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STRUCTURAL CHANGE IN AGRICULTURE IN THE UNITED STATES

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STRUCTURAL CHANGE IN AGRICULTURE IN THE UNITED STATES*

Philip M. Raup**

I. Introduction

Agriculture in the United States is experiencing a period of structural readjustment that ranks with the most profound changes that have occurred since the formation of the union. As one of the most ancient forms of economic activity, it might be expected that agricultural tradition, inertia, and unwillingness to change might be the root causes of the current drastic restructuring.

This is not the case. United States agriculture has been in the forefront of modernization in production methods, labor utilization, and capital renewal. For the past half-century it has consistently led other major sectors of the United States economy in growth in labor productivity as shown in Table 1. The current structural shifts are occurring at a time when output is setting new records in all major crops. It is in fact the degree of success in the spheres of production and productivity that lies at the root of the present reordering of production relationships. It is the institutional structure that is subject to the greatest stress. This will become clearer if we look first at the trends in farm size and tenure.

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Table 1

Estimated Trend Labor Productivity Growth By
Sectors in the United States
1948-1981^{a/}

Private Business Sectors	Average Annual Trend Productivity Growth ^{b/}	
	1948-68	1968-81
	(% per year)	
Service Producing	3.0	1.5
Goods Producing	3.0	2.1
Manufacturing	2.9	2.8
Farming	6.0	6.3
Private Business Sector as a Whole	3.3	1.8

^{a/} Charles S. Morris, "The Productivity 'Slowdown': A Sectoral Analyses", Economic Review, Federal Reserve Bank of Kansas City, April 1984, p. 13.

^{b/} Trend productivity growth is defined as the growth in output per manhour worked if all resources in the economy were fully employed at desired levels (Morris, p. 4).

II. Trends in the Size of Farm Operating Units

B. F. Stanton of Cornell University has assembled data on trends in farm size since 1910, based on the U.S. Censuses of Agriculture (Stanton, 1984). Table 2 shows number of farms by size classes in acres, Table 3 converts the data to percentages, and Table 4 shows the trends in the percent of all land in farms falling into the same size classes.

The most remarkable trends shown in these tables are the sharp decline in the number of farms between 1950 and 1969, when the number of farms was cut in half, the stabilization in the number and percent of small farms (under 50 acres) after 1969, the steady increase in the percent of farms and percent of land in farms in the size classes above 500 acres, and the continuous decline in the percent of land in farms in all size classes between 50 and 500 acres since 1910. Between 1969 and 1982 the only size classes showing increases in the number of farms were those for farms of under 10 acres and 1000 acres and over.

Measured in acres, the resulting degree of concentration in the larger size classes is remarkable. In 1982, farms of 1,000 acres (405 hectares) and over numbered 161 thousand, or 7.2 percent of the number of farms, but accounted for 58.5 percent of the land in farms. If we consider the 365 thousand farms of 500 acres and over in 1982, they were 16.3 percent of the number of farms but controlled 73.5 percent of the acreage.

These measures of size based on acres of land in farms can be misleading. They include large acreages of semi-arid grazing

Table 2: NUMBER OF FARMS BY ACRES IN FARM
United States, 1910 - 1982

(1)	(2)	(3)	(4)	(5)	(6)
Size group	1910	1930	1950	1969	1982
<u>acres</u>					
<u>Small:</u>					
Under 10	335	359	485	162	187
10 - 49	1,918	2,000	1,478	473	449
Subtotal	(2,253)	(2,359)	(1,963)	(635)	(636)
<u>Medium:</u>					
50 - 99	1,438	1,375	1,048	480	344
100 - 179	1,516*	1,343*	1,103	542	368
180 - 259	534*	521*	487	307	211
Subtotal	(3,488)	(3,239)	(2,638)	(1,309)	(923)
<u>Large:</u>					
260 - 499	444	451	478	419	315
500 - 999	125	160	182	216	204
1,000 and over	50	81	121	151	161
Subtotal	<u>(619)</u>	<u>(692)</u>	<u>(781)</u>	<u>(786)</u>	<u>(680)</u>
TOTAL	6,362	6,289	5,382	2,730	2,239

*The census classes were 100 - 174, and 175 - 259 in 1910 and 1930.

SOURCE: U.S. Censuses of Agriculture (from B. F. Stanton, 1984).

Table 3: DISTRIBUTION OF FARM NUMBERS BY ACRES IN FARM
United States, 1910 - 1982

(1)	(2)	(3)	(4)	(5)	(6)
Size group	Census Years				
	1910	1930	1950	1969	1982
-total acres-					
Under 10	5.3	5.7	9.0	5.9	8.4
10 - 49	30.1	31.8	27.5	17.3	20.0
Subtotal	(35.4)	(37.5)	(36.5)	(23.2)	(28.4)
50 - 99	22.6	21.9	19.5	16.9	15.4
100 - 179	23.8	21.4	20.5	19.9	16.4
180 - 259	8.4	8.3	9.1	11.2	9.4
Subtotal	(54.8)	(51.6)	(49.1)	(48.0)	(41.2)
260 - 499	7.0	7.2	8.9	15.4	14.1
500 - 999	2.0	2.5	3.4	7.9	9.1
1,000 and over	0.8	1.3	2.3	5.5	7.2
Subtotal	<u>(9.8)</u>	<u>(11.0)</u>	<u>(14.6)</u>	<u>(28.8)</u>	<u>(30.4)</u>
TOTAL	100.0	100.0	100.0	100.0	100.0

SOURCE: U.S. Censuses of Agriculture (from B. F. Stanton, 1984).

Table 4: PERCENT OF LAND IN FARMS BY SIZE CLASS
Census, United States, 1910 - 1982

(1)	(2)	(3)	(4)	(5)	(6)
Farm size class	Census Years				
	1910	1930	1950	1969	1982
<u>total acres</u>	<u>percent of all land</u>				
Under 10	0.2	0.2	0.2	0.1	0.1
10 - 49	6.0	5.5	3.4	1.2	1.3
50 - 99	11.7	10.0	6.5	3.2	2.7
Subtotal	(17.9)	(15.7)	(10.1)	(4.5)	(4.1)
100 - 179	23.4	18.3	12.9	7.0	5.4
180 - 259	12.0	11.2	9.1	6.2	4.9
260 - 499	18.2	15.9	14.4	14.0	12.1
Subtotal	(53.6)	(45.4)	(36.4)	(27.2)	(22.4)
500 - 999	9.5	11.0	10.9	13.9	15.0
1,000 and over	19.0	28.0	42.6	54.4	58.5
Subtotal	<u>(28.5)</u>	<u>(39.0)</u>	<u>(53.5)</u>	<u>(68.3)</u>	<u>(73.5)</u>
TOTAL	100.0	100.0	100.0	100.0	100.0
Acres of land in farms, United States, millions	879	987	1,160	1,063	985

SOURCE: U.S. Censuses of Agriculture (from B. F. Stanton, 1984).

land in cattle and sheep ranches, as well as intensively farmed or irrigated lands devoted to fruit, nuts, and specialized horticultural crops.

Prior to 1950, the U.S. Census of Agriculture relied upon acres in farms as the primary indication of differences in size. Dissatisfaction with this measure led to the introduction in 1950 of an additional measure of size, based on the gross value of farm products sold per farm. Size classes based on this measure have been regularly reported in subsequent Censuses, with the dollar value of the size-class limits adjusted to reflect changes in price levels, technology and farm organization. The most recent data on farm size by value of gross sales from the 1982 Census of Agriculture are shown in Table 5.

Measured in the aggregate, the concentration is striking. Only 27,800 farms, or 1.2 percent of the total, had sales of over \$500,000 and accounted for 32.4 percent of total sales. Those farms with sales of over \$100,000 were 13.4 percent of all farms but accounted for 72.5 percent of all sales. Just under one-half (48.9 percent) of all farms with sales under \$10,000 reported only 2.7 percent of gross sales in 1982.

This aggregated measure of concentration is also misleading. This becomes apparent if we examine the relative degree of concentration by major crops and products. One way to show this is to rank crops and products by the proportion of total sales accounted for by farms with gross sales of \$500,000 or more.

Table 5. U.S., Distribution of Farm Size By Value of Gross
Sales of Farm Products in 1982 ^{a/}

Annual Value Per Farm of Gross Sales of Farm Products	Number of Farms		Value of Gross Sales	
	Number	Percent of total	Value	Percent of Total
	No.	%	000\$	%
\$500,000 or more	27,800	1.2	42,764,189	32.4
250,000-499,999	58,668	2.6	19,851,024	15.1
100,000-249,999	215,912	9.6	32,930,351	25.0
40,000-99,999	332,751	14.8	21,641,795	16.4
20,000-39,999	248,825	11.1	7,142,112	5.4
10,000-19,999	259,007	11.6	3,694,306	2.8
Under 10,000	1,096,337	48.9	3,565,838	2.7
5,000-9,999	281,802	12.5	2,008,512	1.5
2,500-4,999	278,208	12.4	999,920	.76
Less than 2,500	536,327	23.9	558,106	.42
"Abnormal farms"	1,676	0.07	310,608	.23
TOTAL, All farms	2,240,976	100.0	131,900,223	100.0

^{a/} U.S. Dept. of Commerce, Bureau of the Census, 1982 Census of
Agriculture, Vol. 1, Part 51, Table 49, pp. 102-103.

Gross sales of \$500,000 in 1982 would correspond to a cattle feeding enterprise with annual sales of some 800 head, a hog enterprise selling 5,000 head, a Kansas wheat farm of 3,000 acres or more, an Iowa corn-soybean farm of some 1,500 acres, or a dairy farm selling about 4 million pounds of milk and milking 250 to 300 cows. These are at or beyond the upper limits of enterprises that could by any stretching of definitions be called family-type farms. Using this definition of a "large farm", the rank order of concentration by major product classes is shown in Table 6.

It is apparent that much of the concentration in very large farms when measured by value of gross sales is explained by products that typically require relatively small areas of land. Vegetables, nursery products, and fruits are intensive forms of land use, as are poultry production and cattle feeding. Among field crops, only cotton and "other crops" (sugar beets, sunflowerseed, lentils, peanuts, dry beans, etc.) are above the national average of 32.4 percent of gross sales from farms with product sales of \$500,000 or more.

Among livestock products, dairying and hogs and pigs are least concentrated in very large farms, and this is also true of all of the major grain crops. Wheat is slightly more concentrated than other grains with 13.3 percent of gross sales coming from farms with sales of \$500,000 and over, while soybeans are the least concentrated of the major grains, with only 8.8 percent of sales from this size class.

Table 6: U.S., Rank Order of Concentration in Major Agricultural Crops and Products Measured by Farms With Gross Sales of \$500,000 and Over ^{a/}

Product Group	Gross Sales All Farms	Farms With Gross Sales of \$500,000 and Over		
		Percent of Farms in Product Group	Gross Sales	Percent of Gross Sales in Product Group
	000\$	%	000\$	%
All Products	131,900,223	1.2	42,764,189	32.4
Vegetables, Sweet Corn, Mellons	4,145,466	4.2	2,864,043	69.1
Nursery, Greenhouse	3,821,196	5.0	2,380,637	62.3
Fruits, Nuts, Berries	5,846,095	3.3	3,037,780	52.0
Poultry products	9,796,927	3.6	5,027,520	51.3
Cattle, calves	31,635,157	1.1	15,531,577	49.1
"Other crops"	3,715,789	5.5	1,813,605	48.8
Cotton	3,232,615	6.5	1,498,302	46.3
"Other livestock"	1,415,845	1.1	598,349	42.3
Sheep, lambs, wool	608,048	0.8	197,617	32.5
Hay, silage, field seeds	2,312,006	1.4	522,529	22.6
Dairy	16,320,417	1.9	3,100,585	19.0
Hogs, pigs	9,867,741	1.5	1,723,442	17.5
Grains	36,409,105	1.6	4,327,789	11.9
Tobacco	2,773,835	0.3	140,413	5.1

^{a/} U.S. Department of Commerce, Bureau of The Census, 1982 Agricultural Census, Vol. 1, Part 51, Table 49.

A more useful measure of economic size would be in terms of value added in production, which can be approximated by the value of gross sales minus the cost of purchased inputs. A ranking of farm sizes by this standard would result in a substantial reordering of the rankings shown in Tables 5 and 6. Most of the largest poultry, cattle, hog, and dairy operations produce little (or often none) of the feed used and have very low ratios of value-added to gross sales. In beef cattle feeding, for example, value-added falls typically in the range of 8 to 12 percent of the value of gross sales, and is often lower. In a family-operated dairy farm producing most of the feed required, value-added can range from 25 to 40 percent of the value of gross sales.

Unfortunately, no nation-wide data are available on value-added. We can only note that, if they were, the degree of concentration measured by the value of gross sales would be substantially reduced. Much of the value of gross sales from farms in the largest size classes comes from units that cannot be regarded as "farms" in a conventional, land-using sense. They are processing plants, buying raw materials (feeds, young livestock) from land-using farms, and producing a product very much like other plants processing farm products that are not included in the classification of farms. There is a high degree of similarity between a large cattle feedlot and a processing plant canning peas or sweet corn. To classify one as "farm" and

the other as "non-farm" confuses the statistics on trends in farm size.

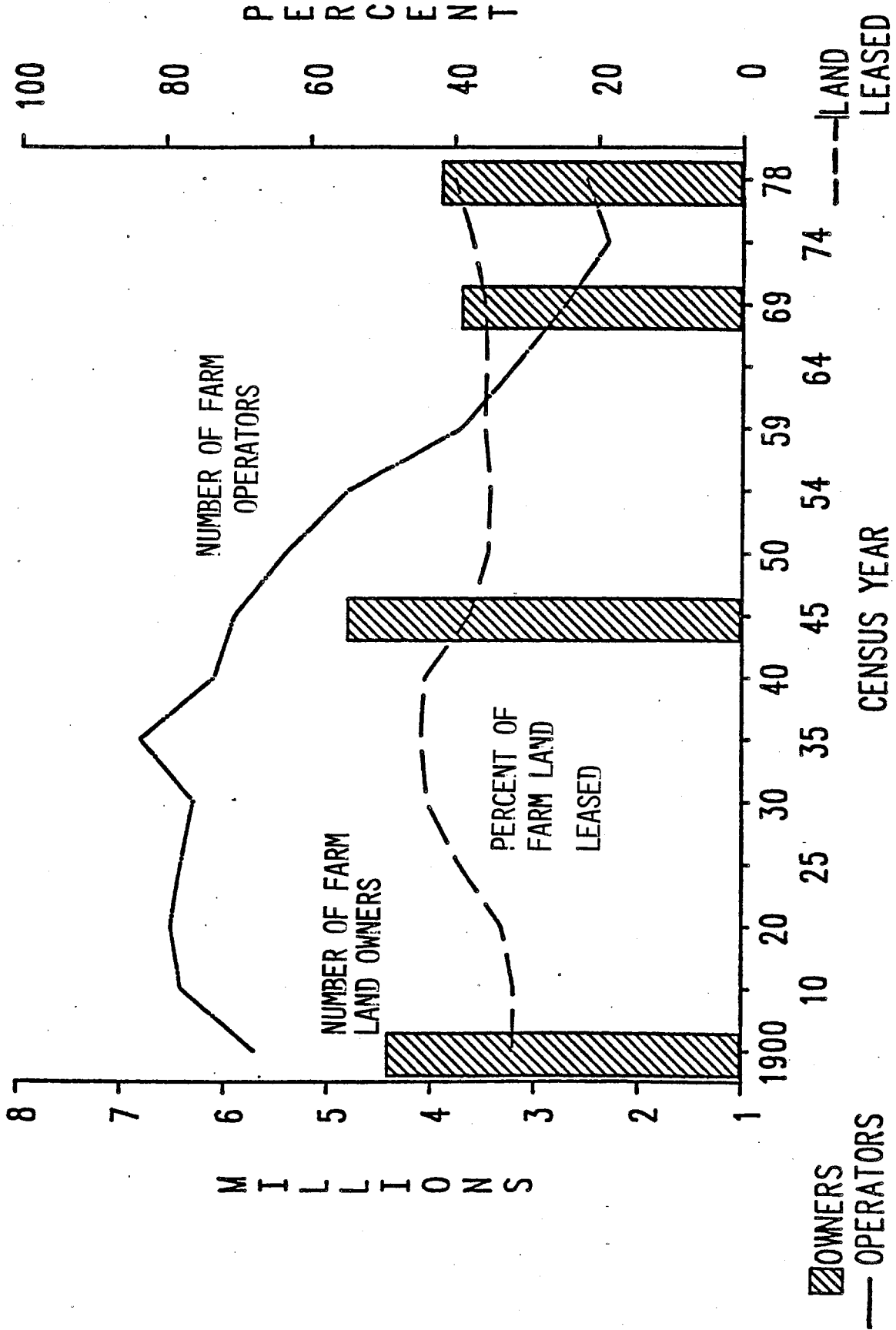
III. Trends in Farm Land Tenure

A graphic presentation of trends since 1900 in the number of farm operators, the number of farm land owners, and the percentage of farm land leased or rented is given in Figure 1. The number of operators and owners in millions is shown on the left-hand scale, and the percentage of land leased on the right-hand scale. The data extend only to 1978 since that is the most recent date for which ownership data are available.

The decline in number of farm operators has been almost constant since 1935, as noted above in Section II. No similar decline has taken place in the number of farm land owners, although their numbers in 1978 were below the levels of 1900 and 1945.

The most surprising feature of the chart is the relative stability in the proportion of farm land leased, especially since 1950. This is confirmed by the data in Table 7, showing acres of land rented by tenants (who own none of the land they farm) and by part-owners. While the acres of land farmed by tenants has declined almost without interruption since 1935, this has been offset by parallel increases in the acres rented by part-owners. As a result, the percentage of land rented or leased has fluctuated within narrow limits of 35.2 to 39.6 percent of the total area of land in farms since 1945.

FIGURE 1: US, OPERATORS, OWNERS, LAND LEASED
1900-1978



Source: Robert F. Boxley, "Farmland Ownership and the Distribution of Farm Program Benefits", Working Paper, ERS-NRED, U.S. Dept. of Agriculture, Washington, D.C., March 1984.

Table 7--Tenancy and land rented, United States, 1900-78^{a/}

Year	Acres of Land in Farms	Acres of land rented by		Total	Percent land leased	Rate of tenancy ^{8/}
		Tenants	Part owners			
		million			percent	
82	986.8	113.6 ^{1/}	269.9 ^{2/}	383.5	38.9	11.6
78	1014.8	121.7 ^{1/}	279.7 ^{2/}	401.4	39.6	12.3
74	1017.0	122.3	258.4	380.7	37.4	11.3
69	1063.3	137.6	241.8 ^{3/}	379.4	35.7	12.9
64	1110.2	144.9	248.1 ^{3/}	393.0	35.4	17.1
59	1123.5	166.8	234.1	400.9	35.7	20.5
54	1158.2	192.6	212.3	404.9	34.9	24.4
50	1161.4	212.2	196.2	408.4	35.2	26.9
45	1141.6	251.6	178.9	430.5	37.7	31.7
40	1065.1	313.2	155.9	469.1	44.0	38.8
35	1054.5	336.8	134.3	471.1	44.6	42.1
30	990.1	307.3	125.2	432.5	43.6	42.4
25	924.3	264.9 ^{4/}	96.3 ^{5/}	361.2	39.0	38.6
20	958.7	265.0 ^{4/}	54.7 ^{6/}	319.7	33.3	38.1
10	878.8	225.5	51.3 ^{7/}	277.8	31.6	37.0
1900	841.2	195.1	71.1 ^{7/}	266.2	31.6	35.3
90	623.2	NA	NA	NA	NA	28.4
1880	536.1	NA	NA	NA	NA	25.6

^{a/} J. Peter DeBraal and Gene Wunderlich, Rents and Rental Practices in U.S. Agriculture, Farm Foundation and ERS, U.S. Department of Agriculture, 1983, p. 49.

- ^{1/} Columns (3) and (4) are as comparable as possible between part owner and tenant in the same year but series definitions change over time.
- ^{2/} The 1978 figure is all farm "land rented from others".
- ^{3/} "It is estimated that partowners and tenants operate 393 million acres of land leased from others," 1964 Census of Agriculture, Vol. II, Ch. 8, p. 757.
- ^{4/} 1922 Census of Agriculture, Vol. VI, Part I, table 5, p. 19.
- ^{5/} Assumes same proportion of owner and part owner as in 1910. 1920 Census of Agriculture, table 5, p. 19 (23 percent of acres are part owner, .23 (636.8) = 142.6 million acres of which same 38.4% is leased = 54.7 million acres).
- ^{6/} Computed as total acreage from the difference in size of full owners and part owners. FO = 138.6, PO = 225.0; 86.4 acres per PO farm or 51.3 million acres. 1910 Census of Agriculture, Ch. II, table 1, 3, pp. 97, 99.
- ^{7/} Sum of part owners and owner/tenant, 1900 Census of Agriculture, table 20, p. 308.
- ^{8/} Percent of farm operators who operate only land rented from others.

Basic sources: 1969 Census of Agriculture, Table 5, p. 14; 1974 Census of Agriculture, Table 3, pp. I-6; 1978 Census of Agriculture, Vol. 1, Part 51, Table 5, pp. 124-127.

Stated in other terms, the proportion of farm land operated by those who own it (either as full owners or part-owners) has remained relatively constant at 60 to 65 percent of the total area for the past 40 years. A more detailed presentation of these trends from 1969 to 1982 for one state, Minnesota, is given in Table 8.

From these data it is clear that the rapid growth of rented land in part-owner farms has not been associated with a significant increase in the area of farm land operated under rental or tenancy arrangements. The major change that has occurred is a dilution of equity in farm land in part-owner farms. If we can assume that the operators of these farms approach their tasks of farm management with the attitudes of land owners, which they are in part, then we can conclude that 873 million or 88.5 percent of the 987 million acres of land in farms in 1982 were managed by operators who had the security of tenure provided by full or partial land ownership. While the proportion of land operated by full owners has declined, the proportions operated since 1950 by those who have the security and stability provided by some land ownership are the highest they have been since 1880, when statistics on agricultural land tenure were first reported in the Censuses.

IV. Farm Population and Employment

The U.S. farm population was 30.5 million in 1930, and 30.5 million in 1940. It declined to 23.0 million in 1950, to 15.6 million in 1960, to 9.7 million in 1970, and to 6.9 million in

TABLE 8: PERCENTAGE DISTRIBUTION OF OWNED AND RENTED
LAND IN FARMS IN MINNESOTA,
1969, 1974, 1978, 1982^{a/}

CATEGORY	1982 ^{c/}	1978 ^{c/}	1974 ^{b/}	1969 ^{b/}
LAND IN FARMS (ACRES)	27,708,456	28,459,790	26,303,948	26,420,631
PER CENT OF TOTAL				
<u>OWNED LAND IN FARMS</u>				
FULL OWNERS	37.1	37.7	41.1	41.5
PART OWNERS	<u>27.8</u>	<u>28.4</u>	<u>27.5</u>	<u>25.5</u>
SUBTOTAL	64.9	66.1	68.6	67.0
<u>RENTED LAND IN FARMS</u>				
PART OWNERS	25.0	23.3	21.9	20.8
FULL TENANTS	<u>10.1</u>	<u>10.6</u>	<u>9.5</u>	<u>12.2</u>
SUBTOTAL	35.1	33.9	31.4	33.0

^{a/} U.S. CENSUS OF AGRICULTURE.

^{b/} CLASS I-V FARMS, SALES OVER \$2,500.

^{c/} ALL FARMS, SALES OF OVER \$1,000.

1981, using the old Census definition of a farm (changed in 1978). Using the new definition of a farm, the farm population was 5,787,000 in 1983, or 2.5 percent of the total population.

Assuming that most of this migration out of agriculture involved individuals under 25 years of age, the reduction in the farm population of 23 million between 1940 and 1981 involved primarily individuals born after 1915. The oldest members of the generation that contributed to this heavy migration off of farms would thus have been under 68 in 1983 and, with normal life expectancy, perhaps 80 percent of them are still living. It seems probable that the United States now has a population of people with farm backgrounds but who are no longer in farming that is triple the size of the farm population as currently defined.

Using the post-1978 Census definition of a farm and of the farm population, it is roughly true to say that for every person now on a farm there are three persons in the non-farm population whose roots were once in farming. This farm-rooted portion of the non-farm population is now at a peak, and will decline gradually to 2000 or 2010, and then precipitously. For the remainder of this century the U.S. population will include a large number of non-farm people who have at least emotional or sentimental identification with agriculture. The significance of this observation is that many of them, and perhaps a majority, have more than sentimental ties. They are the heirs or prospective heirs of farm land owners. As a result of a massive

off-farm migration concentrated in little more than 25 years, much of the beneficial ownership of farm land has moved out of agriculture.

These trends were accelerated by the land-boom of the 1970's. From 1972 through 1981 real capital gains in land values made farm land a very attractive asset. This added a financial incentive to sentimental reasons that off-farm migrants may have had for retaining any ownership interest in farm land.

Much of the increase in rented land in part-owner farms in the recent past is explained by the desire of heirs of former farmland owners to retain their inheritance. They have rented their inherited land to neighboring farmers. In a previous generation many of the heirs of deceased farmers eventually sold out, and their holdings were recombined into new farm units. The prospect of rapid capital gains in farmland in the 1970's narrowed the farmland market substantially, as more owners who in an earlier era would have sold out chose instead to remain as landlords, often of relatively small tracts of land. The result was a motive for landholding rooted in capital gain expectations. This has led to a tendency for the size of ownership tracts to decline at the same time that the size of farm operating units was increasing. A much larger population of landowners is now involved in decision-making in agriculture.

The land owning population is not the same as the population of farm operators. The majority of people in the United States in this generation who identify with agriculture are not on

farms. These are overriding demographic and political facts that will affect the tailoring of agricultural policies and programs for the remainder of this century.

Migration out of agriculture has not always involved an abandonment of employment in agriculture. This is reflected in the rapid growth since the 1950's in part-time farming. As noted in Section II, Table 3, small farms of under 50 acres have increased as a proportion of all farms since 1969. But not all part-time farms are small farms.

Mechanization and specialization have increased the size of operation that can be managed as a part-time farm. This potential has been accelerated by a decline in the proportion of commercial farms that produce poultry, pigs, beef cattle, or dairy products. The absence of livestock converts cash-crop farms into part-time operations, in that the operators are underemployed for four to five months of the year. While the operator may not have an off-farm job, he is not fully employed in agriculture.

For this reason, statistics that identify part-time farms as those whose operators hold non-farm jobs significantly understate the extent of "part-time" farming.

Keeping this reservation in mind, Table 9 shows the trend since 1954 in the proportions of farms whose operators reported any work off-farm, or work off-farm for 100 days or more.

The significance of the growth in part-time farming, or the combination of farm employment with off-farm jobs, is shown in

Table 9. Percentage of Farm Operators in the U.S. with Off-Farm Work, 1954, 1974, 1978 and 1982.^{a/}

	<u>1954</u>	<u>1974</u>	<u>1978</u>	<u>1982</u>
	Percent			
Farm operators who worked off the farm				
Any days	45	55	53	53
100 days or more	28	44	42	43
Farm operators with any off-farm work who worked off the farm 100 days or more	62	80	79	81

a/ U.S. Censuses of Agriculture.

Table 10: Farm and Off-Farm Income of Farm Households, United States, 1975, 1980, and 1985^{a/}

	<u>1975</u>	<u>1980</u>	<u>1985^{b/}</u>
	Billion Dollars		
Total Net Farm Income	25.5	20.2	23 to 27
Off-farm income	23.9	35.1	39 to 43
Total household income	49.4	55.3	62 to 70
		Percent	
Off-farm income as percent of total	48.4	63.5	63 to 61

a/ U.S. Department of Agriculture, Economic Research Service, Agricultural Outlook, November 1985, p. 41.

b/ Forecast.

Table 10 by the trend in the proportion of total farm household income derived from off-farm sources.

For U.S. agriculture as a whole, farm households now derive 60 percent or more of total household income from off-farm sources. This provides a degree of income stability that would be lacking in the absence of off-farm employment opportunities. It also illustrates the degree to which the farm economy is being integrated into the non-farm economy. The boundary between farm and non-farm sectors is becoming blurred.

V. Land Values and Input Costs

Well-publicized world food shortages in the 1960's and early 1970's created a belief in a virtually unlimited export demand for U.S. farm products. This was accelerated by the unexpectedly large import of grain by the USSR in 1972. One result was a phenomenal increase in U.S. farm land values.

From 1971 to 1981 farm land values rose four-fold nationally and increased 4.5 to 5.5 fold in major grain-producing areas of the Mid-West and Great Plains. This was followed by a drop from 1981 to 1985 that exceeded any four-year decline in land values in the Grain Belts ever recorded.

Nationally, from February 1981 to April 1985 farm land values fell 17 percent in nominal (i.e. current) dollars. In real terms (current dollars deflated with the consumer price index), the decline from 1981 to 1985 was 30 percent. In the Corn Belt, Lake States, and Northern Plains declines were much

more severe, as shown in Table 11. These declines erased asset values and credit capacity on a massive scale.

Historically, the great strength of a farm structure composed of many relatively small units has been the ability to absorb economic or weather-induced crises by suppressing family levels of living. When labor was a major input in farming, the willingness of producers to tolerate low labor returns measured their shock-absorbing capacity. Until the 1960's, labor remained the largest single input cost in U.S. farming. Faced with economic adversity, large shocks could still be absorbed by underrewarding labor. The extent to which this option has been eroded is shown in Table 12. The basic fact revealed by this table is the rise in the proportion of total input cost represented by purchased inputs.

Underrewarding the labor input no longer offers much shock absorbing capacity. The labor share of input cost is too small, averaging 13 to 14 percent in the 1980's for U.S. farming as a whole. In many cash-crop operations, the proportion falls to 5 percent or lower. Some shock absorbing capacity exists in the possibility of varying fertilizer and chemical inputs, but together they accounted for only about 10 percent of the cost of total farm inputs in 1983. Taxes and interest costs are also significant, but in 1975-83 they were at about the same levels of relative importance that they were in 1910-20, i.e. averaging about 8 to 9 percent of the cost of total inputs.

Table 11: Nominal and Real Declines in Farm Land Values,
Lake States, Corn Belt, Northern Plains, 1981-1985 ^{a/}
(Deflated With The Consumer Price Index,
January-June 1981 and April 1985)

CPI Deflator (1967=100)	1981		1985		Percent Decline	
	Nominal	Deflated 272	Nominal	Deflated 322	Nominal	Real
	\$	\$	\$	\$	%	%
<u>Lake States</u>						
Michigan	1,289	474	1,052	327	18	31
Wisconsin	1,152	423	847	263	27	38
Minnesota	1,281	471	823	256	36	46
<u>Corn Belt</u>						
Ohio	1,831	673	1,126	350	39	48
Indiana	2,031	747	1,259	391	38	47
Illinois	2,188	804	1,314	408	40	49
Iowa	1,999	735	1,064	330	47	55
Missouri	990	364	659	205	33	44
<u>Northern Plains</u>						
N. Dakota	436	160	360	112	17	30
S. Dakota	329	121	250	78	24	36
Nebraska	729	268	444	138	39	49
Kansas	619	228	466	145	25	36
U.S. (48 states)	819	301	679	211	17	30

^{a/} USDA, ERS, Agricultural Land Values and Markets,
CD-90, August 1985, Table 2.

Table 12:U.S., Percentage Distribution of Farm Inputs^{a/}
1910-1983

Year	Labor	Farm Real Estate	Inputs Involving Production Credit				Taxes, Int.	Msc1.
			Mech. & Machinery	Agr. Chem.	Feed, Seed, Live- stock Purch.	Sub- Total		
PERCENTAGE OF TOTAL 1935-39 WEIGHTS								
1910	53.4	20.2	8.5	1.7	3.2	13.4	8.3	4.7
1915	51.6	19.8	9.8	1.6	3.0	14.4	9.3	4.9
1920	50.0	18.5	11.8	2.1	3.9	17.8	8.8	4.9
1925	48.9	17.8	12.0	2.3	4.6	18.9	9.7	4.7
1930	46.2	17.7	14.1	2.8	4.4	21.3	10.4	4.4
1935	47.0	19.2	12.9	2.7	4.1	19.7	9.7	4.4
1939	42.8	18.4	14.7	3.4	6.2	24.3	10.3	4.2
1947-49 WEIGHTS								
1939	54.4	17.0	10.1	1.9	6.5	18.5	7.0	3.1
1945	48.0	15.8	14.3	3.2	8.2	25.7	7.4	3.1
1950	38.1	16.7	20.3	4.7	9.4	34.4	7.5	3.3
1955	32.0	16.4	23.3	6.2	10.7	40.2	7.9	3.5
1957-59 WEIGHTS								
1955	32.2	19.4	24.0	4.4	9.0	37.4	7.7	3.2
1960	26.5	19.4	25.0	5.8	10.9	41.7	8.6	3.8
1965	20.4	19.7	24.9	9.1	12.5	46.5	9.4	4.0
1967-69 WEIGHTS								
1965	23.2	23.6	26.8	5.3	6.7	38.8	10.8	3.5
1970	19.0	23.0	28.3	8.0	7.4	43.7	10.8	3.5
1975	16.7	21.8	31.5	8.8	7.1	47.4	10.8	3.3
1976	16.0	21.6	31.3	9.6	7.4	48.3	10.5	3.6
1976-78 WEIGHTS								
1975	17.1	24.1	33.0	8.0	6.2	47.2	8.3	3.2
1980	13.8	23.6	33.5	11.0	6.9	51.4	7.8	3.7
1983	12.8	25.2	32.5	9.6	6.9	49.0	8.5	4.6

^{a/} National Economics Div., Economic Research Service, U.S. Dept. of Agriculture, Washington, D. C., Feb. 1985.

The only two large items of input costs that can be varied in the 1980's to absorb economic shock are land costs, at about 25 percent of total costs, and mechanical and machinery expenses, which in 1983 accounted for one-third of total input costs. The adjustment in land costs is well underway, as we saw in Table 11.

The largest fraction of current farm input costs is accounted for by mechanical equipment and farm machinery. Any attempts to reduce current expenditures must focus on this class of inputs and this is occurring. Bankruptcy and merger activity are prominent among farm machinery manufacturers, and farm machinery dealers are going out of business throughout the farm belts. Tractor manufacturers in the U.S. in 1983 operated at only 22 percent of capacity, and combine manufacturers at 14 percent of capacity (USDA, 1984, p. 31). In 1949, there were 1492 farm equipment dealers in Minnesota and South Dakota; in 1984, only 600 were still in business (Austin, 1985).

Although it is widely recognized that high labor costs have been a driving force in the mechanization of agriculture, it is less often understood that mechanization has substituted machinery for time, as well as for labor. This substitution increases in importance as agriculture moves into more fragile environments, where the timeliness of operations is more critical, e.g.:

- a) at the rainfall margins of cultivation
- b) at the temperature margins of cultivation

One consequence is that the importance of capital investments to save time has increased with the development of earlier maturing varieties of crops. In North America this has had the effect of shifting the cropping margins north into areas with shorter growing seasons, and further into drier areas where rainfall is the critical variable. These are the areas in which the mechanization of field crop production developed first, and has reached its highest levels.

The importance of the time variable in field crop operations at the rainfall and temperature margins of cultivation has resulted in capital investments in machinery that sometimes seem excessive when compared to investments per acre in more favored regions. They may not be excessive when the importance of timely operations is properly evaluated.

Farm management advisors in grain-producing regions of Canada, for example, have observed that on average not more than three days of favorable weather and soil conditions are available for each of the principal operations of ground preparation, seeding, and harvesting. Levels of mechanization to accomplish each of these tasks in three working days would be excessive in less marginal locations but can be justified under Canadian conditions. Similar situations prevail in the U.S. in the High Plains (elevations above 800 meters) of Texas, Oklahoma, Kansas and Colorado, and in the northern wheat and barley belts of Minnesota, North Dakota and Montana.

One result is that these regions are especially sensitive to the high costs of depreciation of farm machinery. They are vulnerable to capital costs, and particularly to high interest rates. When rates of inflation exceeded nominal rates of interest in the 1970's, resulting in negative real rates of interest, the effect was dramatic in highly mechanized types of agriculture. An impetus was given to investment in machinery, and in land, that could not be sustained under more normal calculations of the real cost of capital.

Declining rates of inflation and rapidly rising real rates of interest after 1980 resulted in severe financial strain on farms in regions engaged in highly mechanized field crop production. These are the regions experiencing the most drastic pressures for financial restructuring in the 1980's.

One aspect of the massive shift to purchased inputs shown in Table 12 is of central importance. At the end of the Second World War those inputs requiring short-term or production credit involved only one-fourth of total input costs. In the 1980's, short and intermediate-term credit is required for one-half or more of total inputs. The farmer has become much more dependent on credit markets, and is much more exposed to interest rate fluctuations on loans that would normally not be based on land collateral.

This helps explain why the collapse of land values has had a dramatic effect on the farm financial structure. Much of the expansion in farm credit in the 1970's was triggered by the

growing need for short-term credit, but was secured by rising land values. Land-based credit was used extensively for production purposes. When the land value base collapsed after 1981 the need for production credit had to be supported by a much smaller collateral base.

Many of the farmers currently in financial difficulty did not buy overpriced land. Instead, they used unrealistic land values to finance a level of input use that could not be supported by conventional short-term credit standards. The heavy requirement for production credit led to a burden on the land-capital base that became, in effect, a way of living off of capital.

Interpreting the probable consequences of this credit crisis is confused by the extreme range that separates farmers with no debt from those that are all but bankrupt. Madden has pointed out that just over half of the 2.2 million farms enumerated in the 1982 Census of Agriculture reported no interest expenses. The percentages ranged from a low of 30 percent in Iowa and North Dakota to highs of 65 percent or over in Connecticut, Hawaii, Massachusetts, Rhode Island, Tennessee, Virginia, and West Virginia (Madden, 1985, Table 2). In general, farms reporting no interest payments (and presumably no debt) were concentrated in the New England states and the South. While the burden of debt declines with size of farm, a surprising statistic is that almost one-fourth (23 percent) of all farms of over 500 acres reported no

interest payments in 1982 and the percentage was the same for all farms over 2,000 acres (Madden, 1985, Table 3).

The farm debt problem is acute, but not universal. One of the clearest conclusions to emerge from Madden's study is that in all age groups of farm operators the low debt burdens were reported by those who listed their principal occupation as other than farming, i.e. whose primary income source was from non-farm employment (Madden, 1985, Table 7). These were 45 percent of the total of all farms.

Two conclusions seem indicated:

- a) Small farms are not the source of the most acute financial problems.
- b) Survival in farming depends more than ever before on the availability of off-farm employment.

The historic survival strategy of suppressing family living expenses (i.e. labor income) has been supplanted by the search for off-farm jobs. Specialization and mechanization have converted the majority of producers of crops into part-time farmers. Where they have little or no livestock, they are underemployed for a major fraction of the year. Farms in areas where off-farm job opportunities are limited are the farms experiencing the most acute financial difficulties.

VI. The Central Issue of Excess Production

All of the explanations for current structural problems in U.S. agriculture are dwarfed by the primary cause, which is overproduction. Throughout history, and for the majority of the world's population today, the farm problem has been one of too little food, not too much. Dramatic reports of food shortages, malnutrition and famine are daily reminders of the existence in major populations with food needs but without effective demand. In the United States, farm and non-farm people alike have misinterpreted this need as evidence of potential export markets.

This misinterpretation is reinforced by the entire agricultural information system. Increasing output has been an almost universal goal of agricultural universities, experiment stations, and extension activities serving agriculture in the public sector. This is even more characteristic of private firms and information services supplying inputs or information to agriculture, or marketing its products. Agri-business interests that benefit directly from a high volume of farm output avoid or oppose any discussion of production controls.

The prospect for future structural change is confused by a persistent failure to distinguish between the problem of too many farmers, and the problem of too much land and capital committed to production. For at least forty years the problem of increasing farmers' income has been viewed simplistically as a problem of too many farmers. The solution has been personalized

by focusing on the withdrawal of labor and the elimination of farm firms.

It is arguable that the withdrawal of labor has gone far enough. Excessive labor costs are not the cause of current agricultural problems, and they will not be resolved by eliminating farmers. The more critical question is what will be done with the land. Eliminating farm firms will leave untouched the problem of too much land in production, and may even make it worse. The farm firms in difficulty in the 1980's are not concentrated at the margins of cultivation, nor are they grouped at the bottom end of the scale of farm sizes. Their land will remain in production unless there are active programs to restrict land use.

The conclusion seems unavoidable that some program of land use control must be a part of any prescription for the restructuring of agriculture in the 1980's. The structure of U.S. agriculture is basically sound, but it is seriously threatened. The origin of this threat lies largely outside of the agricultural sector. It originated in macroeconomic policies that generated inflation and unrealistic expectations in the 1970's, and dashed these expectations by a preference for interest-rate instead of tax policy to control inflation in the 1980's. These policies raised credit costs, choked back exports, and precipitated a deflation in the agricultural sector that ranks with a scale of destruction of capital values that other nations have only experienced in time of war.

The resulting structural adjustments that are under way involve a significant conversion of farm land to forest uses. One of the most remarkable aspects is the correlation between the degree of regional urbanization and the extent of forest land area. As a percent of rural regional land area, the most heavily forested region in the United States is the urbanized Northeast, with forests occupying 65 percent of the total area. Among the three Lake States, Michigan is the most heavily industrialized and urbanized and also has the largest percentage of its land area in forests, at 49.6 percent.

This trend is also apparent in the degree to which part-time farming characterizes the agricultural sector. Urban and industrial growth have progressively drawn labor out of agriculture. Where soils and climate are favorable much of the former area of land in farms has shifted from crop land to forested land. The ownership of this land has remained in relatively small tracts, with many owners practicing limited levels of agricultural activity, while receiving the major part of their income from non-farm sources. As a result, farming in this reduced sense has become much more intimately related to the ownership of forest land.

We are witnessing, in both farming and forestry, the growth of a dual structure of land holdings. Owners of part-time farms can draw upon non-farm income to support their demand for rural land. Many owners of private non-industrial forest land can regard the capital cost of ownership as an amenity value, to be

charged against consumption or the maintenance of a life style. The capital represented by these part-time farms and forests is in relatively strong hands. Their land values have suffered less from rising production costs, declining foreign markets, or high real interest rates, than has been the case with commercial farms and industrial forests. The survival prospects of part-time farms and private non-industrial forest units seem surprisingly good.

The structural problem that remains unresolved is the necessity to withdraw agricultural land and capital from production on a scale that can balance production with prospective demand while retaining usable capacity for unknown future needs. The dominant interest of the non-farm population in a judicious solution to this problem is the principal justification for continuing support for farm policies that require high levels of financial support from public tax revenues. This is the heart of current debates over farm policies and not only in the United States. The final analysis of prospects for structural change can only rest on a hope that any reduction in production capacity will place the conservation of land and water resources at the top of the list of policy goals. This concerns far more than the people of the United States.

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