# The Dynamics of Wealth Concentration Among Farm Operator Households

**Hisham S. El-Osta and Mitchell J. Morehart**

The method of computing wealth shares accruing to lowest and highest quintiles, along with the concepts of the Lorenz curve and the Gini coefficient, are used in conjunction with data from the 1996 and 1999 Agricultural Resource Management Study (ARMS) survey to measure the distribution of wealth among U.S. farm operator households. Findings show that the distribution of wealth in 1996 was slightly more concentrated than in 1999, with the farm wealth component contributing significantly more toward measured concentration in both years than the nonfarm wealth component. The robustness of the findings under varied value judgments concerning society's level of aversion to wealth concentration is also examined.

***Key Words:*** Agricultural Resource Management Study, distribution of farm wealth, extended Gini coefficient, Lorenz curve, social welfare function

The Federal Agricultural Improvement and Reform (FAIR) Act became law on April 4, 1996. The commodity provisions of the farm legislation gave participating farmers much greater flexibility in terms of crops that could be grown, while guaranteeing decreasing payments over a seven-year period. Because the values of fixed production flexibility contract (PFC) payments as provided by FAIR are known over the seven-year program with certainty and are tied to land ownership, these outlays will be capitalized into land values (see Bierlen et al., 2000; Schertz and Johnston, 1997, 1998).

Recently released data by the U.S. Department of Agriculture (USDA) show that in 1999, 58% of all farming operations were fully owned, 34% were partly owned, and the remaining 8% were entirely leased. Fully owned farms controlled 52% of all the assets of the farm sector, compared to nearly 45% by partly owned businesses and 3% by full-tenant farms. Real estate holdings, including land and buildings, amounted to more than 75% of total farm assets.

The U.S. Department of Agriculture defines a farm, for statistical purposes, as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold during the year under consideration. A study by Ahearn, Perry, and El-Osta (1993), based on data from the USDA's 1990 Farm Costs and Returns Survey (FCRS), found many farm businesses are operated by other households in addition to that of the senior operator. The authors estimated 130,000 farm operator households split their net income with another 190,000 households. However, data from the USDA's 1999 Agricultural Resource Management Study (ARMS)[1] show these figures have declined to 121,000 and 172,000, respectively.

Farm wealth, measured as proprietors' equity (farm net worth), amounted to nearly one trillion dollars in 1999 (USDA, ARMS). This equity was shared by more than 2.1 million farm businesses, the vast majority of which were organized as

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[1] The ARMS is an annual farm survey, jointly conducted by the USDA's Economic Research Service and National Agricultural Statistics Service. Prior to 1996, the ARMS was known as the Farm Costs and Returns Survey (FCRS).

individual proprietorships, partnerships, or family corporations (98.9%), with only a small percentage (1.1%) organized as nonfamily corporations or cooperatives.

From a policy-making perspective, a study that examines the size distribution of farm wealth would be more meaningful if it includes in the analysis only those farming units clearly held by the senior operator and by members of his or her household. Targeting this group of households (which also means the exclusion of some operator households where the farms are organized as nonfamily corporations or cooperatives, or where the operator does not receive any of the net income of the business) is prudent because these households represent the major entrepreneurs and are the recipients of most of the residual income from the agricultural production process, making them the most affected by market and policy shifts.

The rationale for the need to examine the wealth distribution of farm operator households is that their operators are directly linked to their farms in terms of how the farm's wealth is managed, dispensed among various wealth components, or expended. Yet another benefit of the focus on this population of family farms is that it allows for consideration of a full measure of wealth where nonfarm equity is added to farm equity, thereby making the examination of wealth concentration more complete.

The potential for increased uncertainty in future farm incomes resulting from the 1996 FAIR Act, with its downward pressure on asset values, combined with the potential for PFC payments to landowners to be capitalized into land values, is likely to cause farm asset values to undergo some type of adjustment (Morehart, Ryan, and Green, 2001). Similarly, the increasing likelihood of unfavorable macroeconomic conditions, as evident in the weakening exhibited recently in the general economy, is apt to affect nonfarm equity values. While the direction and extent of adjustments in farm and nonfarm wealth are hard to predict as a result of these impending shocks, it is nevertheless safe to assume the equity position of farm operator households will be influenced.

The objectives of this study are twofold. First, it measures and ascertains the dynamics of wealth concentration—how wealth concentration varies from one time period to another—among a selected group of farm operator households (primarily those with nonnegative equity) using data from the 1996 and 1999 ARMS surveys. The nearly 1.8 million farm households considered here account for 90% of the equity held by all farm families, receive 81% of direct government payments, and produce 79% of the total farm output.

In measuring wealth concentration, the study also aims at assessing how much of the inequality is attributed to the farm and nonfarm components of farm household wealth. Because it is prudent to consider the importance of the geographic location of the farm with its attendant impact on farmland values when examining the distribution of farm household wealth, the second objective of our investigation is to extend the analysis based on whether the farm is located in a metro or a nonmetro area.[2]

For our analysis, it is particularly relevant to examine wealth concentration by farm location. Because of dependence on local supply and demand factors (among others), land values exhibit great variation across geographic areas. For example, the per acre average value of farm real estate in 1999 ranged between $219 and $7,000, depending on whether the location of the farm was in New Mexico or in New Jersey, respectively (USDA, 1999).

The high cost of real estate in New Jersey, as in other states in the North Atlantic region, reflects greater competition for land from urban influences. For this region, the contribution of urban influence toward the region's market value of farmland is about 45% (USDA, 2000a). In terms of farmland valuation for the entire United States, it has been suggested that 10–20% of U.S. farmland is subject to urban influence, with the degree of influence varying directly with proximity to metropolitan areas (USDA, 2001).

This study allows for the examination of farmers' wealth distributions based on data from 1996 and 1999. Thus, our findings should prove useful to policy makers as they begin to gear up for debating the 2002 farm bill, particularly because the study provides insights as to whether farmers' equity position has improved or worsened since the 1996 enactment of FAIR. The study's uniqueness is further highlighted by its application of the extended Gini coefficient, which allows for testing of the robustness of the findings under varied value judgments

[2] As defined by the USDA's Office of Management and Budget, counties are categorized as metro if they include a city of 50,000 or more people or have an urbanized area population of 50,000 or more and total area population of at least 100,000. Nonmetro counties in this study are grouped into two mutually exclusive categories: farming-dependent nonmetro counties, and nonfarming-dependent nonmetro counties. The notion of "farming-dependent" refers to whether farming contributed a weighted annual average of 20% or more of total labor and proprietors' income over the three years from 1987 through 1989. For more detail on these definitions, refer to USDA (2000b).

concerning society's level of aversion to wealth concentration.

**Previous Studies**

The literature on the subject of concentration of wealth in agriculture appears to be scant. Hill (1989, p. 157) noted the lack of studies on this subject despite the fact that wealth is important—it not only generates income, but also provides economic and political power. In a more recent work, Hill (1996) has greatly remedied the paucity of literature concerning farm wealth in general by providing a renewed and more comprehensive analysis in which he examines how to value wealth, capital gains in farming, and wealth in the context of agricultural policy in Western countries.

In addition to examining the effect of inflation (or deflation) on the distribution of wealth of farm operators, Boyne (1964) explored the linkage between real wealth changes and the welfare implications of asset owners. Ahearn and El-Osta (1991), used data from the 1988 FCRS in conjunction with published 1988 data from the U.S. Department of Commerce to compare the wealth distribution of U.S. farm businesses to that of all U.S. households. Based on their findings, not only was wealth greater for farm businesses, it was also more equally distributed than among U.S. households.

Weldon, Moss, and Erickson (1993) examined the changes in U.S. farm wealth for the period 1960–1991 using state-level data from multiple data sources including FCRS. Their conclusions point to the importance of factors such as farm income, government program payments, and increased off-farm income in generating a more favorable wealth distribution.

Using simulation techniques, Skees, Reed, and Pederson (1985) illustrate how relative changes in land prices, returns, and interest rates impact generated wealth of differently structured corn-soybean farms in Illinois. Larger farms were found to be more sensitive to changes in land inflation, especially when land was owned, when interest rates were lower, and when the farm had less debt.

Wunderlich (1984) gives an intriguing portrayal of the notions of fairness and distributive justice as they relate to measurement of income and wealth distributions. Hepp (1996) provides a comparison of the returns from investing in Michigan farmland to nonfarm investments. His findings point to the superiority of land investments over a long period of time compared to nonfarm alternatives.

**Data**

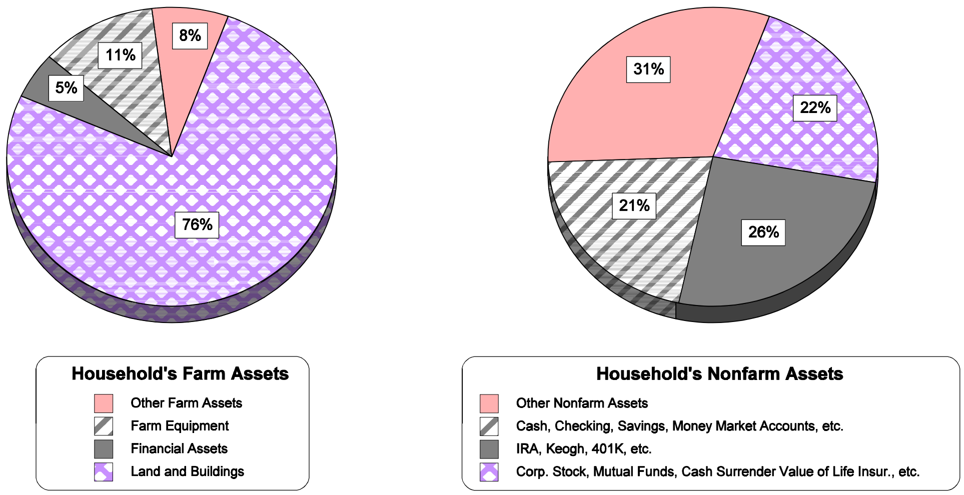
Pertinent data from the USDA's 1996 and 1999 ARMS surveys were used to measure the concentration of wealth among U.S. farm operators. The ARMS, which has a complex stratified, multiframe design, is a national survey conducted annually by the Economic Research Service and the National Agricultural Statistics Service. Each observation in the ARMS represents a number of similar farms, with the particular number representing the survey expansion factor (or the inverse of the probability of the surveyed farm being selected for surveying). This expansion factor is referred to hereafter as survey weight. The sample sizes considered in the analysis for the 1996 and 1999 survey years were 6,190 and 7,898, which, when properly expanded using survey weights, yielded respective 1996 and 1999 populations of farm operator households totaling 1,759,997 and 1,756,601.[3]

The wealth position of the farm operator household is characterized by its equity, which is comprised of farm and nonfarm components. The farm and nonfarm equities are derived by subtracting total farm debts from total farm assets, and by subtracting total nonfarm debts from total nonfarm assets, respectively. Estimates of both farm and nonfarm assets are based on current market valuations. The pie charts in figure 1 show that while real estate holdings account for the bulk of farm capital held by the farm household (76%), a category of holdings labeled "other nonfarm assets" (e.g., nonfarm real estate, off-farm houses, recreation vehicles, etc.) captures the largest share of nonfarm capital (31%).[4]

In 1996, the total equity of an average farm operator household was $446,302, with farm equity comprising the larger share at 80.5% (table 1). By

[3] It should be noted that these sample sizes are what remained after excluding primarily those observations where household equity (farm or nonfarm equity, or total equity) was negative. Exclusion of observations with negative equity was done in order to accommodate the technique used here to measure concentration, which is most suitable when the variate being analyzed has nonnegative observations only.

[4] In terms of farm household's share of farm assets (figure 1), the "financial assets" component includes items grouped into three major categories: (*a*) prepaid insurance for the farm/ranch business (e.g., casualty insurance, crop and livestock insurance, motor vehicle liability, and blanket insurance policies); (*b*) other current assets (e.g., accounts receivable for commodities, plus money owed to the operation except money owed from commodity sales, cash, certificates of deposit, stock in Farm Credit System, hedging account balances, government payments due, balance of land sales contracts, etc.); and (*c*) all stock in farm cooperatives. The component labeled "other farm assets" includes livestock inventory and livestock for breeding, crop inventory, purchased inputs, and inputs for crops planted but not harvested.




Source: 1999 ARMS Survey (USDA).

**Figure 1. Components of farm and nonfarm assets of farm operator households, 1999**

**Table 1. Components of Equity of Farm Operator Households, 1996 and 1999**

| | Year | | | |
|---|---|---|---|---|
| Equity Source | 1996 | | 1999 | |
| Farm Equity | $359,352 | (80.5%) | $410,278* | (66.1%) |
| Nonfarm Equity | $86,950 | (19.5%) | $210,628* | (33.9%) |
| Total Equity | $446,302 | (100.0%) | $620,906* | (100.0%) |

Source: 1996 and 1999 ARMS surveys (USDA).

Notes: * denotes that the difference of the mean of this item relative to the same item in the 1996 time period is statistically significant at the 0.05 level or better. Dollars are constant 1999 dollars. Conversion to real-term basis is done using the Gross Domestic Product implicit price deflator. All estimates have coefficients of variation (CVs) of less than 10%. [See Dubman (2000) for the underlying jacknife variance method used in the measurement of CVs.]

comparison, a farm operator household in 1999 averaged $620,906 in total equity, with farm equity contributing 66.1%. The nearly 74% increase in the share of nonfarm wealth over the two time periods indicates farm operator households are becoming more astute at recognizing the opportunity of higher returns to their stock of wealth by investing off-farm, particularly when interest rates are low and the general economy is expanding as was the case over the time period analyzed.

## Methodology

Three concentration measures were used to measure the distribution of total farm wealth. First, shares of wealth by the lowest and highest quintiles were analyzed. Second, Lorenz curves of wealth distributions were plotted and examined. Finally, wealth concentrations were evaluated using the concept of the extended Gini coefficient as developed by Yitzhaki (1983) and later utilized by Stark, Taylor, and Yitzhaki (1988).

In the case of farmers' wealth, a simple measure of how unequally this variate is distributed can be attained by using the concept of the standard Gini coefficient, which ranges between 0 and 1. If wealth among farmers is equally distributed, which is equivalent to stating concentration of wealth is nonexistent, the Gini coefficient would be 0. Conversely, if wealth is not equally distributed, which is analogous to the presence of concentration, then the Gini coefficient approaches a value of 1.0.

In the context of this study, we employ an extended concept of the Gini coefficient. Specifically, let the $k$th component (e.g., farm or nonfarm net worth) of total farm household wealth, denoted $A_k$, be defined as:

$$(1)\quad G_k(\gamma) = -\gamma \operatorname{Cov}\left(A_k, [1 - F(A_k)]^{\gamma-1}\right) / \mu_k,$$

where $\mu_k$ is the mean of $A_k$, $F(A_k)$ is the cumulative distribution, Cov is a covariance indicator, and $\gamma$ is an "equity weight" parameter ranging from one to infinity.

Where data are based on a random sample, the estimator of $F(A_k)$ in equation (1) is the rank of the variate $A_k$ divided by the sample size. However, when data are weighted, as in this study, the estimator of $F(A_k)$ is described by Lerman and Yitzhaki (1989) as a mid-interval of $F(A_k)$. For example:

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

where $w_i$ denotes the survey weight corresponding to the $i$th farm such that $\Sigma w_i = 1$ ($i = 1, ..., n$), and $w_j$ is the weight of the farm exactly next to the last $i$th farm, with indicator $j$ allowing for the cumulation of weights exclusive of that of the $i$th's. Equation (2) requires that farms be ranked so the values of $A_k$ are in an increasing order. Once the values of $F_i(A_k)$ are estimated from equation (2), direct estimation of the weighted covariance between $A_k$ and $F(A_k)$ can proceed as follows:

$$(3)\quad \xi_k = \mathrm{Cov}\big(A_k, [1 - F(A_k)]^{\gamma-1}\big) = \sum_{i=1}^{n} w_i(A_{k,i} - \bar{A}_k)[(1 - \hat{F}_{k,i})^{\gamma-1} - m],$$

where

$$(4)\quad m = \sum_{i=1}^{n} w_i(1 - \hat{F}_{k,i})^{\gamma-1}.$$

In the context of a weighted sample, the decomposition of the extended Gini for total farm household wealth $A$, where $A = \Sigma_k A_k$, hence is given by equation (5) (Stark, Taylor, and Yitzhaki, 1988; Lerman and Yitzhaki, 1989):

$$(5)\quad G_A(\gamma) = \sum_{k=1}^{k} S_k R_k(\gamma) G_k(\gamma), \qquad 0 \le G_A(\gamma),\ G_k(\gamma) \le 1,$$

where

$$(6)\quad S_k = \bar{A}_k/\bar{A}$$

is the $k$th wealth component's share of total farm household wealth, and where

$$(7)\quad R_k(\gamma) = \mathrm{Cov}\big(A_k, [1 - F(A)]^{\gamma-1}\big)\big/\xi_k, \qquad -1 \le R_k \le 1.$$

$R_k(\gamma)$ in equation (5) is the extended Gini correlation coefficient which measures the correlation between the $k$th wealth component and farm household rankings in terms of total farm household wealth. In other words, $R_k(\gamma)$ measures how closely correlated is the $k$th wealth component with total farm household wealth.

Pyatt, Chen, and Fei (1980), and Lerman and Yitzhaki (1985) developed a number of relative measures important to studies of households' income distributions and that also are relevant to studies of wealth distribution. One such measure is the "proportional contribution to inequality," denoted $P_k(\gamma)$. It is determined by the ratio of the contribution of the $k$th wealth component to the total extended Gini coefficient:

$$(8)\quad P_k(\gamma) = S_k R_k(\gamma) G_k(\gamma)/G_A(\gamma).$$

Yet another measure is $I_k(\gamma)$, which is computed as the ratio of the proportional contribution to inequality $P_k(\gamma)$ to the $k$th source's share of total wealth, as in (6).

Lerman and Yitzhaki (1985, p. 153) developed an income elasticity measure which, when adapted to a wealth variate, shows how wealth inequality changes due to a marginal change in $A_k$, the wealth from the $k$th source. This measure, denoted $M_k$, is obtained by first taking the partial derivative of the overall extended Gini coefficient with respect to a small change ($e_k$) in wealth source $k$:

$$(9)\quad \partial G_A(\gamma)/\partial e_k = S_k[R_k(\gamma)G_k(\gamma) - G_A(\gamma)].$$

Dividing equation (9) by $G_A(\gamma)$ yields:

$$(10)\quad M_k(\gamma) = \frac{[\partial G_A(\gamma)/\partial e_k]}{G_A(\gamma)} = P_k(\gamma) - S_k.$$

As Lerman and Yitzhaki (1985) point out, the sum of the $k$ elasticities equals zero. In our study, this implies that if all components of wealth are multiplied by $e$, the overall extended Gini coefficient will be left unchanged.

Computation of equations (1)–(10), when $\gamma = 2$, will yield the standard Gini coefficient and other relevant standard measures. These statistics, in turn, can be used to evaluate the distribution of wealth along with the contribution of the components of wealth to inequality. The benefit of using the concept of the extended Gini as outlined above (based on Stark, Taylor, and Yitzhaki, 1988) is that it will allow for testing of the robustness of the results under different value judgments as captured by different levels of $\gamma$.

To illustrate, Stark, Taylor, and Yitzhaki (1988) note the Gini coefficient in (1), when examined at large and increasing values of $\gamma$ (i.e., as $\gamma \to \infty$), becomes an inequality index that progressively reflects the Rawlsian criterion of fairness which evaluates distributions based on the economic welfare of the poorest in the society (see Rawls, 1972).[5]

In the context of this study, an extremely large value of $\gamma$ allows for inequality to be assessed under a social preference framework which intends on maximizing the $A_k$ of the farm household with the poorest $A_k$. In contrast, as $\gamma$ 61, equation (1) will yield a Gini coefficient which presumes a social tolerance regarding inequality.

Underlying the method of measuring concentration discussed above is a vast literature on welfare economics, which aims at providing rules allowing for the ranking of various policy proposals.[6] One such rule, for example, utilizes what is identified in the literature as a Bergson-Samuelson social welfare function. Despite the fact that not much can be said about its form, this social welfare function, like all others, has three properties.

First, the function depends on the utility levels ($U$) of the households. Second, the social welfare is assumed to be increasing, ceteris paribus, in each household's utility level (i.e., negatively sloping social indifference curves are presumed here). This property allows the function to satisfy the (strong) Pareto criterion of social ordering since an increase in the utility of any household, ceteris paribus, increases social welfare. Third, the intensity of any tradeoff is usually assumed to depend on the degree of inequality. This property ensures the social welfare indifference curves are convex to the origin.

In the case of a two-household society, and if social welfare ordering is continuous, a fitting social welfare function can be depicted as $f(a \cdot U_1, b \cdot U_2)$, where a higher value of $f$ is preferred to less, and where $a$ and $b$ are equity weights (denoted earlier as $\gamma$), and where $U_1$ and $U_2$ are the utility levels of household 1 and household 2, respectively. Under the assumption that this simple society's welfare ($W$) is equal to the sum of the utilities of its two members (i.e., $W = a \cdot U_1 + b \cdot U_2$), the following social views toward inequality emerge.

In the case of a utilitarian society, the equity weights $a$ and $b$ are equal to 1 in magnitude, which, in effect, would yield a social welfare resulting from the unweighted sum of household utilities. The social welfare indifference curves in this case, when drawn in the cartesian coordinate plane (e.g., $U_1$ and $U_2$ measured on the horizontal axis and the vertical axis, respectively), are negatively sloping straight lines. This indicates society is indifferent to the degree of inequality, as it is willing to trade away one unit of household 1's utility for the benefit of one unit of household 2's utility. In the case of a society willing to accept a decrease in the utility of the poor only if there is a much larger increase in the utility of the rich, the equity weights in this case would be different—with $a$ being larger than $b$ the poorer is household 1. Here, the social welfare indifference curves will be curved or convex.

Yet a more extreme position based on the work of Rawls (1972) suggests the welfare of society depends only on the utility of the poorest household. Under this situation, the social indifference curves are $L$-shaped (i.e., $W = \min[(U_1/a), (U_2/b)]$), which in effect abolishes any possibility of substitution (see Silberberg, 1978, p. 314).

The discussion presented above, although it uses the simplified world of only two households and utility as the medium of exchange, is nevertheless useful as it illustrates that when equity weights are used in the context of the Gini coefficient, each of the weighting schemes reflects a separate and potentially different social welfare function. As noted by Stark, Taylor, and Yitzhaki (1988), because of the ambiguity of comparing absolute values of different welfare functions, extended Gini ratios (for the different components of the variate and for the variate itself) cannot be unambiguously compared for different equity weights. For an additional, more thorough discussion on the underlying welfare theory of the extended Gini index, refer to Yitzhaki (1983).

### Findings and Results

This section presents findings on the dynamics of wealth concentration among farm operator households using the method of computing wealth shares accruing to the lowest and the highest quintiles, the concept of the Lorenz curve, and the method of the extended Gini coefficient based on selected quasi-national samples from the 1996 and 1999 ARMS surveys. Assessment of the extent of wealth concentration and of the contribution of farm and nonfarm

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[5] In attending to the question of whether inequalities of all social primary goods (i.e., liberty and opportunity, income and wealth, and the bases of self-respect) are justifiable, Rawls points out that treating people unequally is only justifiable if, by doing so, the least advantaged member of society is made better off (Kilcullen, 1996; Yen, 1999). The Rawlsian criterion of fairness thus would imply more equity weight is attached to the income (or wealth) of those at the bottom of the income (or wealth) distribution. It becomes obvious, then, that larger weights are attached at the lower end of the distribution when equation (1) is numerically evaluated based on large equity values (i.e., $\gamma$64), where $F(A_k)$ is approximated by the rank of $A_k$ divided by the sample size.

[6] This section draws heavily on the work of Johansson (1991, pp. 22–35).

**Table 2. Shares in Farm Operator Households' Total Equity by Equity Quintiles, 1996 and 1999**

| Year | Equity Quintiles 1st 20% | 2nd 20% | 3rd 20% | 4th 20% | 5th 20% |
|---|---|---|---|---|---|
| | <!!!!!!!!!!!!! | | (Percent) | | !!!!!!!!!!!!!> |
| 1996 | 3.4 | 7.2 | 11.7 | 21.4 | 56.3 |
| 1999 | 4.2 | 8.4 | 12.9 | 20.6 | 54.0 |

Source: 1996 and 1999 ARMS surveys (USDA).

wealth to overall wealth concentration is presented based on selected full samples and on "metro" and "nonmetro" subsamples.

In 1999, the large gap in the shares of wealth accruing to households in the lowest and highest quintiles points to a concentrated wealth distribution (table 2). For example, while farm households in the lowest quintile of the sample owned 4.2% of the $1.09 trillion in total farm household equity, households in the highest quintile owned a disproportionate share of 54%. Findings also show the concentration of farm household wealth in 1999 has decreased from its 1996 level, as evident from the narrowing of the wealth gap between households in the poorest and richest quintiles.

The Lorenz curves of wealth distributions of U.S. farm households are shown in figure 2.[7] These curves are used here because of their usefulness in graphically illustrating the degree of concentration of farm wealth, and because [as noted by Wunderlich (1958), who was among their early users] they allow for the direct comparison of distributions between time periods.

To demonstrate, if all operators are equal owners of the stock of wealth so that each 1% of the population owns 1% of total wealth, then the Lorenz curve is the diagonal (also known as the egalitarian line; see figure 2). When interpreted in the context of the Gini coefficient, this scenario yields a Gini value of zero. If the top 1% of operators own more than 1% of total wealth, then the Lorenz curve lies below the diagonal, and will lie even further away

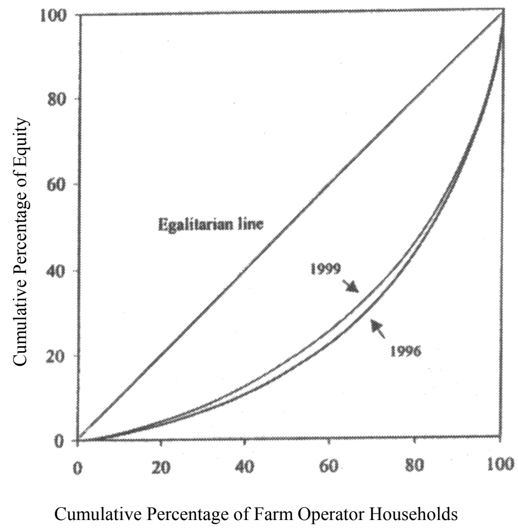


**Figure 2. Lorenz curves of equity (farm and nonfarm), 1996 and 1999**

(thus yielding larger Gini values) the higher is the proportion of owned wealth.

In addition, as noted by Atkinson (1983, p. 55), if the Lorenz curves for two distributions do not intersect, one can conclude unambiguously that, for a wide class of concentration measures including the Gini coefficient, the distribution closer to the diagonal is less concentrated than the other. The concentration curves in figure 2 show the distribution of wealth in 1999 was less concentrated relative to its 1996 counterpart.

Table 3 presents extended Gini indices of farm household wealth and decomposition of wealth concentration at different values of $\gamma$, the equity weights that allow for the interjection of value judgments when measuring concentration.[8] At $\gamma = 2$, equation (5) reflects the standard Gini coefficient, which, at Gini values of 0.521 in 1996 and 0.486 in 1999 (see table 3, column 2, third and bottom panels, respectively), demonstrates a measurable yet decreasing level of wealth concentration. The nearly 7 percentage points reduction in the value of the standard Gini coefficient between the 1996 and 1999 time periods clearly begs the question, "Which of the two sources of total household wealth was mostly responsible for this reduction in inequality and how did the reduction occur?"

Equations (5) and (8) provide the basis for answering this question. By comparing the standard

[7] Stark, Taylor, and Yitzhaki (1988) note the Lorenz curve allows for a graphical interpretation of the difference between the standard Gini and the extended Gini coefficient. This difference involves the area between the Lorenz curve and the diagonal (see figure 2) which represents perfect equality, as a proportion of the total area under the diagonal. In the absence of assigning different weights [i.e., when $\gamma$ in equation (1) takes the value of 2] to different portions of this area, such a proportion yields the standard Gini. When different weights are considered, this proportion of the total area under the diagonal becomes the extended Gini coefficient with larger values of $\gamma$ implying larger weights are assigned at the lower portions of the wealth distribution, and lower values of $\gamma$ implying the assignment of smaller weights (see Yitzhaki, 1983).

[8] The equity weights used here are similar to those used by Stark, Taylor, and Yitzhaki (1988).

**Table 3. Extended Gini Decomposition of Farm Household Equity, 1996 and 1999**

| | Equity Weights | | | | | |
|---|---|---|---|---|---|---|
| Equity Source | γ = 1.5 | γ = 2.0 | γ = 2.5 | γ = 3.0 | γ = 3.5 | γ = 4.0 |
| | <**! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! 1996 ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !**> | | | | | |
| **Farm:** | | | | | | |
| Share in total equity (n) | 0.805 | 0.805 | 0.805 | 0.805 | 0.805 | 0.805 |
| Gini coefficient (*G*(γ)) | 0.391 | 0.545 | 0.629 | 0.682 | 0.718 | 0.745 |
| Gini correlation (*R*(γ)) | 0.950 | 0.954 | 0.959 | 0.962 | 0.965 | 0.967 |
| Proportional contribution to inequality (*P*(γ)) | 0.812 | 0.804 | 0.801 | 0.800 | 0.800 | 0.799 |
| Relative inequality ratio (*I*(γ)) | 1.009 | 0.998 | 0.995 | 0.994 | 0.993 | 0.993 |
| Equity elasticity (*M*(γ)) | 0.007 | !0.001 | !0.004 | !0.005 | !0.005 | !0.006 |
| **Nonfarm:** | | | | | | |
| Share in total equity (n) | 0.195 | 0.195 | 0.195 | 0.195 | 0.195 | 0.195 |
| Gini coefficient (*G*(γ)) | 0.535 | 0.732 | 0.824 | 0.875 | 0.907 | 0.928 |
| Gini correlation (*R*(γ)) | 0.663 | 0.717 | 0.751 | 0.774 | 0.791 | 0.805 |
| Proportional contribution to inequality (*P*(γ)) | 0.188 | 0.196 | 0.199 | 0.200 | 0.200 | 0.201 |
| Relative inequality ratio (*I*(γ)) | 0.964 | 1.007 | 1.021 | 1.026 | 1.028 | 1.029 |
| Equity elasticity (*M*(γ)) | !0.007 | 0.001 | 0.004 | 0.005 | 0.005 | 0.006 |
| **Total Equity:** | | | | | | |
| Share in total equity (n) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Gini coefficient (*G*(γ)) | 0.368 | 0.521 | 0.606 | 0.660 | 0.698 | 0.726 |
| Gini correlation (*R*(γ)) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Proportional contribution to inequality (*P*(γ)) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Relative inequality ratio (*I*(γ)) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Equity elasticity (*M*(γ)) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | <**! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! 1999 ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !**> | | | | | |
| **Farm:** | | | | | | |
| Share in total equity (n) | 0.661 | 0.661 | 0.661 | 0.661 | 0.661 | 0.661 |
| Gini coefficient (*G*(γ)) | 0.388 | 0.537 | 0.618 | 0.669 | 0.706 | 0.734 |
| Gini correlation (*R*(γ)) | 0.894 | 0.899 | 0.906 | 0.911 | 0.916 | 0.919 |
| Proportional contribution to inequality (*P*(γ)) | 0.670 | 0.657 | 0.653 | 0.652 | 0.652 | 0.653 |
| Relative inequality ratio (*I*(γ)) | 1.014 | 0.994 | 0.988 | 0.987 | 0.987 | 0.988 |
| Equity elasticity (*M*(γ)) | 0.009 | !0.004 | !0.008 | !0.009 | !0.008 | !0.008 |
| **Nonfarm:** | | | | | | |
| Share in total equity (n) | 0.339 | 0.339 | 0.339 | 0.339 | 0.339 | 0.339 |
| Gini coefficient (*G*(γ)) | 0.450 | 0.632 | 0.725 | 0.781 | 0.819 | 0.846 |
| Gini correlation (*R*(γ)) | 0.741 | 0.779 | 0.799 | 0.811 | 0.819 | 0.825 |
| Proportional contribution to inequality (*P*(γ)) | 0.330 | 0.343 | 0.347 | 0.348 | 0.348 | 0.347 |
| Relative inequality ratio (*I*(γ)) | 0.974 | 1.012 | 1.023 | 1.025 | 1.025 | 1.023 |
| Equity elasticity (*M*(γ)) | !0.009 | 0.004 | 0.008 | 0.009 | 0.008 | 0.008 |
| **Total Equity:** | | | | | | |
| Share in total equity (n) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Gini coefficient (*G*(γ)) | 0.343 | 0.486 | 0.566 | 0.618 | 0.655 | 0.682 |
| Gini correlation (*R*(γ)) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Proportional contribution to inequality (*P*(γ)) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Relative inequality ratio (*I*(γ)) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Equity elasticity (*M*(γ)) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Gini coefficients (i.e., at γ = 2) of the two wealth components, the findings in table 3 show that while the distribution of the farm wealth component improved just slightly in 1999 from its 1996 level [from *G*(γ) = 0.545 to *G*(γ) = 0.537, or a 1.47% reduction], the distribution of the nonfarm wealth component improved dramatically [from *G*(γ) = 0.732 to *G*(γ) = 0.632, or a 13.7% reduction].

Despite the sizable improvement in the distribution of the nonfarm wealth component, however, the fact that its contribution to the inequality (*P*(γ)) of total household wealth has increased rather than decreased (from 19.6% in 1996 to 34.3% in 1999) in effect makes it inconsequential to the improvement exhibited in the distribution of total wealth between the 1996 and 1999 time periods. Instead, it appears the farm wealth component, despite the mild improvement exhibited in its distribution, is the factor most responsible for the decrease in the concentration of total wealth over the 1996 and 1999 time periods; i.e., this factor contributed much less toward the concentration in total wealth in 1999 than it did in 1996 (down from 80.4% to 65.7%).

By comparing the standard Gini coefficients (i.e., at $\gamma = 2$) of total household wealth to those of farm and nonfarm wealth components, measures of the overall impacts of farm and nonfarm wealth upon the concentration of total wealth for a particular time period are obtained. For example, had farm household's total wealth in 1999 consisted only of the nonfarm component, the Gini value corresponding to total household wealth would have been 30 percentage points higher, at 0.632 instead of 0.486. On the other hand, had farm household's total wealth in the same time period consisted only of the farm component, the Gini corresponding to total household wealth would have been only 10.5 percentage points higher, at 0.537 instead of 0.486. This finding, and the fact that farm wealth's share in total wealth stood at nearly 66%, point to the favorable impact of farm wealth upon the concentration of total household wealth.

Although farm wealth is shown to have a favorable impact on concentration, its contribution toward concentration in total wealth as measured by $P(\gamma)$, again due to its larger share, nevertheless remains sizable at 65.7%. The favorable impact of farm wealth on concentration can further be ascertained from the value of its 1999 (at $\gamma = 2$) computed relative inequality measure [$I(\gamma) = 0.994$], which indicates that in comparison to nonfarm wealth [where $I(\gamma) = 1.012$], farm wealth contributes a smaller portion to concentration than the portion it contributes to total farm household wealth (table 3).

The previous discussion focused on the share of farm wealth in total wealth and on its distribution. However, as equation (5) implies, the potential impact of the wealth components depends also on where holders of farm equity were located in the overall wealth distribution. For the farm component, as well as for the nonfarm component of farm household wealth, this is captured by $R(\gamma)$, an index that measures the correlations between each wealth source and total wealth. In 1999, and at $\gamma = 2$, an $R(\gamma)$ of 0.899 for farm wealth and 0.779 for nonfarm wealth (table 3) reveals the farm wealth component is much more highly correlated with total wealth than is nonfarm wealth. As such, it is likely to have a greater impact on the inequality in total wealth.

Also presented in table 3 are the computed values of $M(\gamma)$, or the elasticities that allow for the description of how small percentage changes in each of the two wealth components, while holding the other component constant, affect the concentration of overall wealth [see equation (10)]. For example, the elasticity at $\gamma = 2$ for farm wealth in 1999 was estimated at ! 0.004%. This elasticity indicates a negative, albeit minute, effect on the concentration of wealth attributable to a 1% increase in farm wealth. In contrast, a 1% increase in nonfarm wealth is shown to have the effect of increasing the concentration of total household equity by 0.004%.

It should be noted that the elasticity results in table 3, as small as their values are, depend to a large extent on (*a*) where the holders of each of the two wealth components considered were located in the total wealth distribution, (*b*) the shares of these components in total wealth, and (*c*) the distribution of the wealth components in their own right. To the extent these components do get impacted by macroeconomic conditions (among others) that tend to affect both the price and the availability of capital, and by supply and demand conditions of agricultural commodities which have relevance to the price of inputs including land (a major component of farm equity), it is important to point out that the elasticities evaluated here are for the short term and, accordingly, their absolute levels may vary subject to possible long-term adjustments in these factors.[9]

Are the findings robust to the equity weights attached at different points in the farm operator households' wealth distribution? Phrasing the question slightly differently: Would the findings with regard to the impact of farm and nonfarm wealth on the distribution of total wealth change based on a shift in the assigned equity weights? Table 3 provides answers to this question by reporting measurements of extended Gini correlations ($R(\gamma)$), of percentage contributions of different sources of wealth to the concentration of wealth ($P(\gamma)$), and of elasticities ($M(\gamma)$) for different values of $\gamma$.

[9] Stark, Taylor, and Yitzhaki (1988) caution that estimated elasticities, as in this analysis, should be interpreted to represent the minimum impact of marginal percentage changes on inequality.

Because the findings concerning $R(\gamma)$, $P(\gamma)$, and $M(\gamma)$ in both 1996 and 1999 follow the same general trend as the equity weights take on different values, and to conserve space, discussion of the robustness of these findings will be presented here based only on the 1999 time period. Accordingly, where the farm wealth component in 1999 is shown to contribute significantly to the concentration of total household wealth as measured by $P(\gamma)$, this contribution decreases, although not sharply, as $\gamma$ increases. In other words, as more weight is assigned to the total wealth of households at the lower end of the wealth distribution, the percentage contribution of farm wealth to the concentration of total household wealth declines slightly.

By moving from $\gamma = 1.5$ to $\gamma = 4.0$ (table 3), $P(\gamma)$ correspondingly drops from 0.670 to 0.653, thus exhibiting a mild reduction (0.61%) in the percentage contribution of farm wealth to the concentration of total wealth. A likely explanation for this reduction in $P(\gamma)$ is the mild increase in the contribution of nonfarm wealth to the concentration in total wealth as the weighting scheme moves from $\gamma = 1.5$ to $\gamma = 4.0$.

As seen in table 3, $P(\gamma)$ of farm wealth appears to be impacted only slightly with the movement of $\gamma$ from 1.5 to 4.0, demonstrating that the percentage contribution of this wealth component is not very sensitive to the weights affixed to total wealth at the lower end of farm households' wealth distribution. This result is not surprising considering the constancy of farm wealth's $R(\gamma)$ over the range of the equity weights considered—increasing by only 2.8% (from 0.894 to 0.919) in 1999 as $\gamma$ increases from 1.5 to 4.0. However, the mere fact that each of the $R(\gamma)$ values reported here is considerably high, and rises (although mildly) as $\gamma$ increases from 1.5 to 4.0, suggests the correlation of farm wealth with total household wealth is higher at the top portion of the wealth distribution.

This observation corresponds to the 1999 ARMS survey finding that farm equity rises sharply with total household equity, and also may be reflective of the ability of households in the top of the wealth distribution to earn higher returns to their farm-capital investments (ROA) than their counterparts in the lower end of the distribution. Supporting evidence is provided in the 1999 ARMS, where the returns to assets for those households in the top quintile (fifth 20%) of the wealth distribution were reported at 1.52% compared to the !4.24% for households in the first quintile (the poorest 20%) of the distribution.

For the nonfarm wealth components, the extended Gini correlations in 1999 are positively related to $\gamma$, with $R(\gamma)$ increasing by nearly 11% over the range of equity weights considered (from 0.741 to 0.825) (table 3). The results suggest this component's percentage contribution to wealth concentration [i.e., $P(\gamma)$] is not very sensitive to attaching more weights to the overall wealth of the poorest farms. This insensitivity is explained by n, which shows this component accounting for only one-third of total wealth. As in the case of extended Gini correlation, assigning more weights to households at the lower end of the distribution increases the percentage contribution of nonfarm wealth by about 5% (from 0.330 to 0.347), making the effectiveness of equity weights on this component's capacity to contribute toward wealth inequality rather mild.

The reported decompositions of wealth concentration in table 3 for the 1996 and 1999 time periods illustrate a generally stable pattern in the components of wealth when various underlying social welfare functions are considered. This is evident when comparing the results pertaining to $R(\gamma)$ and $P(\gamma)$ as the equity weights are changed from levels favoring inequality ($\gamma = 1.5$) to those depicting aversion to inequality ($\gamma = 4.0$). For the $M(\gamma)$ results, findings reveal the computed elasticities are slightly less stable, as indicated by the change in the sign of $M(\gamma)$ for both wealth components as $\gamma$ is increased from 1.5 to 4.0.

Table 4 presents the results of measuring the dynamics of wealth concentration and of decomposing concentration based on farms' locations. The use of the standard Gini coefficient ($\gamma = 2.0$) reveals the group of farm households in the nonmetro, nonfarming-dependent counties (e.g., mining- or manufacturing-dependent counties, among others) exhibited both the lowest concentration in total household wealth and the most notable improvement in concentration (i.e., 8.38% decline in the Gini) over the 1996 and 1999 time periods. In contrast, the group of households in the nonmetro, farming-dependent counties exhibited the highest concentration in wealth and a mild improvement in concentration (i.e., 4.23% decline in the Gini).

While the nonmetro, nonfarming-dependent group of households in 1999 accounted for 52% of all households considered in the analysis, it produced 44% of the total output, held 48% of the total wealth, and received 47% of the direct government payments. In comparison, the nonmetro, farming-dependent group of households accounted for 12% of the population, produced 19% of the output, held

**Table 4. Standard Gini Decomposition of Farm Household Equity (γ = 2.0), by Geographic Location, 1996 and 1999**

| | Nonmetro Counties | | |
|---|---|---|---|
| Equity Source | Nonfarming-Dependent | Farming-Dependent | Metro County |
| | <! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! 1996 ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !> | | |
| **Farm:** | | | |
| Share in total equity (n) | 0.807 | 0.877 | 0.775 |
| Gini coefficient ($G(\gamma)$) | 0.531 | 0.540 | 0.556 |
| Gini correlation ($R(\gamma)$) | 0.958 | 0.977 | 0.938 |
| Proportional contribution to inequality ($P(\gamma)$) | 0.800 | 0.890 | 0.779 |
| Relative inequality ratio ($I(\gamma)$) | 0.991 | 1.015 | 1.006 |
| Equity elasticity ($M(\gamma)$) | !0.007 | 0.013 | 0.005 |
| **Nonfarm:** | | | |
| Share in total equity (n) | 0.193 | 0.123 | 0.225 |
| Gini coefficient ($G(\gamma)$) | 0.738 | 0.749 | 0.697 |
| Gini correlation ($R(\gamma)$) | 0.720 | 0.623 | 0.729 |
| Proportional contribution to inequality ($P(\gamma)$) | 0.200 | 0.110 | 0.221 |
| Relative inequality ratio ($I(\gamma)$) | 1.036 | 0.897 | 0.980 |
| Equity elasticity ($M(\gamma)$) | 0.007 | !0.013 | !0.005 |
| **Total Equity:** | | | |
| Share in total equity (n) | 1.000 | 1.000 | 1.000 |
| Gini coefficient ($G(\gamma)$) | 0.513 | 0.520 | 0.518 |
| Gini correlation ($R(\gamma)$) | 1.000 | 1.000 | 1.000 |
| Proportional contribution to inequality ($P(\gamma)$) | 1.000 | 1.000 | 1.000 |
| Relative inequality ratio ($I(\gamma)$) | 1.000 | 1.000 | 1.000 |
| Equity elasticity ($M(\gamma)$) | 0.000 | 0.000 | 0.000 |
| | <! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! 1999 ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !> | | |
| **Farm:** | | | |
| Share in total equity (n) | 0.665 | 0.718 | 0.640 |
| Gini coefficient ($G(\gamma)$) | 0.517 | 0.560 | 0.552 |
| Gini correlation ($R(\gamma)$) | 0.895 | 0.921 | 0.898 |
| Proportional contribution to inequality ($P(\gamma)$) | 0.655 | 0.744 | 0.637 |
| Relative inequality ratio ($I(\gamma)$) | 0.985 | 1.037 | 0.997 |
| Equity elasticity ($M(\gamma)$) | !0.010 | 0.026 | !0.002 |
| **Nonfarm:** | | | |
| Share in total equity (n) | 0.335 | 0.282 | 0.360 |
| Gini coefficient ($G(\gamma)$) | 0.629 | 0.631 | 0.625 |
| Gini correlation ($R(\gamma)$) | 0.769 | 0.715 | 0.800 |
| Proportional contribution to inequality ($P(\gamma)$) | 0.345 | 0.256 | 0.363 |
| Relative inequality ratio ($I(\gamma)$) | 1.029 | 0.907 | 1.006 |
| Equity elasticity ($M(\gamma)$) | 0.010 | !0.026 | 0.002 |
| **Total Equity:** | | | |
| Share in total equity (n) | 1.000 | 1.000 | 1.000 |
| Gini coefficient ($G(\gamma)$) | 0.470 | 0.498 | 0.497 |
| Gini correlation ($R(\gamma)$) | 1.000 | 1.000 | 1.000 |
| Proportional contribution to inequality ($P(\gamma)$) | 1.000 | 1.000 | 1.000 |
| Relative inequality ratio ($I(\gamma)$) | 1.000 | 1.000 | 1.000 |
| Equity elasticity ($M(\gamma)$) | 0.000 | 0.000 | 0.000 |

12% of the wealth, and received 32% of all the direct government payments.

Based on these statistics, any changes in the size or direction of payments, or in commodity prices with their attendant impact on farmland values, would likely affect the equity levels of these two groups of households more so than those households located in metro counties.

Households in nonmetro, farming-dependent counties have the highest reported participation in government programs (69%), and those reporting participation received the highest average payment in 1999 ($24,930), making the corresponding wealth distribution particularly sensitive to the uncertainties of the market and to the outcome of the debate concerning the new farm bill.

This sensitivity is evident as the contribution of the farming component toward wealth concentration is the highest among households in nonmetro, farming-dependent counties (74.4%). Moreover, this component contributes to concentration more than its own share of total wealth [i.e., $I(\gamma) = 1.037$].

While the distribution of wealth for farm operator households located in metro counties is somewhat similar to that of households in the nonmetro, farming-dependent counties (with Gini coefficient values of 0.518 and 0.497 in 1996 and 1999, respectively), these households nevertheless are different in the way they allocate their total equity between farm and nonfarm wealth components. For example, in 1999, the farming and nonfarming wealth components comprised, respectively, 64% and 36% of the total equity of metro county households (table 4). This is compared to a farm and a nonfarm wealth allocation of 72% and 28% by households in nonmetro, farming-dependent counties.

Another obvious difference among households in the metro and nonmetro, farming-dependent areas is the extent to which the nonfarm component contributes to wealth concentration, at 36% and 26%, respectively (table 4). The nonfarm wealth component is more important to households in the metro areas, both in terms of its share of total wealth and in terms of how much it contributes to wealth concentration, making metro county households particularly more vulnerable to the market conditions in the general economy. Evidence of the recent economic slowdown, with its potential of a "negative wealth effect," will likely impact farm households in this group the hardest.

## Summary and Conclusions

The size distribution of wealth among farm operator households in the United States was examined using data from the USDA's 1996 and 1999 Agricultural Resource Management Study surveys. In 1999, the distribution of wealth was concentrated, although slightly less concentrated than in 1996. The impact of farm equity on the concentration of wealth was sizable, particularly in 1996 where it accounted for 80% of the measured inequality. Application of the method of the extended Gini coefficient proved the results were robust to different value judgments when measuring wealth concentration.

The evidence obtained of wealth concentration based on a large sample representing nearly 1.8 million farm households obscures a wide variation in wealth inequality attributable to differences in the geographic location of the farms. To mitigate this likelihood, measurement of wealth concentration was extended based on three categories of farm households: those households located in nonmetro, nonfarming-dependent counties; those located in nonmetro, farming-dependent counties; and those located in metro counties.

Results have pointed toward differentials in the distribution of wealth and in the extent of contribution toward concentration by the farm and nonfarm wealth components based on farms' location. The findings highlight the importance of maintaining a stable agricultural economy, particularly for households in farming-dependent counties, with their accompanying influence on land markets and their subsequent influence on households' equity position, and on households' debt servicing capacity. For farm households in metro counties, in addition to maintaining a healthy agricultural economy, federal policies aimed at sustaining economic growth are essential for preventing a swooning wealth base.

## References

Ahearn, M. C., and H. S. El-Osta. (1991, June). "Farm Wealth: Its Distribution and Comparison to the Wealth of U.S. Households." In *Agricultural Income and Finance: Situation and Outlook Report* (pp. 21–23). Pub. No. AFO-41, USDA/Economic Research Service, Washington, DC.

Ahearn, M. C., J. S. Perry, and H. El-Osta. (1993, January). "The Economic Well-Being of Farm Operator Households, 1988–90." Pub. No. AER-666, USDA/Economic Research Service, Washington, DC.

Atkinson, A. B. (1983). *The Economics of Inequality.* Oxford, UK: Clarendon Press.

Bierlen, R., L. D. Parsch, B. L. Dixon, and B. L. Ahrendsen. (2000). "The 1996 FAIR Act: Measuring the Impacts on Land Leasing." *Review of Agricultural Economics* 22(2), 336–354.

Boyne, D. H. (1964). *Changes in the Real Wealth Position of Farm Operators, 1940–1960.* Agricultural Experiment Station, Michigan State University, East Lansing.

Dubman, R. W. (2000, April). "Variance Estimation with the USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Study Surveys." Pub. No. AGES 00-01, USDA/Economic Research Service, Washington, DC.

Hepp, R. E. (1996, October). "Comparison of Michigan Farmland Returns to Nonfarm Investments." Staff Paper No. 96-93, Department of Agricultural Economics, Michigan State University, East Lansing.

Hill, B. (1989). *Farm Incomes, Wealth, and Agricultural Policy.* Brookfield, VT: Gower Publishing Co.

———. (1996). *Farm Incomes, Wealth, and Agricultural Policy.* Brookfield, VT: Ashgate Publishing Co.

Johansson, P.-O. (1991). *An Introduction to Modern Welfare Economics.* London: Cambridge University Press.

Kilcullen, R. J. (1996). "John Rawls: Liberty." Online. Available at http://www.humanities.mq.edu.au/Ockham/y64115.html. [Accessed March 28, 2000.]

Lerman, R. J., and S. Yitzhaki. (1985, February). "Income Inequality Effects by Income Source: A New Approach and Applications to the U.S." *Review of Economics and Statistics* 67, 151–156.

———. (1989, September). "Improving the Accuracy of Estimates of Gini Coefficients." *Journal of Econometrics* 42, 43–47.

Morehart, M., J. Ryan, and R. Green. (2001, February 22). "Farm Income and Finance: The Importance of Government Payments." Paper presented at Agricultural Outlook Forum-2000, Arlington, VA.

Pyatt, G., C. Chen, and J. Fei. (1980). "The Distribution of Income by Factor Components." *Quarterly Journal of Economics* 95, 451–473.

Rawls, J. A. (1972). *A Theory of Justice.* London: Clarendon Press.

Schertz, L., and W. Johnston. (1997, August). "Farm Act '96: Managing Farm Resources in a New Policy Environment." In *Agricultural Outlook* (pp. 18–21). USDA/Economic Research Service, Washington, DC.

———. (1998, First Quarter). "Landowners: They Get the 1996 Farm Act Benefits." *Choices*, pp. 4–7.

Silberberg, E. (1978). *The Structure of Economics: A Mathematical Analysis.* New York: McGraw-Hill, Inc.

Skees, J. R., M. R. Reed, and G. D. Pederson. (1985, January). "Some Distribution Effects of Changing Price Levels on Farm-Level Wealth." *North Central Journal of Agricultural Economics* 7, 94–104.

Stark, O., J. E. Taylor, and S. Yitzhaki. (1988, May). "Migration, Remittances, and Inequality—A Sensitivity Analysis Using the Extended Gini Index." *Journal of Development Economics* 28, 309–322.

U.S. Department of Agriculture. (1996, 1999). "Agricultural Resource Management Study" (ARMS). Annual farm survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service, USDA, Washington, DC. Online. Available at http://www.ers.usda.gov/data/ARMS/index.htm.

———. (1999). *Agricultural Land Values.* Pub. No. Sp Sy 3(99), USDA/National Agricultural Statistics Service and Economic Research Service, Washington, DC.

———. (2000a). "Urbanization Affects a Large Share of Farmland." *Rural Conditions and Trends*, Vol. 10, pp. 57–63. USDA/Economic Research Service, Washington, DC.

———. (2000b). "Appendix: Data Sources and Definitions." *Rural Conditions and Trends*, Vol. 11, No. 2, pp. 87–93. USDA/Economic Research Service, Washington, DC.

———. (2001, September). "Moderate Increases in Farmland Values Help Farm Lenders and Farmers Holding Real Estate-Backed Farm Loans." In *Agricultural Income and Finance: Situation and Outlook Report* (p. 30). Pub. No. AIS-76, USDA/Economic Research Service, Washington, DC.

Weldon, R. N., C. B. Moss, and K. Erickson. (1993). "The Distribution of Farm Wealth in the United States." *Agricultural Finance Review* 53, 100–109.

Wunderlich, G. (1958). "Concentration of Land Ownership." *Journal of Farm Economics* 40, 1887–1893.

———. (1984). "Fairness in Landownership." *American Journal of Agricultural Economics* 66, 803–806.

Yen, D. H. (1999). "Fairness." Online. Available at http://www.noogenesis.com/malama/fairness.html. [Accessed March 2000.]

Yitzhaki, S. (1983, October). "On an Extension of the Gini Inequality Index." *International Economic Review* 24, 617–628.