PROFIT PATTERNS IN THE U.S. AND THE WEST, 1992 and 1997: WHAT COUNTY-LEVEL DATA REVEAL

by

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This is a selected paper prepared for presentation at the
Western Agricultural Economics Association annual meetings, Honolulu, Hawaii, July 1, 2004

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The authors thank the reviewers at the USDA-ERS for their input, Chris Dicken of ERS for his help in producing the GIS maps of county-level data, William Quinby of ERS for his help in obtaining these data, and Linda Atkinson of ERS-ISD. The views expressed here are not necessarily those of the Economic Research Service, U.S. Department of Agriculture, the University of California-Davis, or the University of Florida.

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Abstract

We examine whether there are spatial relationships in U.S. production agriculture's profitability across regions and over time. We test the traditional view that factor markets (approximately) adjust to equalize agriculture's net returns over space and time using county-level data from the USDA's Census of Agriculture, 1992 and 1997. We estimate Gini coefficients and calculate the Theil Entropy Measure (TMI) to examine changes in the concentration of returns over space and time, and to decompose the variation in inequality in returns into two components: the percent of total variation in returns due to within-region inequality, and the percent of variation in returns due to between-region variation in returns. Although factor markets (approximately) adjust to equalize net returns over space and time, there is still considerable variability in returns within regions and within states. Use of county-level (Census of Agriculture) and farm-level data (ARMS Survey) to help highlight these differences. In general, farm-level Gini coefficients have remained fairly constant but show a mild increase in concentration since the 1996 FAIR Act. The TMI analysis reveals that in 1997 about 54 percent of the variation in total returns (net cash returns) was due to within-region variation, and about 46 percent was due to (average) between-region variation (compared to 53 and 47 percent in 1992). Total U.S. inequality of net cash returns increased from 0.14 in 1992 to 0.21 in 1997.

Key words: Gini coefficient, Theil Entropy Measure, net cash returns, net cash and net farm income, farm structure

JEL code: Q-Agricultural and Natural Resource Economics
Q-140 Agricultural Finance

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Introduction

To remain viable, agriculture in each location must offer returns that are both competitive with those from alternative investments and sufficient to cover producers' financial obligations. In turn, economic theory says that returns converge over time as resources flow into more-profitable industries. The Heckscher-Ohlin (H-O) trade model argues that incomes of regions vary because of their differing factor endowments and factor prices. Economic integration and trade in goods leads to income convergence through factor price equalization. Since regions differ in factor endowments, regions will specialize in different industries. This implies that differences in agricultural returns across states and regions over time are most likely due to different "crop portfolios" being produced across locations.

The traditional H-O model assumption of one integrated network of markets for all commodities may not be valid. If there are spatial relationships affecting agriculture's profitability over time, then factor markets will not adjust to equalize agriculture's marginal returns over space. Differences in profitability between commodity markets due to limited factor mobility and the effects of an evolving "global competitive advantage" system that has not yet fully integrated all markets may cause a lack of convergence in net returns across regions and over time. To the extent that net returns do not converge over space and time, the general level of profitability of across and within regions (by state and county) will vary.

It is critical that analysts and policy makers identify locations within regions and states most likely to prosper under the pressure of current global economic conditions. Yet most empirical studies of profitability patterns have focused on regional and state-level profitability, rather than digging more deeply into county-level profit patterns. Using county-level net returns data will provide new insights into the economic performance and structural changes in production agriculture across and within geographic regions.

The objective of this paper is to examine whether there are spatial relationships in agriculture's profitability across regions and states and over time. A forthcoming study by Blank, Erickson, Moss and Nehring (2004) using state-level data from the USDA's farm income accounts finds that U.S. farm sector returns are converging over the 1960-2002 period across regions. However farm profits still vary widely by farm type, farm size, location, and by other factors. We examine the traditional view that factor markets (approximately) adjust to equalize agriculture's net returns over space and time across the U.S. and Western production regions using county-level estimates of "net returns".

Background

Significant structural changes within the U.S. farm production sector, as well as macroeconomic and international forces outside the sector are changing the composition and distribution of farm and non-farm income and cash receipts and the concentration of farm production over time. Factors directly influencing the far sector include changes in government farm policies, technology, relative input and output prices, and the composition of demand for farm products. More indirect factors include macroeconomic policies and the international competitiveness of Canadian and U.S. agriculture vis-à-vis other nations.

The U.S. farm sector has experience considerable structural change in size and number of farms in each size class during the last century. Despite the inclusion of small hobby farms in the estimates of farm numbers, the trend toward fewer operations overall but a greater number of larger farms continues.

Various factors are driving these changes, including economies of scale and greater coordination between producers and processors. Horizontal integration through consolidation has occurred rapidly, as some producers leave the sector while others purchase these assets in an attempt to more fully exploit scale economies. Vertical integration and more complex operating arrangements (including increased contracting) are connecting the retail sector back to the production sector, processing stages of the food system, and input suppliers (value chain). Other factors driving these structural changes include the relative profitability of farm vs. non-farm investments, government programs and farm programs, trade policies, economies of scope (reduced costs associated with the production of more than one output), and globalization. Some researchers believe that the substitution of capital for labor is driving the 'upsizing' of average farm size as the opportunity cost of farm operators' labor increases relative to the price of capital (Bollman, Whitener, and Tung, 1995).

Data and Methods

We use county-level estimates of net cash return from agricultural for farms and ranches from the USDA's Census of Agriculture, 1992 and 1997. We first present these county-level estimates visually using GIS software (figures 1 and 2). Given the rapidly changing structure of U.S. production agriculture, we find considerable variation in net cash returns over space and time, despite the overall convergence of net returns noted above. Next, we use two alternative measures of dispersion: the Theil Measure of Inequality (TMI) and the Gini coefficients. We calculate the TMI to examine changes in the distribution of U.S. net returns between and within ERS production regions (figure 3), and in the total inequality of net returns at the U.S. level (table 2). We also calculate the total inequality of net cash returns by region, and use the TMI to determine the percentages of total inequality due to (average) within-state and between-state inequality of net cash returns (tables 3 and 4). Finally, we discuss how the "dichotomy" between the farm household and business establishments affects the conceptualization of and the interpretation of results.

The U.S. Department of Agriculture's (USDA) annual Agricultural Resource Management Survey (ARMS) applies complex stratified, multiple-frame, probability-weighted, and sometimes multiple-phase sampling methods to provide financial measures of the agricultural sector (Banker, Green, and Korb). These multifaceted sampling methods lead to complications in estimating the efficiency of Gini coefficients.

A SAS© matrix program was created to estimate the weighted Gini coefficients and hypothesis tests. Both stratified variances and jackknife variances were calculated where appropriate. The program also provides summary statistics and extensive error checking (Dubman).

Gini coefficients and Theil entropy measures (TMI) have traditionally been applied as a measure of equality or inequality in the distribution of wealth or income for a given population. Social preferences are implied for given distributions (El Osta and Morehart). This paper applies the Gini coefficient in an atypical way to describe structural constants or changes in farm income concentration over time. It also uses the TMI to examine how much of the total variation in net cash returns is due to (average) between versus within-region income inequality.

The Gini Coefficient

The Gini coefficient is a 0-1 measure with the level of inequality increasing as the value of the measure approaches 1. The Gini coefficient (unlike the Theil measure of inequality, or TMI) is not an exactly decomposable inequality index, nor does any other commonly used measure satisfy perfect aggregation properties. The arithmetic mean of Gini coefficients should therefore be viewed simply as a summary measure of the Gini coefficients within a subcategory. The Gini coefficient is based on the Lorenz curve which is a unique ordered presentation of the variable.

Concerns about statistical estimation have led to many variations of Gini coefficient formulas to account for unbiasedness and accuracy. The basic Gini formula is:

$$\text{Gini} = \sum_{i=1}^{N} 2\left(X_i - Y_i\right)\Delta X_i \,,$$

where X_i=1/N, Y_i=cumulative percentage of income,
and $\Delta X_i = X_i - X_{i-1}$

If the values of the income or expense series are not all positive an adjusted version of the Gini is calculated. Three variables are bipolar and can have negative values— net cash income, the value of inventory changes, and net farm income. The standard Gini presented above may exceed the zero-one bounds in the presence of negative values. An adjusted Gini coefficient (see Chen, Tsaur, and Rhai or Berrebi and Silber) that theoretically remains within the zero-one bounds was applied to the bipolar series. The mean of the variable must remain positive for the adjusted Gini to be valid.

We estimate the variance for the Gini coefficient as a ratio estimator

$$\text{Variance } g = 1/nx^2[\text{var}(d_i - gx_i)](N - n/N)$$

where d_i is the sample average absolute deviation about the *i* th observation, x_i, x is the sample average, *n* is the sample size, g is the Gini index and *N* is the population size. A resampling Jackknife variance estimator is applied for years (1996 and later) of the Agricultural Resource Management Study Survey (ARMS) due to complex sampling.

The sampling structure of the ARMS survey is complicated. Multi-phase sampling and changes in weight estimation place barriers on the development of classical variance formulas. Since classical variance formulas for the ARMS are not appropriate, a structured resampling method, the delete-a-group jackknife variance estimator, is applied.

In the NASS version of the delete-a-group jackknife, the sample is divided into 15 nearly equal and mutually exclusive parts. Fifteen estimates of the statistic, called "replicates," are created. One of the 15 parts is eliminated in turn for each replicate estimate with replacement. Then the replicate and full sample estimates are placed into the following basic jackknife variance formula:

$$\text{Variance}(\beta) = {}^{14}\!/_{15} \sum_{k=1}^{15} (G_{(k)} - \text{G})^2 ,$$

where G is the full sample estimate and $G_{(k)}$ is a replicate estimate with part k removed.

In a simple jackknife, each replicate weight is defined by setting the full sample weight of every 15th observation to zero. The remaining weights in each replicate are then adjusted so that their sum approximates the sum of the full sample weights. NASS constructs its replicates so that each first-phase stratum is as equally represented in every replicate as possible. Replicate weights are adjusted in a complex manner to assure the near unbiasedness of the jackknife variance estimator (Kott and Fetter).

Theil Measure of Entropy:
Total, Between, and (Average) Within-Region(State) Inequality

We use the Theil measure of entropy (Theil, 1967), a statistical measure of dispersion or entropy, to examine changes in the distribution of net cash returns added in relation to the number of farms, by states and regions, 1960-2002. The basic notion of decomposition of the inequality measure (TMI) is that the total inequality can be decomposed into inequality between regions and the average inequality within each region. Additionally, inequality across regions can be defined from equation 1 as

$$I_R = \sum_{f=1}^{F} P_f \ln\left(\frac{P_f}{Q_f}\right) \tag{3}$$

The measure of inequality within each farming region can then be defined as

$$I_f = \sum_{i \in f} \left(\frac{p_i}{P_f}\right) \ln\left(\left(\frac{p_i}{P_f}\right) \Big/ \left(\frac{q_i}{Q_f}\right)\right) \tag{4}$$

Finally, overall inequality in equation 1 can be decomposed as: $I = I_R + I_A$ where $I_A = \sum P_f I_f$ is the average inequality within regions. There are two major advantages of TMI over other measures of inequality. First, the TMI provides a descriptive measure of the distribution of net cash returns that measures inequality of net cash returns per farm weighted by the number of farms. This is particularly important given structural changes in the agricultural sector. Second, the TMI enables empirical decomposition of national-level inequality. The measures of between-regions inequality, I_R, and the average-within region inequality, I_A, indicate whether the national inequality in the distribution of net cash returns is due to variation between states, within regions or between the individual regions. We apply the TMI to decompose the national-level inequality into the average within-region and between-regions inequality.

Results

In general, an examination of the Gini coefficients and the Theil entropy measure (TMI) using Census of Agriculture and ARMS data suggests that returns have remained fairly stable since 1992. This is consistent with the findings of Blank, Erickson, Moss and Nehring that show temporal and spatial trends toward convergence of returns by regions and by state and with H-O trade theory. Use of county-level data indicates that net returns vary considerably by farm size, farm type, and by region and states. This more disaggregated analysis of profit patterns may have significant policy implications for U.S. agriculture.

Dubman, Mishra and Erickson using ARMS data (1991-2000) found that net cash farm income and net farm income show adjusted Ginis above 0.97, indicating extremely skewed distributions (table 1). Most net income is attributed to the largest farms and most small farms have negative net incomes. They found that cash expenses have Ginis a few points lower than gross cash income.   Livestock purchases and hired labor expenses show the highest Ginis of all expenses. Hired-labor intensive farms are mostly fruit and vegetable farms concentrated in California, Washington, Oregon, and Florida.   Most other farms rely on family labor or part-time help. Fixed expenses have moderate Ginis—real estate and property taxes, interest expenses, and insurance premiums must not have many large outliers.

Most evident from table 1 is that the annual Gini coefficients have remained fairly stable over time. This is likely because of the continuity of farm-sector finances and the quality and quantity of the USDA surveys. A glance at the numbers suggests increasing Ginis within most farm income components such as revenues and expenses.

Total (U.S and regional) Inequality of Net Cash Returns

U.S. agriculture has experienced significant structural changes from 1960-2002. The number of farms declined and the average size of farms increased (through consolidation) This expansion/consolidation of agriculture resulted in a more unequal distribution of net cash returns across the states relative to the number of farms in each state. Table 1 shows the average-within, between-regions, and national inequalities of the TMI, 1992 and 1997. Total national inequality of net cash returns increased from about 0.14 in 1992 to about 0.21 in 1997. Table 3 shows the total inequality of net cash returns by region. Total inequality of net cash returns is highest in the Southern Plains (0.90 in 1992 and 1.28 in1997) and in the Southeast (0.77 in 1992 and 0.76 in 1997).

Variations by states within regions, where states tend to be more homogeneous, tend to reflect microeconomic conditions. Variations between regions tend to reflect inherent macroeconomic differences, such as farm structural changes (changes in size distribution of farms, changes in production methods, etc.) and government price support and credit programs.

Between-Region Inequality, and Between-States Inequality (by Region)

Variation in between-region inequality accounted for about 47 percent of the total national inequality in net cash returns in 1992 and for about 46 percent of total national inequality in net cash returns added in 1997 (table 2). Variation in between-state inequality was highest in the Delta and Southern Plains (tables 2 and 3).

(Average) Within-State Inequality, by Region

Estimates of within-state inequality of net cash returns, I_f (equation 4) for 11 regions, are presented Table 5. As expected, within-state inequality tends to be lowest in states producing more homogeneous "crop/livestock portfolios" (e.g., corn, hogs, and soybeans in the Corn Belt). Also, states with relatively high within-state inequality tend to have more diversified portfolios (e.g., Texas). Other causes of relatively high within-state inequality may be that the state's net cash returns are more influenced by micro-economic factors unique to that state than to macro-economic factors such as general economic conditions and government programs.

Conclusion

Inequality of Net Cash Returns by County and over Time

We examined changes in net cash returns that have occurred across states and regions within the U.S. between 1992 and 1997. Specifically, we applied Theil's measure of income inequality to U.S. county-level net cash returns data to measure the variation in net cash returns across States and production regions. The national inequality in net cash returns increased from about 0.14 in 1992 to about 0.21 in 1997.

Net cash returns and its distributional changes over time are related both to structural changes within the farm sector, and to macroeconomic and international forces outside the sector. Factors within the farm sector include changes in government farm policies, technology, relative input and output prices, and changes in the composition of demand for farm products. Factors outside the farm sector include macroeconomic policies and the international competitiveness of

U.S. agriculture vis-à-vis other nations. The effects of these factors on the concentration of farm production need to be measured and considered.

Estimates of inequality presented in this study (TMI and Gini coefficients) suggest a trend toward more concentration in agricultural production since the 1996 FAIR Act. However, several important caveats need to be made. First, net cash returns are but one indication of farm sector performance and well-being. Second, net cash returns include returns to a variety of "stakeholders" (farm operators, partners, landlords, and contractors). Third, returns to stakeholders from net cash returns from agricultural sales are only a portion of total farm household income. Off-farm income is becoming an increasing share of total farm household income. Therefore, using county-level net cash returns data that are disaggregated by farm size and by farm type would enhance our understanding of the forces driving these changes in profit patterns by county and over time.

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Figure 1. Net Cash Returns Per Acre, 1992

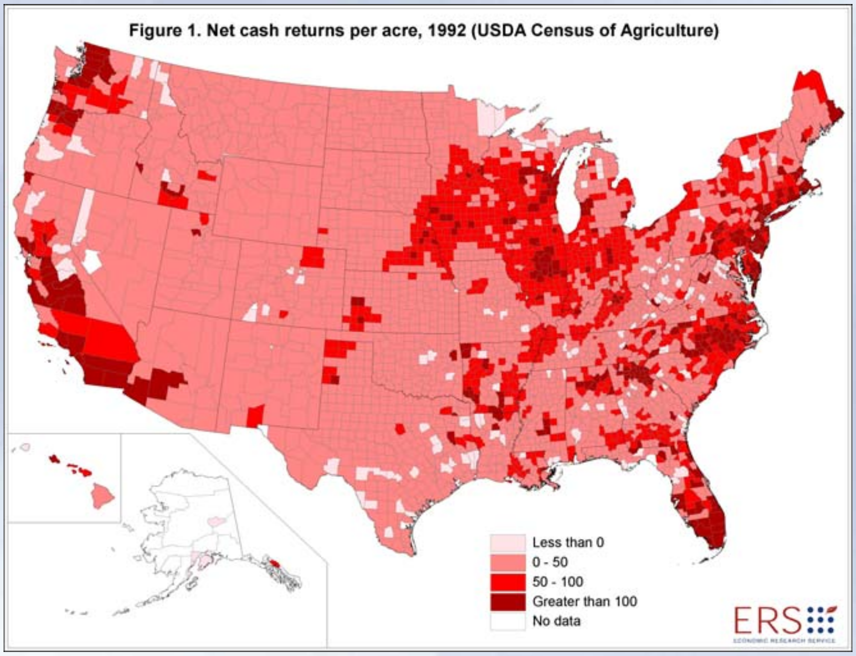

Figure 2. Net Cash Returns Per Acre, 1997

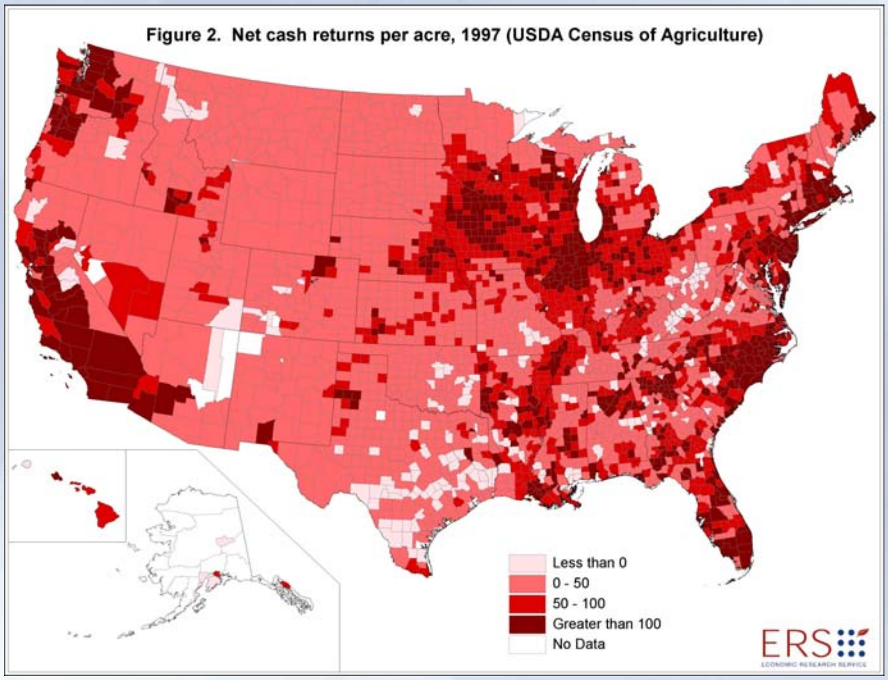

Figure 3. USDA-ERS production regions

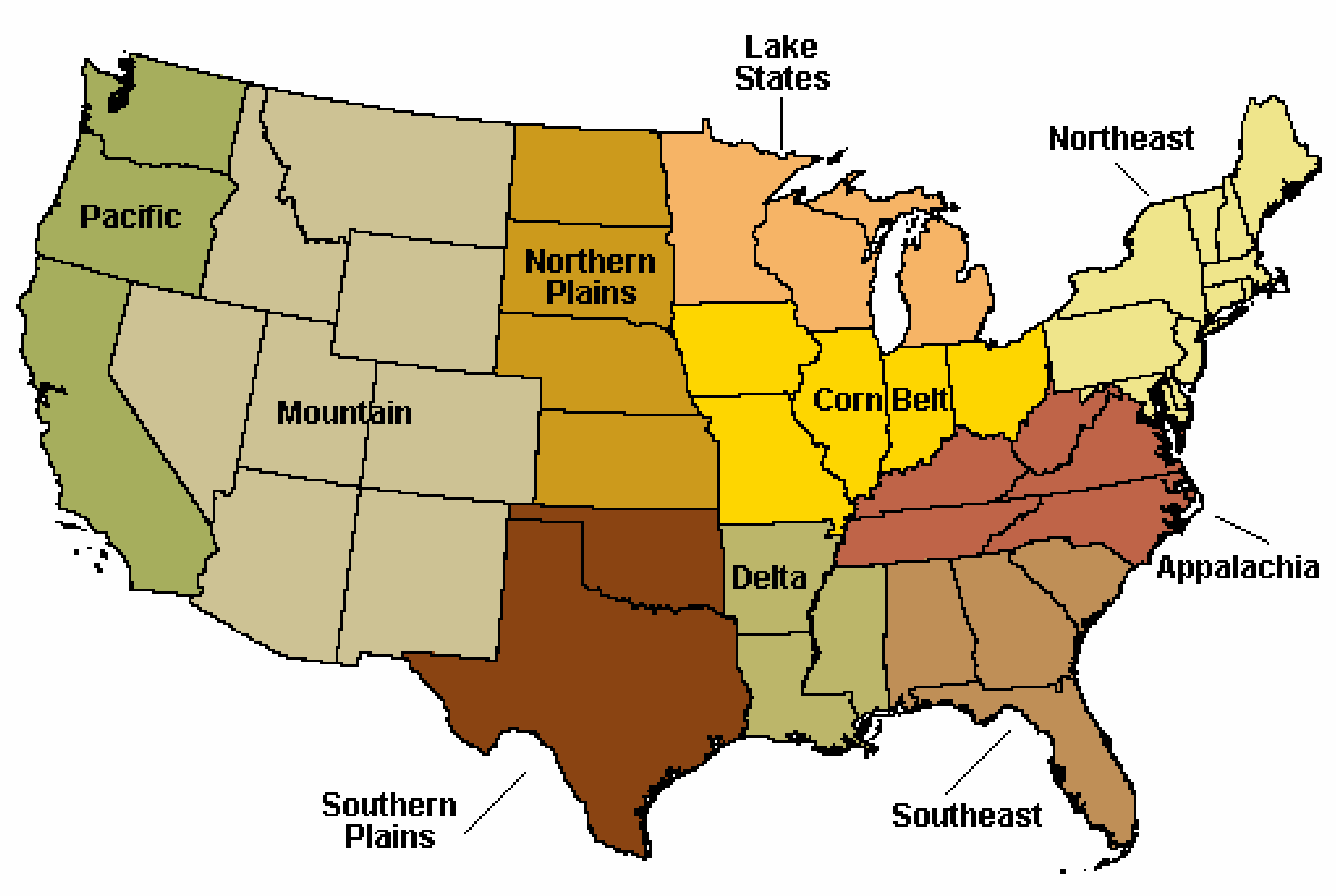

Table 1.—Farm operation income statement Gini estimates, by year, 1991–2000

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Ten-year total
Number of farms	2,099,900	2,090,700	2,063,300	2,035,500	2,068,000	2,025,386	2,049,384	2,054,709	2,186,950	2,166,060	20,839,889
Percent of farms	10.1	10.0	9.9	9.8	9.9	9.7	9.8	9.9	10.5	10.4	100.0
Percent of value of production	8.6	8.6	9.0	9.4	9.9	10.8	11.4	11.2	10.5	10.6	100.0
						Gini coefficient					
Gross cash income	0.76851	0.77097	0.77858	0.78045	0.79397	0.80767	0.81202	0.82346	0.82113	0.81795	0.79998
Livestock income	0.78664	0.79027	0.79833	0.80665	0.82796	0.84299	0.84686	0.83836	0.85136	0.85017	0.82568
Crop sales (incl. net CCC loans)	0.77552	0.77149	0.78594	0.77531	0.77855	0.77443	0.79649	0.82040	0.81003	0.80606	0.79193
Government program crops	0.65543	0.64471	0.66096	0.65606	*0.65954	0.64481	0.68812	0.67196	0.67287	0.65805	0.66798
Non-program crop sales	0.98913	0.99640	0.99250	0.99872	0.99123	0.99971	0.98640	0.99734	0.99352	0.99341	0.99622
Government payments	0.61048	0.62687	0.61392	0.61628	0.59218	0.62952	0.62150	0.66507	0.69985	0.70272	0.66244
Other farm-related income[1]	0.84131	0.83306	0.83064	0.83760	0.83218	0.82968	0.85822	0.86007	0.84776	0.83219	0.84561
Less: Cash expenses	0.74961	0.74532	0.76538	0.76107	0.76813	0.77518	0.78658	0.78718	0.78947	0.78939	0.77360
Variable	0.77340	0.76702	0.78658	0.78378	0.79259	0.79547	0.80784	0.80693	0.81476	0.81008	0.79566
Fixed	0.72367	0.71807	0.73299	0.72141	0.72797	0.74144	0.74567	0.75834	0.74989	0.76038	0.73989
Equals: Net cash farm income	0.97302	0.97051	0.97068	0.97827	0.98211	0.97820	0.98536	0.98443	0.98077	0.98575	0.97987
Less:											
Depreciation	0.68464	0.67117	0.67113	0.69250	0.66647	0.70430	0.69041	0.68267	0.68681	0.66206	0.68700
Labor, non-cash benefits	0.70315	0.75596	0.75580	0.75827	0.75562	0.72316	0.72736	0.72393	0.77611	0.71646	0.74495
Plus:											
Value of inventory change	0.99396	0.98593	1.00066	0.99701	1.00209	0.99257	0.99032	1.00019	0.99778	0.99762	0.99762
Nonmoney income[4]	0.35347	0.32610	0.34130	0.34115	0.31379	0.33199	0.30711	0.33403	0.31669	0.33603	0.33416
Equals: Net farm income	0.96611	0.95612	0.98204	0.98167	0.99076	0.97239	0.97543	0.98914	0.97487	0.98596	0.97936

Source: 1991–2000 USDA Farm Costs and Returns Survey/Agricultural Resource Management Study.
Based on 100,803 observations.(45,776 Households, 2,253 Non-households, 52,774 where HHCLS is missing). Expansion factors=ef_vall/vallwt0. Versions=1, 2, 3, 4, 5, 6, and 7.
All 48 contiguous States were included in the sample.

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Table 2. Theil measure of inequality (TMI): inequality of net cash returns, 1992 and 1997 (Census of Agriculture)						
Year	Average within-region inequality		Between-region inequality		Total (U.S.) inequality	
	TMI	% of total	TMI	% of total	TMI	% of total
1992	0.07480	52.65	0.06727	47.35	0.14207	100.0
1997	0.11373	53.83	0.097538	46.17	0.21127	100.0

Table 3. (Average) within-states, between-states, and total inequality of net cash returns, 1992 and 1997, by region (Census of Agriculture)

Theil Measure of Inequality (TMI)

	1992			1997		
Region	Within	Between	Total	Within	Between	Total
Northeast	0.09	0.26	0.35	0.06	0.26	0.32
Lake States	0.12	0.12	0.24	0.09	0.23	0.33
Corn Belt	0.24	0.17	0.42	0.27	0.23	0.50
Northern Plains	0.06	0.18	0.24	0.16	0.20	0.36
Appalachia	0.22	0.32	0.53	0.35	0.51	0.86
Southeast	0.33	0.44	0.77	0.27	0.48	0.76
Delta	0.15	0.47	0.62	0.04	0.62	0.66
Southern Plains	0.08	0.83	0.90	0.14	1.13	1.28
Mountain States	0.17	0.36	0.52	0.22	0.51	0.73
Pacific	0.24	0.33	0.56	0.33	0.35	0.69
Alaska & Hawaii	n.a.	n.a.	n.a.	0.03	0.0031	0.0337

Note: numbers may not add due to rounding.

Table 4. (Average) within-states, between-states, and total inequality of net cash returns, 1992 and 1997, by region (percent distribution of TMI) (Census of Agriculture)

Percent Distribution of TMI

	1992			1997		
Region	Within	Between	Total	Within	Between	Total
Northeast	25.4	74.4	100.0	20.0	80.0	100.0
Lake States	49.6	59.4	100.0	28.7	71.3	100.0
Corn Belt	58.4	41.6	100.0	53.9	46.1	100.0
Northern Plains	26.0	74.0	100.0	45.6	54.4	100.0
Appalachia	40.7	59.3	100.0	40.9	59.1	100.0
Southeast	42.5	57.5	100.0	36.0	64.0	100.0
Delta	24.0	76.0	100.0	5.8	94.2	100.0
Southern Plains	8.3	91.7	100.0	11.2	88.8	100.0
Mountain States	31.7	68.3	100.0	30.1	69.9	100.0
Pacific	42.5	57.5	100.0	48.7	51.3	100.0
Alaska & Hawaii	n.a.	n.a.	n.a.	90.7	9.3	100.0

Table 5. (Average) Within-state inequality of net cash returns, 1992 and 1997
Theil measure of inequality (TMI) (USDA-Census of Agriculture)

State	1992	1997	State	1992	1997
Alabama	0.24994	0.31738	Montana	0.34342	0.29311
Alaska	n.a.	0.10217	Nebraska	0.094481	0.12370
Arizona	0.61733	0.57119	Nevada	0.069210	0.01751
Arkansas	0.42905	0.55275	New Hampshire	0.35409	0.20855
California	0.30346	0.30823	New Jersey	0.41615	0.35233
Colorado	0.49008	0.74504	New Mexico	0.46933	0.62733
Connecticut	0.085469	0.47757	New York	0.11777	0.16573
Delaware	n.a.	n.a.	North Carolina	0.35122	0.56120
Florida	0.53311	0.55451	North Dakota	0.77933	0.26337
Georgia	0.41745	0.48858	Ohio	0.21397	0.3113`
Hawaii	n.a.	n.a.	Oklahoma	0.58183	0.55145
Idaho	0.19123	0.43092	Oregon	0.45544	0.45680
Illinois	0.13136	0.15482	Pennsylvania	0.33723	0.29429
Indiana	0.24798	0.29006	Rhode Island	0.16119	0.070550
Iowa	0.09654	0.11563	South Carolina	0.33602	0.38277
Kansas	0.36767	0.30262	South Dakota	0.054234	0.09079
Kentucky	0.18885	0.29100	Tennessee	0.33189	0.72949
Louisiana	0.36922	0.50693	Texas	0.89201	1.26321
Maine	0.33171	0.43814	Utah	0.21970	0.37607
Maryland	0.33519	0.19598	Vermont	0.24892	0.24217
Massachusetts	0.32916	0.24202	Virginia	0.43304	0.47178
Michigan	0.31091	0.25848	Washington	0.35077	0.52179
Minnesota	0.10622	0.31983	West Virginia	0.82715	0.82305
Mississippi	0.64767	0.83544	Wisconsin	0.071996	0.096584
Missouri	0.34956	0.57204	Wyoming	0.064233	0.13778

Appendix 1. Description of "Net Cash Returns" as defined in the USDA Census of Agriculture, 1992 and 1997

"Net cash return from agricultural sales for the farm unit" is derived by subtracting total operating expenses from the gross market value of agricultural products sold. Both gross sales and production expenditures include sales and expenses of the farm operator as well as those of partners, landlords, and contractors. Therefore, the net cash return is that of the farm unit rather than the net farm income of the operator. Consequently, while the net cash return of a contractee grower could be negative, the actual return could be position, meaning the integrator/contractor was absorbing an even larger loss on the growout operation. Often these losses are offset by later gains from further processing. Conversely, a very high net cash return is usually shared between an integrator/contractor and a contractee grower and should not be viewed as a return to the contractee grower.

Operating expenses used in calculating net cash return do not include depreciation or changes in inventory values. Expenses may have been understated on farms renting land from others because taxes paid by landlords are excluded, and insurance and other landlord expenses not readily known to renters may have been omitted or underestimated.

Source: U.S. Department of Agriculture, National Agricultural Statistics Service, *1997 Census of Agriculture*, Appendix A.