leq \ldots \leq Y_m$.[9] In the absence of any negative income, and where data are not grouped, $G(Y)$ and $G^*(Y)$ are identical. In order to yield an estimate of the population $G^*(Y)$, the income levels Y_j in this paper are multiplied by their corresponding weights. Because $G(Y)$ is computed here according to equation (9) in order to correct for the fact that the underlying data that were used are grouped, $G^*(Y)$ is expected to be less than or equal to that of $G^*(Y)$.[10]

The advantage of using the "adjusted" Gini in the presence of negative incomes is that it allows for the same geometric interpretation as in the conventional Gini. However, the "adjusted" Gini measure has two major limitations. First, this concept does not allow for the accurate decomposition of income inequality by source. Second, any elasticity of income source (M_k) that needs to be derived using this concept will have to be derived using simulation techniques. As Boisvert and Ranney note, the M_k derived using this technique is analytically inconsistent because of the need to use finite changes in components of total income in the simulation. Doing so, however, will cause the sum of the k elasticities to be no longer zero when all farm operator households' incomes from each source are multiplied by ϵ_k. In comparison, the elasticities derived from using the conventional Gini, while analytically consistent, are biased. However, while the elasticities based on the conventional Gini are always higher than those derived under the "adjusted" Gini (i.e. using simulation), the corresponding elasticities under both techniques retain the same sign (Boisvert and Ranney). Hence, any qualitative policy implications that need to be drawn from analyzing the elasticities of total family income from marginal changes in income by source are the same.[11]

Recognizing the advantages and the disadvantages of the conventional and the "adjusted" Gini coefficient concepts, this paper pursues its objective by attempting to benefit from the advantages of both procedures and by discarding the disadvantages. Specifically, the paper adopts the conventional Gini as proposed by Pyatt *et al.* and by Lerman and Yitzhaki (1985, 1989) in the effort of measuring income inequality of each source of income for the U.S., by region, and by level of participation in off-farm employment, and to measure the importance of each income source to total income inequality. Furthermore, this technique is used to provide qualitative policy implications to changes in each source of income in terms of their effects on total income inequality.[12] Because of the

[9] For computational purposes, m is determined where the sum of incomes over the first m families is negative and the first $m + 1$ families is positive.

[10] Pyatt, Chen, and Fei show that the value of a Gini computed under grouped data is always less than or equal to that computed under individual data. However, as Benson notes, the potential for bias increases when a large percentage of observations fall within one group since much of the information about the distribution is lost.

[11] It is important to point to a remaining but insurmountable limitation that the surrounds the use of the Gini index in general. Specifically, as Carlin and Reinsel point out, because the Gini coefficient measures only relative equality without consideration of the absolute level of income, it is possible to find poverty rates that are higher in a population for which incomes are equally distributed than in one for which incomes are unequal, but much higher. Kinsey discusses the axioms that underlie the use of the Gini coefficient. According to the study, while these axioms allow for the interpretation that a Gini coefficient of .5 as representing income that is less equally distributed than .4, it does not provide information about how each distribution is skewed or who won and who lost, which is central to policy makers in their debate regarding the welfare of income earners.

[12] Only policy implications that are qualitative in nature will be ad-

presence of negative incomes, the "adjusted" Gini is used for the purpose of comparing income inequality among farm operator households based on their production region and their level of participation in off-farm employment.

Source of Data

The data source for this paper is the 1991 FCRS. This survey, which has been conducted annually since 1984 by ERS and by NASS, is composed of multiple versions, all of which collect consistent financial data on the farm business and data on the demographic characteristics of the farm operator. Further, the survey is based on a stratified, multiframe sample of farms. When properly weighted (i.e., when each observation unit is multiplied by its proper expansion factor), the sample yields an accurate representation of U.S. farms. For example, the 2,080,132 farms considered in the analysis (see footnote b, Table 1) are based on a sample of 11,779 farms. It is important to note that, as of 1991, the number of farms reported by FCRS is consistent with the official number of farms as reported by the U.S. Department of Agriculture.

Characteristics of Farm Operator Households

In this paper, a participating household is defined as one in which at least one member of the household received remuneration from off-farm wages and salaries and/or from an off-farm business.[13] Based on the 1991 FCRS, nearly two-thirds of the 2 million farms across the U.S. had farm operator households that participated in off-farm employment. Off-farm labor participation levels similar to that of the U.S. were found in the North Central and West regions, and slightly lower levels were found in the Northeast and the South regions, at around 60 percent (Table 1).

Table 1 shows that farm operator households in all four regions who participated in off-farm employment, in comparison to those who did not, generated less income from sales of farm products, had higher debt to assets ratios, and were more likely to specialize in the production of beef, hogs, and sheep. From among all farms of participating operator households, those farms in the Southern region reported the lowest levels of sales, compared to those in the North Central region who had the highest levels of sales. Farms of participating households in the Southern region, in contrast to farms of participating households in other regions, also had the lowest levels of assets and debts as well as the lowest debt to assets ratios. In comparison, farms of participating households located in the Western region had the highest levels of assets and debts and those in the North Central region had the highest levels of debt to assets ratios.

The importance of off-farm income to farm operator households by region is presented in Table 2. Farm operators in the Northeast, West, and South receive more of their total income from off-farm sources than operators in the North Central region, at around 80 percent. However, across all regions, earned off-farm income (i.e., wages and salaries and income from off-farm business) is the most important component of off-farm income. Farm operator households in all regions who participated in off-farm employment netted less from their farming operation than their nonparticipating counterparts. However, earned off-farm income more than compensated for their lower farm incomes.

Farm operators who participated in off-farm employment in all four regions were much younger and were more likely to have had college education than operators with no off-farm employment (Table 2). The majority of the participating operators, with the exception of those in the North Central region, reported something other than farming as their main occupation. The fact that over 50 percent of the participating operators in the North Central region reported farming as their major occupation may explain why their households averaged less from working off the farm ($28,000) than their counterparts in all other regions.[14] However, it is worth noting that these participating households in the North Central region, while reporting lower earnings from off-farm employment,

dressed in the study since in the presence of negative incomes, any other type of implications will be meaningless due to the overstatement of the Gini.

[13] This definition of participation is based on the concept of net off-farm earnings as defined by U.S. Bureau of the Census (U.S. Dept. of Commerce, p. xvi). The off-farm wages and salaries component of net off-farm earnings includes the gross cash wages, salaries, tips, paid bonuses, leave pay, etc. received from all jobs done off the farm or ranch and cash wages and salaries earned by operators and their household members from working on other farms or ranches. The net off-farm business component of off-farm earnings includes income earned from businesses other than farms or ranches. This component excludes income earned from other farming or ranching operations and income from farm-related sources or farm-related business such as custom operations if the headquarters (where bookkeeping is done) is on the operation (National Agricultural Statistics Service, 1991, pp. J-5092 and J-5093).

[14] The seemingly direct relationship between farm operator's occupation and the level of off-farm earned income is consistent with the finding from Ahearn *et al.* (1993, table 45, p. 156) that almost 88% of off-farm earned income gets generated by the operator, 10% by the spouse, and around 2% by other members of the household.

Table 1. Characteristics of U.S. Farms Based on Production Region and Participation of the Farm Operator in Off-farm Employment, 1991

	All Farms				
Item	U.S.	Northeast	North Central	West	South
Share of all farms (%)	100.0	6.2	40.7	13.0	40.2
Number of farms (survey)[b]	11,779	993	3,551	2,043	5,192
Farm tenancy (%):					
Full ownership	55.0	55.1	49.0	64.8	58.0
Other	45.0	44.9	51.0	35.2	42.0
Farm sales ($1,000)	50.5	58.9	59.1	83.2	30.0
Farm sales (%):					
Less than $50,000	73.0	70.0	63.2	71.2	83.8
$50,000–$100,000	11.8	11.9	16.5	12.4	6.9
$100,000–$249,999	10.2	13.4	14.5	8.7	5.8
$250,000 or more	5.0	4.6	5.8	7.7	3.5
Commodity specialty (%):					
Cash grains	19.2	6.3	37.3	8.5	6.4
Other crops	23.0	32.9	12.0	38.9	27.5
Beef, hogs, sheep	42.8	24.9	34.1	38.9	55.5
Other livestock	7.4	9.5	4.9	11.0	8.4
Dairy	7.6	26.4	11.7	2.7	2.1
Farm debts ($1,000)	44.2	41.6	53.1	78.9	24.3
Farm assets ($1,000)	369.0	457.5	342.5	661.8	287.7
Debt to assets ratio (%)	12.0	9.1	15.5	11.9	8.4

	Off-Farm Work Status							
	Northeast		North Central		West		South	
Item	NP[a]	P[a]	NP	P	NP	P	NP	P
Share of all farms (%)	38.6	61.4	33.7	66.3	34.4	65.6	39.2	60.8
Number of farms (survey)[b]	433	560	1,376	2,175	956	1,087	2,424	2,768
Farm tenancy (%):								
Full ownership	52.8	56.5	52.7	47.2	65.8	64.3	63.2	54.7
Other	47.2	43.5	13.3	52.8	34.2	35.7	36.8	45.3
Farm sales ($1,000)	81.5	44.7	79.5	48.7	152.3	47.0	40.7	23.2
Farm sales (%):								
Less than $50,000	59.2	76.9	57.3	66.3	55.9	79.2	79.7	86.5
$50,000–$100,000	13.8	10.7	18.1	15.7	15.5	10.7	8.5	5.8
$100,000–$249,999	20.0	9.3	16.4	13.5	13.3	6.2	7.0	5.1
$250,000 or more	<u>7.0</u>[c]	3.1	8.2	4.5	15.3	3.8	4.9	2.6
Commodity specialty (%):								
Cash grains	—†	6.9	34.9	38.5	11.5	6.9	7.5	5.7
Other crops	36.4†	34.1	14.0	11.0	45.0	35.8	28.8	26.7
Beef, hogs, sheep	17.1	29.8	32.1	35.1	30.3	43.4	53.2	57.0
Other livestock	7.4	10.8	3.6	5.6	8.5	12.3	7.4	9.0
Dairy	39.1	18.5	15.4	9.8	4.8	<u>1.6</u>[c]	3.0	1.6
Farm debts ($1,000)	36.2	45.0	51.8	53.8	109.4	<u>63.0</u>	22.1	25.7
Farm assets ($1,000)	549.7	399.6	430.7	297.6	973.6	498.3	340.3	253.9
Debt to assets ratio (%)	6.6	11.3	12.0	18.1	11.2	12.6	6.5	10.1

Source: Farm Costs and Returns Survey, 1991 (weighted samples).
[a]NP denotes no participation in off-farm employment while P denotes participation.
[b]The weighted sample sizes for the U.S., and the Northeast, North Central, West, and South regions are 2,080,132; 127,982; 845,924; 269,947; and 836,278; respectively. For the Northeast, North Central, West, and the South regions, the weighted sample sizes for the 'NP' and 'P' categories are (49,409; 78,573); (285,430; 560,495); (92,829; 177,118); and (327,431; 508,848), respectively.
[c]Estimates that are underlined have coefficients of variation (CVs) in the range of 25 to 40 percent. All other estimates have CVs of less than 25 percent.
†Category is combined with adjacent category due to disclosure consideration.

Table 2. Characteristics of U.S. Farm Operator Households Based on Production Region and Participation of the Farm Operator Household in Off-Farm Employment, 1991

	All Farms				
Item	U.S.	Northeast	North Central	West	South
Total household income ($1,000)	41.5	44.5	36.7	61.8	39.4
Household income by source ($1,000):					
Farm-related income[b/]	6.9	8.5	7.4	9.5	5.2
Government income	3.0	0.8	4.3	3.9	1.7
Off-farm income	31.6	35.2	25.0	48.3	32.5
Earned	23.6	28.1	18.5	37.3	23.5
Interest and dividends	2.9	3.0	2.5	3.8	2.9
All other non-farm income[c/]	5.2	4.1	3.9	7.3	6.1
Operator age (Average)	54	52	52	53	56
Operator age (%)					
Younger than 35	9.3	10.2	11.5	8.7	7.1
35–54	43.2	47.1	44.7	47.3	39.8
55–64	21.9	22.1	20.8	20.5	23.6
65 or older	25.6	20.6	23.0	23.5	29.5
Operator major occupation (%)					
Farming	56.5	58.4	63.3	55.8	49.6
Other than farming	43.5	41.6	36.7	44.2	50.4
Operator formal education (%)					
High school graduation or less	64.2	62.6	68.0	44.8	66.9
Some college	20.6	15.8	20.2	29.9	18.7
College or beyond college	15.2	21.6	11.9	25.3	14.4

	Off-Farm Work Status							
	Northeast		North Central		West		South	
Item	Np[a/]	P[a/]	NP	P	NP	P	NP	P
Total household income ($1000)	22.1	58.5	26.7	41.7	44.1	71.1	23.4	49.7
Household income by source ($1,000):								
Farm-related income[b/]	9.9[d]	7.6[d]	11.8	5.2	21.4	(3.3)	7.5	3.7[d]
Government income	1.2[d]	0.5	5.2	3.8	5.2	3.2	2.2	1.4
Off-farm income	11.0	50.4	9.8	32.7	17.4	64.5	13.7	44.5
Earned	0.0	45.8	0.0	28.0	0.0	56.8	0.0	38.6
Interest and dividends	4.6[d]	2.0	3.4	2.0	5.3	3.0[d]	4.1	2.1
All other non-farm income[c/]	6.4	2.6	6.3	2.7	12.1	4.8	9.6	3.8
Operator age (Average)	58	48	59	49	61	49	63	51
Operator age (%)								
Younger than 35	—†	12.4	8.1	13.3	5.9	10.2	4.3	8.9
35–54	35.7†	58.6	24.8	54.8	23.0	60.0	19.2	53.1
55–64	24.9	20.3	22.4	19.9	23.1	19.1	19.2	26.4
65 or older	39.4	8.8	44.6	12.0	48.0	10.7	57.3	11.6
Operator major occupation (%)								
Farming	84.6	41.9	87.0	51.2	88.5	38.7	77.5	31.6
Other than farming	15.4	58.1	13.0	48.8	11.5	61.3	22.5	68.4
Operator formal education (%)								
High school graduation or less	66.2	60.3	76.9	63.4	54.9	39.5	75.1	61.7
Some college	18.3	14.1	15.4	22.6	27.2	31.3	15.2	20.9
College or beyond college	15.5	25.5	7.7	14.0	17.9	29.2	9.7	17.4

Source: Farm Costs and Returns Survey, 1991 (weighted samples). See Table 1 for sample and population sizes.
[a]NP denotes no participation in off-farm employment while P denotes participation.
[b]Includes money and non-money incomes.
[c]Includes social security, private pensions, non-farm government transfer payments, off-farm rental income, gifts, and income from wages earned on other farms.
[d]Estimates that are underlined have coefficients of variation (CVs) in the range of 25 to 40 percent. All other estimates have CVs of less than 25 percent, except for the number inside parenthesis (see West region, column P), which has a CV of 74.57%.
†Category is combined with adjacent category due to disclosure consideration.

had reported higher levels of off-farm employment (66.3%) than all other participating households. This finding may suggest that either part-time off-farm employment is more prevalent in the North Central region than in all other regions, or that hourly off-farm earnings are lower.

Distribution of Income Among Farm Operator Households

The income sources considered in the analysis included three broad types of incomes: farm-related income, government income, and income from off-farm sources. Off-farm income is further disaggregated into earned income, interest and dividends, and income from all other non-farm sources.

As indicated in Table 3, the conventional Gini coefficient for total income among farm operator households in the U.S. equaled 0.64 in 1991. In comparison, the "adjusted" Gini coefficient which accounts for the presence of negative incomes equaled 0.63. The conventional Gini coefficients for farm operator households in the Northeast, North Central, Western, and Southern regions were 0.69, 0.58, 0.73, and 0.64, respectively. The corresponding "adjusted" Gini coeffi-

Table 3. Contribution of Sources of Income to Overall Inequality Among U.S. Farm Operator Households Based on Production Region, 1991

Income Source	(1) Share in Total ϕ_k	(2) Gini Index $G(Y_k)$[a]	(3) Gini Correlation R_k	(4) Proportional Contribution to Inequality P_k	(5) Income Elasticity M_k
U.S.:					
Farm-related[b]	0.17	2.33 (0.99)	0.73	0.44	0.27
Government income	0.07	0.87 (0.87)	0.20	0.02	−0.05
Earned non-farm income	0.57	0.70 (0.70)	0.74	0.46	−0.11
Interest and dividends	0.07	0.84 (0.84)	0.46	0.04	−0.03
Other non-farm income[c]	0.13	0.81 (0.81)	0.29	0.05	−0.08
Total income	1.00	0.64 (0.63)	1.00	1.00	0.00
Northeast:					
Farm-related	0.19	1.98 (0.98)	0.72	0.40	0.21
Government income	0.02	0.94 (0.94)	0.11	0.00	−0.02
Earned non-farm income	0.63	0.73 (0.73)	0.81	0.54	−0.09
Interest and dividends	0.07	0.86 (0.86)	0.56	0.05	−0.02
Other non-farm income	0.09	0.79 (0.79)	0.13	0.01	−0.08
Total income	1.00	0.69 (0.67)	1.00	1.00	0.00
North Central:					
Farm-related	0.20	2.09 (0.98)	0.76	0.55	0.35
Government income	0.12	0.77 (0.77)	0.18	0.03	−0.09
Earned non-farm income	0.51	0.65 (0.65)	0.62	0.35	−0.15
Interest and dividends	0.07	0.81 (0.81)	0.40	0.04	−0.03
Other non-farm income	0.11	0.81 (0.81)	0.20	0.03	−0.08
Total income	1.00	0.58 (0.57)	1.00	1.00	0.00
West:					
Farm-related	0.15	2.66 (1.00)	0.72	0.41	0.25
Government income	0.06	0.93 (0.93)	0.29	0.02	−0.04
Earned off-farm income	0.60	0.74 (0.74)	0.77	0.48	−0.13
Interest and dividends	0.06	0.87 (0.87)	0.57	0.04	−0.02
Other non-farm income	0.12	0.82 (0.82)	0.40	0.05	−0.07
Total income	1.00	0.73 (0.71)	1.00	1.00	0.00
South:					
Farm-related	0.13	2.51 (1.00)	0.71	0.37	0.24
Government income	0.04	0.94 (0.94)	0.17	0.01	−0.03
Earned off-farm income	0.60	0.70 (0.70)	0.78	0.52	−0.08
Interest and dividends	0.07	0.84 (0.84)	0.45	0.04	−0.03
Other non-farm income	0.15	0.79 (0.79)	0.33	0.06	−0.09
Total income	1.00	0.64 (0.62)	1.00	1.00	0.00

Source of income data: Farm Costs and Returns Survey, 1991 (weighted samples).
[a]Values inside the parentheses are the adjusted Gini coefficients. Values underlined are the Gini coefficients for total income (see equations 2 and 9).
[b]Includes money and non-money incomes.
[c]Includes social security, private pensions, non-farm government transfer payments, off-farm rental income, and gifts.

cients for farm operator households in these regions were 0.67, 0.57, 0.71, and 0.62, indicating that income inequality was lowest in the North Central region and highest in the West region.[15] The results of the "adjusted" Gini coefficients also indicate that income inequality of farm operator households in the South region was almost identical to that of the whole U.S., the inequality in the North central region was lower, and inequality in the Northeast and West regions were greater.

For the U.S. as a whole, farm-related income and government income were the most unequally distributed sources of income as indicated by "adjusted" Gini values of 0.99 and 0.87, respectively (Table 3). As suggested by Findeis and Reddy, the high degree of inequality in farm-related income may be attributed to the dichotomy that exists among U.S. farm families with regard to their farm earnings. For example, the 1991 FCRS data show that nearly three-fourths of all U.S. farm operator households had farm-related income of less than \$10,000 while only around 6 percent had farm-related earnings of \$50,000 or more. Similarly, the reason that the distribution of government income was highly concentrated is partly because the majority of farm operator households, nearly 70 percent (FCRS, 1991), reported no income from this source. Similar to the U.S., the negative relationship between participation in government programs and the inequality in the distribution of government income was also found in all regions. For example, data from the 1991 FCRS show that participation in government programs ranged from a low of 15.2 percent in the Northeast region to a high of 53.2 percent in the North Central region. As a result, the corresponding "adjusted" Gini coefficients for these regions were 0.94 and 0.77 (Table 3). Similarly, low government participation in the South and the West regions (17.7% and 18.9%, respectively) resulted in corresponding high "adjusted" Gini values (0.94 and 0.93).

When income from off-farm sources were added to farm-related income, particularly earned non-farm income, the resulting distribution of total income for the U.S. became less unequal than any of the individual components. In the context of equation (2) which is designed to measure the inequality of total income, the equalizing effect that off-farm income has on the distribution of total household income can be attributed to the fact that all of its components have lower income shares (ϕ_k), except that of earned non-farm income, lower Gini indices ($G(Y_k)$), and generally lower Gini correlations (R_k) than those of farm-related income.

When the U.S. results were disaggregated by region, similar findings regarding the equalizing effect of income from off-farm sources on the distribution of total household income were obtained. Particularly most noticeable was the contribution of non-farm income in the North Central region where the "adjusted" Gini coefficient of total household income was the lowest, at 0.57, which could be interpreted by the generally lower levels of (ϕ_k), $G(Y_k)$, and (R_k) of the components of non-farm income.

At the national level, because the size of the shares of farm-related income and non-farm earned income were large along with their corresponding "adjusted" Gini indices and their Gini correlations, their proportional contributions to inequality were also large (see equation 5), with each contributing over 40 percent towards inequality. When the data were disaggregated by region, the results show that non-farm earned income contributed the most to inequality, due to its share relative to the shares of other components, in all regions except in the North Central region where income from farming was the biggest contributor to inequality. By dividing the values of the proportional contribution to inequality (P_k) by the share of total income (ϕ_k), a concept known in the literature as the "relative contribution to inequality" is generated. While values of the relative inequality are not shown in this paper, these values indicate that, unlike non-farm earned income, farm-related income contributes a larger proportion of the inequality among farm operator households than the proportion it contributes to households' total income. This finding is true for the nation as a whole and for all regions.

Column (5) in table 3 shows the elasticity of income inequality by income source. For the U.S. in aggregate, and in all regions, the signs of M_k indicate that a small increase in income from farming causes inequality to increase. In contrast, the effect of an increase in the income levels of the remaining components of household income is to decrease inequality. As was mentioned above, the elasticity measure M_k is biased when some of the components of total household income contain negative values as in farm-related income. Despite this, the values of M_k that pertain to earned non-farm income are significantly larger than those of other components of household income. As such,

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[15] As one reviewer correctly pointed out, without attaching confidence intervals on the estimated Gini coefficients, one can not discern if any of these noted differences are significant. However, because of the complex nature of the FCRS' sample design, computing standard errors for the Gini coefficients and consequently confidence intervals is a formidable task which is beyond the scope of the paper (see Glasser on the estimation of Gini variances when data originates from a random sample).

the values of M_k can be used in pointing to the importance of earned non-farm income in equalizing the size distribution of total household income. This result is not surprising since in the U.S., and in all regions, earned non-farm income is found to be the least unequally distributed income component based on values of "adjusted" Gini coefficients. This is in addition to the fact that the earned non-farm income's share of total income is the largest among all other income sources (see equation (6)). The income elasticity results for the U.S. and for all regions also point to the importance of other non-farm income (i.e., social security, private pension, public assistance, unemployment compensation, etc.) in lessening the inequality in the distribution of total household income.

When the data were disaggregated by region based on the level of participation in off-farm employment, the results of the "adjusted" Gini coefficients show that the distribution of total income for nonparticipating households in the North Central region was the least unequal and that of the West the most unequal, 0.71 and 0.85, respectively (Table 4). The results also show that income from farming for households in this group was the most unequally distributed income component. Farm-related income also contributed the most to inequality, as indicated by P_k, in all regions. Based on the elasticity measures M_ks among households that did not participate in off-farm employment, farm-related income in all regions was the only income component that caused income inequality to increase. 'Other non-farm income' which includes social security, private pensions, govern-

Table 4. Contribution of Sources of Income to Overall Inequality by Region Among U.S. Farm Operator Households Based on their Participation in Off-Farm Employment, 1991

	(1) Share in Total ϕ_k		(2) Gini Index $G(Y_k)$[a]		(3) Gini Correlation R_k		(4) Proportional Contribution to Inequality P_k		(5) Income Elasticity M_k	
Income Source	NP[b]	P[b]	NP	P	NP	P	NP	P	NP	P
Northeast:										
Farm-related[c]	0.45	0.13	1.90 (0.97)	2.03 (0.99)	0.89	0.69	0.79	0.31	0.34	0.18
Government income	0.06	0.01	0.92 (0.93)	0.94 (0.95)	0.45	−0.07	0.02	−0.00	−0.03	−0.01
Earned non-farm income	—	0.78	—	0.55 (0.56)	—	0.86	—	0.64	—	−0.14
Interest and dividends	0.21	0.03	0.89 (0.89)	0.80 (0.80)	0.73	0.44	0.14	0.02	−0.07	−0.01
Other non-farm income[d]	0.29	0.05	0.68 (0.69)	0.86 (0.86)	0.23	0.44	0.05	0.03	−0.24	−0.02
Total income	1.00	1.00	0.96 (0.83)	0.59 (0.59)	1.00	1.00	1.00	1.00	0.00	0.00
North Central:										
Farm-related	0.44	0.13	1.55 (0.95)	2.70 (0.99)	0.90	0.73	0.80	0.49	0.36	0.37
Government income	0.19	0.09	0.75 (0.75)	0.77 (0.77)	0.27	0.16	0.05	0.02	−0.14	−0.07
Earned non-farm income	—	0.67	—	0.48 (0.48)	—	0.66	—	0.42	—	−0.25
Interest and dividends	0.13	0.05	0.82 (0.83)	0.78 (0.78)	0.55	0.38	0.08	0.03	−0.05	−0.02
Other non-farm income	0.24	0.06	0.68 (0.68)	0.88 (0.88)	0.35	0.33	0.07	0.04	−0.16	−0.03
Total income	1.00	1.00	0.77 (0.71)	0.50 (0.49)	1.00	1.00	1.00	1.00	0.00	0.00
West:										
Farm-related	0.49	0.05	1.76 (0.98)	5.56 (1.02)	0.92	0.58	0.80	0.24	0.31	0.19
Government income	0.12	0.05	0.90 (0.91)	0.94 (0.95)	0.30	0.33	0.03	0.02	−0.09	−0.02
Earned non-farm income	—	0.80	—	0.60 (0.60)	—	0.86	—	0.66	—	−0.14
Interest and dividends	0.12	0.04	0.87 (0.87)	0.86 (0.86)	0.55	0.68	0.06	0.04	−0.06	−0.00
Other non-farm income	0.28	0.07	0.75 (0.75)	0.86 (0.86)	0.53	0.43	0.11	0.04	−0.16	−0.03
Total income	1.00	1.00	0.99 (0.85)	0.63 (0.63)	1.00	1.00	1.00	1.00	0.00	0.00
South:										
Farm-related	0.32	0.08	2.13 (0.99)	2.98 (1.01)	0.87	0.64	0.71	0.26	0.39	0.19
Government income	0.09	0.03	0.93 (0.93)	0.94 (0.94)	0.20	0.18	0.02	0.01	−0.07	−0.02
Earned non-farm	—	0.78	—	0.51 (0.51)	—	0.86	—	0.62	—	−0.16
Interest and dividends	0.18	0.04	0.83 (0.83)	0.83 (0.83)	0.56	0.58	0.10	0.04	−0.08	−0.01
Other non-farm income	0.41	0.08	0.63 (0.63)	0.90 (0.90)	0.54	0.55	0.17	0.07	−0.24	−0.01
Total income	1.00	1.00	0.83 (0.76)	0.54 (0.54)	1.00	1.00	1.00	1.00	0.00	0.00

Source of income data: Farm Costs and Returns Survey, 1991 (weighted samples).
[a] Values inside the parentheses are the adjusted Gini coefficients. Values underlined are the Gini (conventional and "adjusted") coefficients for total income (see equations 2 and 9).
[b] NP denotes no participation in off-farm employment while P denotes participation.
[c] Includes money and non-money incomes.
[d] Includes social security, private pensions, non-farm government transfer payments, off-farm rental income, and gifts.

ment transfer payments, among other things, had larger negative elasticity than the negative elasticities of other components of total income. This indicates that, in all regions, 'other non-farm income' plays a significant role in lowering income inequality. This finding is expected as the distribution of this income source, based on the values of "adjusted" Gini coefficients, is more equal and its share of total income is much bigger than those of other components of total income. Furthermore, the importance of 'other non-farm income' in lowering the inequality in income is consistent with the fact that more than 50 percent of nonparticipating farm operators in all regions receive income from this source, compared to around 25 percent for participating farm operators (FCRS, 1991). This is not surprising considering that nonparticipating farm operators in all regions tend to be much older (see Table 2).[16]

Based on the results from table 4, the "adjusted" Gini coefficients of total household income for the group of farm operator households that participated in off-farm employment indicate that, similar to nonparticipating households, inequality was lowest in the North Central region (0.49) and highest in the West (0.63). Table 4 also shows that the "adjusted" Gini coefficients of farm-related income across all regions were almost identical to those of the non-participating households, and the "adjusted" Gini coefficients for 'other non-farm income' were much larger. It is important to note also that the "adjusted" Gini indices for total household income were lower, thus indicating more equality, for the group of farm operators who participated in off-farm employment than for those who did not across all regions.

Table 4 shows that while the shares of total income received by participating farm operator households from earned non-farm income were always larger than the shares received from farming across all regions, their corresponding contributions to inequality as measured by P_k were also larger in all regions except in the North Central region, where the contribution from farm-related income was greater.

Among participating farm operator households in all four production regions, the elasticity measures M_ks show that when income from farming was increased by 1 percent, the inequality in the distribution of total income was also increased. In contrast, all components of off-farm income caused income inequality to decrease. It is interesting to note, however, that the direction of reduction in inequality attributed to 'interest and dividends' and 'other non-farm income' resembles that of the group of farm operator households who did not participate in off-farm employment.

Summary and Conclusions

The results of the paper indicate that the distribution of income in the North Central region was the most equal and that in the West region the most unequal as reflected by "adjusted" Gini coefficients of 0.57 and 0.71, respectively. The results also show that farm operator households who did not participate in off-farm employment experienced higher income inequality as a group than their participating counterpart. The "adjusted" Ginis for nonparticipating farm operator households in the Northeast, North Central, West, and South regions were 0.83, 0.71, 0.85, and 0.76, respectively. In comparison, the "adjusted" Ginis for participating households were 0.59, 0.49, 0.63, and 0.54.

Interestingly, while income inequality was highest in the West region and lowest in the North Central region, the likelihood of college or beyond college education was also highest in the West region and lowest in North Central region (see Table 2). These results were true irrespective of farm operators' level of participation in off-farm employment. Although one can not discern whether the seemingly positive association between the educational attainment of farm operators and income inequality is genuine based on these results alone, these findings are in accordance with the general view held by many economists that income inequality and human capital are positively correlated (see Gardner; Chiswick; Mincer; Shah).[17] Gardner

[16] Under the assumption that the major portion of 'other non-farm income' of participating farm operators is income from social security, the equalizing effect of this source of income on the distribution of total income may also be attributed to the way Social Security is designed to operate. Specifically, as Levitan (p. 43) notes, benefits from Social Security are designed to replace a larger share of earnings for lower-income workers than high-income workers.

[17] A crude way of testing the relationship between income inequality among farm operator households and certain variables that depict the characteristics of the farm, farm operator, and labor market conditions was undertaken in this study. Specifically, 'adjusted' Gini coefficients (G^*) and means of certain variables were estimated for all of the 48 contiguous states (except one due to small sample size) and results were used in a regression that yielded the following:

$$ln\, G^*/[1 - G^*] = -0.015^*S - 0.019^*O - 0.019^*C + 0.030^*A + 0.278^*E + 0.058^*I,$$

where ln is natural logarithm, S is percent of farms with sales of $50,000 or less, O is percent of farms with full ownership, C is percent of farms specializing in cash grains, A is percent of operators with age of 65 years or older, E is education in years, and I is the state's per capita income. Since the values of G^* are between 0 and 1, and in order to avoid points to the fact that when high quality labor is scarce in the non-farm economy, highly skilled labor in agriculture will be relatively more attracted to non-farm employment and its relative price will rise in consequence. This adjustment will cause the income of farm people with the most human capital to increase, thereby causing income inequality within the farm sector to increase as well.

In trying to address the issue of income inequality in agriculture, the results clearly show the importance of recognizing the heterogeneity that exists among farm operator households, not only by region of production, but also based on the level of participation in off-farm employment. For the nonparticipating households, efforts by the government to formulate macroeconomic policies that are designed to stimulate income from interest and dividends, and income from social security, private pensions, etc., will cause income inequality to decrease across all regions. This finding is in accordance with the fact that the contributions of these sources to the total income of nonparticipating households are more significant than those of participating households. Contrary to popular opinion, government payments do not contribute significantly to income inequality. The very unequal distribution of government payments implies that both broadening participation in government programs and making government payments more equal across program participants would contribute to reducing inequality among farm operators. However, because government payments contribute very little to overall inequality, changes in government programs will have relatively little impact on the overall distribution of income, although the effects will vary by region.

In contrast to the overall weaker effects of government payments on income inequality, efforts to stimulate off-farm employment through higher off-farm wages and salaries and stable employment opportunities will have the greatest effects on decreasing income inequality. To the extent that more and more farm operator households have come to rely on income from off-farm sources, particularly on income from off-farm wages and salaries, events and trends in the general economy and not just in the agricultural sector are of relevance to farm operator households who participate in off-farm employment. A healthy rural non-farm economy is imperative to the financial survival and well-being of the majority of farm operator households.

violating the standard assumption about the error term (i.e., that the error term has a nontruncated normal distribution) which is needed in ordinary least squares (OLS), the actual estimating equation of G^* is specified as logistic (see Slottje and Hayes). Consequently, the logistic specification of G^* was linearized using the logarithmic transformation shown above in the estimated OLS equation. The fit of the model was reasonable as measured by the value of R^2 (0.748). While only coefficients that were found to be significant at 95% are shown here, results of the full model along with t-ratios can be obtained from the authors upon request. As evident from the regression, education is shown to have a sizeable and positively signed estimated coefficient which indicates an increase in the likelihood of more income inequality due to a one year increase in the educational level of farm operators.

References

Ahearn, Mary, Jim Johnson, and Roger Strickland. "The Distribution of Income and Wealth of Farm Operator Households." *American Journal of Agricultural Economics* 67(1985):1087–94.

Ahearn, Mary C., Janet E. Perry, and Hisham S. El-Osta. *The Economic Well-Being of Farm Operator Households, 1988–90*. Agricultural Economics Report No. 666, U.S. Department of Agriculture, January 1993.

Al-Sammarrie, Ahmad and Herman P. Miller. "State Differentials in Income Concentration." *American Economic Review* LVII(67):59–72.

Benson, Richard A. "Gini Ratios: Some Considerations Affecting Their Interpretation." *American Journal of Agricultural Economics* 52(1970):444–7.

Berrebi, Z.M. and Jacques Silber. "The Gini Coefficient and Negative Income: A Comment." *Oxford Economic Papers* 37(1985):525–6.

Boisvert, Richard N. and Christine Ranney. "Accounting for the Importance of Nonfarm Income on Farm Family Income Inequality in New York." *Northeastern Journal of Agricultural Economics* 19(1990):1–11.

Carlin, Thomas A. and Edward I. Reinsel. "Toward a More Complete Comparison of Farm and Nonfarm Proprietorship Income." *Southern Journal of Agricultural Economics* 4(1972):157–63.

Chen, C., T. Tsaur, and T. Rhai. "The Gini Coefficient and Negative Income." *Oxford Economic Papers* 34(1982): 473–8.

Chiswick, Barry R. "The Average Level of Schooling and the Intra-Regional Inequality of Income: A Clarification." *American Economic Review* LVIII(1968):495–500.

Dillard, Dave. *Answers To Common Questions About The New Summary For The Farm Costs and Returns Survey*. U.S. Department of Agriculture, National Agriculture Statistics Service, SMB Staff Report No. SMB-93-04. June, 1993.

Findeis, Jill L. and Venkateshwar K. Reddy. "Decomposition of Income Distribution Among Farm Families." *Northeastern Journal of Agricultural Economics* 16(1987):165–73.

Foster, James E. "An Axiomatic Characterization of the Theil Measure of Income Inequality." *Journal of Economic Theory* 31(1983):105–21.

Gardner, Bruce L. "Determinants of Farm Family Income Inequality." *American Journal of Agricultural Economics* 51(1969):753–69.

Glasser, Gerald J. "Variance Formulas for the Mean Difference and Coefficient of Concentration.'' *American Statistical Association Journal* 57(1962):648–54.

Gould, Brian W. and William E. Saupe. ''Changes in the Distribution of Income and Wealth of Farm Households: Evidence From Wisconsin Panel Data.'' *North Central Journal of Agricalatural Economics* 12(1990):31–46.

Gunter, Lewell and Kevin T. McNamara. ''The Impact of Local Labor Market Conditions on the Off-Farm Earnings of Farm Operators.'' *Southern Journal of Agricultural Economics* 22(1990):155–65.

Hallberg, M.C., Jill L. Findeis, and Daniel A. Lass (Editors). *Multiple Job-Holding Among Farm Families*. Iowa State University Press, Ames, 1991.

Kinsey, Jean. ''Measuring the Well-Being of Farm Households: Farm, Off-Farm, and In-Kind Sources of Income: Discussion.'' *American Journal of Agricultural Economics* 67(1985):1105–7.

Larson, Donald K. and Thomas A. Carlin. ''Income and Economic Status of People with Farm Earnings.'' *Southern Journal of Agricultural Economics* 6(1974):73–9.

Lerman, Robert I. and Shlomo Yitzhaki. ''Income Inequality Effects by Income Source: A New Approach and Applications to the United States.'' *Review of Economics and Statistics* LXVII(1985):151–7.

______''Improving The Accuracy of Estimates of Gini Coefficients.'' *Journal of Econometrics* 42(1989):43–7.

Levitan, Sar A. *Programs in Aid of the Poor*. Sixth Edition. The Johns Hopkins University Press, Baltimore, Maryland, 1991.

Mincer, Jacob. ''Investment in Human Capital and the Personal Distribution of Income.'' *Journal of Political Economics* 66(1958):281–302.

National Agricultural Statistics Service. *Interviewer's Manual-1991 Farm Costs and Returns Survey (FCRS)*. U.S. Department of Agriculture, Washington, DC, 1991.

Pyatt, G., C. Chen, and J. Fei. ''The Distribution of Income by Factor Components.'' *Quarterly Journal of Economics* XCV(1980):451–73.

Reddy, V.K., J.L. Findeis, and M.C. Hallberg. *Determinants of Off-Farm Labor Participation and Impacts on Income Distribution Among U.S. Farm Families*. Pennsylvania State University, University Park, Agricultural Experiment Station. Bulletin 686. Dec. 1988.

Rice, G. Randolph and Tom S. Sale III. ''Size Distribution of Income in Louisiana and Other Southern States.'' *Growth and Change* 16(1975):26–32.

Schneeberger, K.C. and J.G. West. ''Marginal Farms—A Micro Development Opportunity.'' *Southern Journal of Agricultural Economics* 4(1972):97–100.

Schultz, T. Paul. ''Long-Term Changes in Personal Income Distribution: Theoretical Approaches, Evidence, and Explanation.'' *American Economic Review* Papers and Proceedings of the Eighty-fourth Annual Meeting, (New Orleans, Louisiana, December, 27–29, 1971), May 1972.

Shah, Anup. ''Education and Earnings Inequality Across British Labour Markets.'' *Applied Economics* 18(1986):205–17.

Shorrocks, Anthony F. ''Inequality Decomposition By Factor Components.'' *Econometrica* 50(1982):193–211.

______''The Impact of Income Components on the Distribution of Family Incomes.'' *Quarterly Journal of Economics* XCVIII(1983):311–26.

Slottje, Daniel J. and Kathy J. Hayes. ''Labour Force Participation, Race and Human Capital: Influence on Earnings Distributions Across States.'' *Review of Income and Wealth* Series 38(1992):27–37.

Sumner, Daniel A. ''The Off-Farm Labor Supply of Farmers.'' *American Journal of Agricultural Economics* 64(1982): 499–509.

U.S. Department of Agriculture. National Agricultural Statistics Service and Economic Research Service. Farm Costs and Returns Survey, 1991.

U.S. Department of Commerce. U.S. Census of Population—1960. Industrial Characteristics. PC (2)-7F. Bureau of the Census.