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# Structural Change in U.S. Farmland

Robert C. Reining



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**Structural Change in U.S. Farmland.** By Robert C. Reining, Resources and Technology Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 617.

## **Abstract**

Large farms are controlling a significantly larger share of farm sales and land. Large farms have acquired more resources and captured the higher sales primarily because they quickly responded to price changes by altering the mix of land use and by using land rental arrangements instead of buying or selling property. This report examines changes in the distribution of land, sales, and tenure among farms. Changes are put into a consistent perspective by adjusting farm sales classes to correct for the substantial inflation during 1969-82.

**Keywords:** Farm structure, farm sales, farmland use, cropland, irrigated land, rangeland, inflation adjustment, agricultural resource concentration, structural change

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## Summary

Large farms are controlling a significantly larger share of farm sales and land. Large farms have acquired more resources and captured the higher sales primarily because they quickly responded to price changes by altering the mix of land use and by using land rental arrangements instead of buying or selling property.

This report examines changes in the distribution of land, sales, and tenure among farms during 1969-82. Changes are put into a consistent perspective by adjusting classes of farm-product sales to correct for the substantial inflation during 1969-82. Farms are grouped into three sales classes based on constant 1969 farm prices: small farms (\$2,500-19,999 in sales), medium farms (\$20,000-99,999 in sales), and large farms (\$100,000 or more in sales). The changes examined in this report are based on the latest data available. The farm financial crisis in the early and mid-1980's may have affected the distribution of land, sales, and tenure among sales classes. However, assessing the effects of financial stress is outside the scope of this report.

A more realistic picture of the changing agricultural sector emerges after adjusting sales data for the effects of inflationary price increases. Without such adjustment, inflation can mask, or even exaggerate, changes in agriculture. For example, rapid price increases for commodities result in higher product sales figures. With higher prices, more farms move up in sales classes. With no adjustment for inflation, changes in prices between census years tend to move many farms between sales classes whether or not their relative sales have actually changed.

Although changes in the distribution of land, sales, and tenure are less pronounced after adjusting the data for inflation, the trends are consistent nonetheless. Large farms more than doubled their share of sales of farm products between 1969 and 1982, while medium and small farms lost half their share. Product sales per acre of land doubled between 1969 and 1982 for large farms, remained unchanged for small farms, and decreased for medium farms.

Much of the increased share of sales on large farms is due to increased control over the land. Large farms accounted for all the increases in total land on farms during the 1970's. Medium farms had the largest share of land in 1982. But, that share may diminish in the future because large farms acquired farms and farmland at a faster pace than did smaller farms.

Large farms altered the mix of land use in response to price changes. When livestock prices declined relative to crop prices between 1969 and 1974, harvested cropland and irrigated land increased on large farms, while permanent pastureland and rangeland declined. Large farms acquired the largest share of irrigated cropland by 1982. Small and medium farms lost land and shares of irrigated and harvested cropland. If the 1974-82 trend continues, large farms will have the largest share of harvested cropland by 2006.

Large farms also responded to price changes by using rental arrangements instead of buying or selling land. Rental contracts for land are generally easier and faster to arrange than are purchases. Rentals accounted for the largest portion of farmland change in 1974-78, the interval with the largest structural change. In fact, changes in land rented relative to changes in land owned were largest when increases in the amount of farmland on medium and large farms were largest.

Future price shocks (rapid increases in commodity prices similar to the rapid price increases in the early 1970's) are likely to result in large farms acquiring more land than will smaller farms. Price changes smaller than those in the early 1970's could result in large farms acquiring land at rates comparable with those in the 1970's. This trend could stress rural areas by continuing to displace farmers and farm families, thereby further reducing rural population, income, and services.

# Structural Change in U.S. Farmland

Robert C. Reining

## Introduction

Substantial changes are occurring in the structure of U.S. agriculture; that is, changes in the distribution of farms, land, sales, and tenure. And, therefore, many are concerned about large farms displacing small and medium-sized farms. This report places farm numbers, sales, and land use into perspective by adjusting census of agriculture data on farm sales classes to correct for the substantial inflation in agricultural commodity prices during 1969-82. Prices that are adjusted for inflation are called constant prices. Farms are grouped into three sales classes based on constant 1969 farm prices: small farms (\$2,500-19,999 in sales), medium farms (\$20,000-99,999 in sales), and large farms (\$100,000 or more in sales).<sup>1</sup>

This report adjusts data reflecting structural change for the effects of inflation. Inflation can mask, and even exaggerate, changes in agricultural structure. Changes in land use and land tenure associated with structural changes in sales and farm numbers measured in nominal-price sales classes (sales not adjusted for inflation) are distorted by major price changes during 1969-82 in agricultural commodities. For example, major price increases in agricultural commodities can result in farms in larger sales classes seemingly acquiring land at an extremely rapid rate during 1969-82. By adjusting for inflation, we can place farmland, farm sales, and land tenure into a consistent national framework for 1969-82 that removes the distorting

effects of price inflation in agriculture. The method used to adjust for inflation is described in appendix 2.

Many studies report that structural change has resulted in a greater concentration of sales and assets on large farms and that this trend will likely continue (1, 3, 6, 9, 16).<sup>2</sup> Concentration refers to the distribution of resources and returns among groups. In this report, concentration refers to increases in the share of land on farms with sales exceeding \$100,000 in 1969 prices. Concentration can be absolute or relative. Absolute concentration occurs when farms in a sales class acquire the largest share of resources. Relative concentration occurs when farms in a sales class acquire resources faster than other farms.

I analyze structural change by putting census data on farmland acreage, farm sales, and land tenure into a consistent national framework for 1969, 1974, 1978, and 1982 censuses that removes the distorting effect of price inflation in agriculture. Changes in land use and land tenure associated with structural changes in sales and farm numbers measured in nominal-price sales classes are distorted by major price changes in agricultural commodities during this period. Changes in prices between census years tend to move large numbers of farms between sales classes whether or not they actually had increases or decreases in sales. Price changes, therefore, make nominal-price data unsuitable for accurate structural analysis.

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<sup>1</sup>The adjustment method was applied to eight sales classes and aggregated to three classes for presentation. Appendix 1 presents the original eight sales classes. More detailed data are available as an Economic Research Service standard data product.

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<sup>2</sup>Italicized numbers in parentheses refer to literature citations in the References section.



Structural change can produce social costs in rural communities (4, 7, 8). Resource concentration on large farms, for example, results in decreased farm numbers. Rural areas experiencing such concentration lose population, rural services, and income as operators of small and medium farms leave agriculture (2, 8).

Land is the largest asset in agriculture. Land has a dual role in the concentration process. Land concentration may result from the concentration of other resources, and the concentration of other resources may result from the concentration of land. Large farms may increase sales partially by acquiring additional farmland for production. However, increased sales per acre on large farms relative to smaller farms may enable a large farm to compete more successfully for farmland than could smaller farms, thereby resulting in increased concentration of land.

There are several hypotheses about structural change. We know from other studies that sales are concentrating in U.S. agriculture. Sales concentrate in a (constant-price) sales class through two mechanisms: by increases in yield per acre of land or by acquisition of productive land through purchase or lease.

I hypothesize that land acquisition plays a major role in sales concentration; much of the increase in the share of sales on large farms is due to increased control over land. Although differences in the levels of technology and productivity on farms of different sizes have received attention, little is known about the relative contribution of land to structural change.

Two questions are related to the above hypothesis. Have large farms acquired more land used for intensive crop production, such as irrigated land? (See box on land use.) Are large farms more responsive to relative price changes than smaller farms? For example, since crop prices increased more than livestock prices, we might expect that large farms acquired more cropland than pastureland or rangeland in comparison with smaller farms.

Rental arrangements for control over land resources may also play a major role in concentration of land on large farms. Rental contracts for land are generally easier and faster than land purchases. Renting, therefore, allows farmers to respond to commodity price increases more readily than if they purchased the land.

## Sales Classes

I adjusted farm numbers, sales, and land use in eight sales classes reported by the census of agriculture to examine structural change. Appendix tables 1-6 show the complete distribution of farm numbers, sales, and land in farms. I then grouped farms into three constant-price sales classes (small, medium, and large) to simplify discussion (table 1). Except where noted, all sales classes are in constant 1969 farm prices. Comparing equivalent sales classes in 1969 and 1984 prices indicates that small does not necessarily mean tiny or hobby scale, and that the medium class includes a large portion of farms that are generally considered commercial operations.

### Large Farms

Sales exceed \$100,000 in 1969 prices. Farm income is likely the primary income source for operators and farm households in this class. Although generally classified as commercial farms, most (95 percent) large farms are owned and operated by farm families (8). On average, these farmers had incomes nine times the overall national average income for all households in 1969 (10, 13, 14, 15). These farmers were still well off in 1982 (their average incomes had declined to eight times the national average for all households), although their income had fallen substantially since 1969 and especially since 1974. Most farms in this class required at least one full-time operator, and many depended on hired labor at some time during the year.

### Medium Farms

Sales range from \$20,000 to \$99,999 in 1969 prices. Medium farms are in a transitional class in the sense that the composition of income shifted strongly from farm income toward off-farm income during the 1970's. The average net farm income in 1969 and 1974, with some supplementary off-farm income, was sufficient to support a household (8). By 1982, however, these farm households had become

**Table 1—Farm sales classes in 1969 and 1984 farm prices**

Sales class	Sales class ranges	
	1969 price intervals	1984 price intervals
	<i>Dollars</i>	
Small farms	2,500 to 19,999	5,920 to 47,330
Medium farms	20,000 to 99,999	47,331 to 234,299
Large farms	100,000 and over	234,300 and over

dependent on off-farm incomes that were almost twice as large as their net farm incomes. In 1982, most operators of medium farms were considered part-time farmers. Nonetheless, members in this class of farms are numerous and economically important.

### **Small Farms**

Sales range from \$2,500 to \$19,999 in 1969 prices. This diverse class includes households that have incomes well below the poverty level and households for which farming is a hobby rather than a significant source of income. Even in 1969, average farms

in this class had low farm income and off-farm income that was twice as large as farm income (8). By 1982, average farm income had become negative and off-farm income had greatly increased.

### **Using Constant Prices Instead of Nominal Prices**

Prices for agricultural products increased rapidly during the 1970's (11). These price increases were both inflationary and real (table 2). The difference between inflationary price increases and real price increases in agriculture depends on price changes in the rest of the economy. Increases in agricultural commodity prices are real when the agricultural

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## **Land Use**

Farmland is used intensively and extensively. These terms refer to the relative amount of inputs to products and commodities produced per acre of land. Intensively used land receives relatively large amounts of inputs such as irrigation water, fertilizers, chemicals, labor, and management. In return, intensively used land produces relatively high-value crops and crop products, such as grains, fruit, vegetables, and fiber. Extensively used land generally receives fewer purchased inputs and generally produces commodities with lower annual values. Some high-value commodities, such as select hardwood lumber, are produced on land in extensive use (forest land). However, these tree crops are harvested at such long intervals that the annualized value is relatively low.

### **Extensive Farmland Uses**

***Cropland pastured.*** Cropland used only for pastures or grazing, including rotation pasture and grazing land that could have been used for cropland without further improvements.

***Permanent pastureland and rangeland.*** Any pastureland and rangeland other than cropland and woodland that was pastured. This is a general category in that it includes huge tracts of desert, barren rock, and scrub brush.

***Woodland.*** Includes all farmland in woodlots and timber tracts and cutover and deforested land with young timber growth. Land in orchard crops is included in harvested cropland.

### **Intensive Farmland Uses**

***Harvested cropland.*** Includes all land from which crops were harvested or hay was cut, and all land in orchards, citrus groves, vineyards, and nursery and greenhouse products.

***Irrigated land.*** Includes irrigated harvested cropland, irrigated land from which hay was cut, land in bearing and nonbearing fruit and nut crops, pastureland and rangeland from which hay was not cropped, and cropland without crops. Irrigated land is less than 5 percent of the total land on farms but generally receives high input levels and is highly productive.

## **Land Tenure**

Land is either owned or used through some type of rental agreement. In looking at the changing structure of agriculture, it is helpful to examine changes in land tenure, which classifies land according to ownership/management attributes, such as farmland owned, rented in, and rented out.

***Farmland owned.*** Farmland owned by the farm operator.

***Land rented in.*** Land rented by the farm operator from other owners.

***Land rented out.*** Land rented to others by the farm operator.

Source: (12).

prices rise faster than other prices, such as prices for inputs to production, interest on loans for production costs, and prices for household goods and services. Increases in agricultural prices are simply inflationary when agricultural prices rise at the same rate as prices for other goods and services.

Inflation in agricultural prices can create a distorted profile of changes in the structure of agriculture. For example, unadjusted data from the census of agriculture show that farms in larger sales classes appeared to acquire land at an extremely rapid rate between 1969 and 1982. Inflation in prices resulted in farms with relatively constant physical production being placed in higher sales classes in successive censuses. In turn, the land these farms operated was reported as being located on farms in larger and larger sales classes. This report adjusts farm numbers, sales, and land for the effects of inflation.

## Structural Change

A complex but consistent picture of structural change in U.S. farmland emerges after adjusting for the effects of inflation. Absolute concentration of sales and relative concentration of total land on farms are evident, though at levels that are substantially lower than are apparent without adjusting for inflation. Sales per acre increased much more rapidly on large farms than on smaller farms; sales per acre on medium farms actually decreased substantially in the 1969-82 period.

Concentration of land in specific uses occurred for the two intensive land use categories: irrigated land and harvested cropland. If large and medium farms continue acquiring harvested cropland at the same average rate as between 1974 and 1982, large farms will have as much harvested cropland as medium farms by 2006. A trend toward concentration of non-intensive farmland categories is not evident. In general, the concentration rate of sales on large farms was closely related to the concentration rate of land, especially harvested cropland and irrigated land.

**Table 2—Price indexes normalized to 1969 levels**

Year	All prices received by farmers	All prices paid by farmers	All crops	All livestock products	Interest rates paid by farmers
<i>Index (1969 = 100)</i>					
1974	178	153	234	140	186
1978	195	204	210	185	334
1982	225	296	242	199	689

Dramatic changes in the structure of land tenure are also evident. The trend toward concentration of land rented and land owned on large farms is strong. Also, changes in land rented appear to be the means by which structure rapidly changes.

## Concentration of Sales

Changes in shares of sales are much larger when sales are not adjusted for inflation. However, changes in sales were substantial even after adjusting for inflation. Large farms (constant-price sales class) more than doubled their share of sales between 1969 and 1982 (table 3). Medium and small farms both decreased to less than half their 1969 share of sales by 1982. Changes in shares without adjusting for inflation would be much larger.

## Concentration of Farmland

Land has not concentrated on large farms to the same extent as have sales. Land on farms is the most inclusive measure of farmland and includes all farmland types reported by farm operators in the census of agriculture. Concentration on large farms is substantial relative to medium and small farms when land on farms is viewed in nominal-price sales classes (table 4). The share of land held by large farms in the nominal-price class increased from 19 to 49 percent between 1969 and 1982. The share of land on medium farms in the nominal-price sales class decreased from 46 to 36 percent. However, the apparent increase in farmland on large farms in the nominal-price sales class is largely illusory. That is, the increase is due more to inflation in farm prices than shifts in shares of land among farms in different constant-price sales classes.

When land on farms is viewed in constant-price sales classes, it is evident that large farms did not increase

**Table 3—Share of sales and change in shares by constant-price and nominal-price sales classes**

Sales class	Share of sales				Change in share, 1969-82
	1969	1974	1978	1982	
<i>Percent</i>					
Constant-price (1969 prices):					
Small	22	16	13	10	-54
Medium	43	31	26	20	-54
Large	34	53	61	70	103
Nominal-price:					
Small	16	9	7	5	-69
Medium	58	36	30	22	-62
Large	26	54	63	73	185

their land share relative to medium farms. But, large farms did increase their land share relative to small farms (table 4). The share of farmland on small farms dropped 31 percent from 1969 to 1982. The share of land on medium farms stayed relatively constant at about 45 percent, while the share on large farms increased from 19 to 28 percent. Large farms are acquiring land faster than medium farms, but the actual rate of land concentration on large farms is much lower than it would be without adjusting for inflation. If large and medium farms continue acquiring farmland at the same rate as during 1974-82, large farms will have as much land as medium farms by 2001.

### Changes in Sales per Acre

While large farms almost doubled their constant-price sales per acre from \$87 to \$168 between 1969 and 1982, sales per acre on medium farms decreased substantially (table 5). Total constant-price sales per acre of land on constant-price sales class farms are crude measures of land productivity because they lump together all farmland types and agricultural production. Nonetheless, this measure shows that there are important differences between medium and large farms with respect to constant-price sales per acre over time.

Constant-price sales per acre of land on small farms were about the same in 1982 as in 1969. Land on small farms has generally decreased in proportion to their decrease in sales. But, there is no evidence at this level of aggregation that decreases in the land on small farms have resulted in higher sales per acre. Sales per acre on medium farms have also decreased to the point that they equaled sales per acre on small farms in 1982. This general decline in sales per acre on medium farms, combined with the strong sales concentration on large farms, may increase the rate that land is concentrated on large farms.

**Table 4—Share of land on farms by nominal-price and constant-price sales classes**

Sales class	1969	1974	1978	1982
	<i>Percent</i>			
Nominal-price:				
Small	39	24	19	16
Medium	43	45	41	36
Large	19	31	40	49
Constant-price (1969 prices):				
Small	39	38	31	27
Medium	43	44	46	46
Large	19	18	23	28

### Changes in Farmland Use

The way land was used on farms changed significantly between 1969 and 1982, and each sales class had different patterns of change. This section examines concentration of land use by sales class, rates of structural change by land use types, and net changes in land use by sales class in particular census intervals. Five major land use categories are considered: harvested cropland, permanent pastureland and rangeland, cropland pastured, wooded farmland, and irrigated land (see box for land use definitions).

### Concentration in Land Use

Separating total land on farms into the five land use categories shows that there is a concentration of irrigated land on large farms. Although medium farms hold nearly half the total land on farms, large farms have acquired over 54 percent of irrigated land (table 6). Irrigated land is 5 percent of total farmland, but it is the most intensively farmed and most productive category of land considered in this report. Medium farms retained the largest share of the two largest land use categories, harvested cropland and permanent pastureland and rangeland, between 1969 and 1982.

### Relative Changes in Land Use

Relative changes in land use appear to be related to relative changes in prices of commodities, the production of which is associated with a particular land use. For example, harvested cropland acreage increased on medium and large farms during the 1969-74 interval. Crop prices, adjusted for inflation, also increased during 1969-74. The number of acres in permanent pastureland and rangeland decreased on large farms, which could reflect changes in response to the decline in livestock prices relative to crop prices. Permanent pastureland and rangeland remained approximately the same on medium farms.

**Table 5—Constant-price sales per acre of land on farms by constant-price sales classes**

Constant-price sales class (1969 prices)	1969	1974	1978	1982
	<i>Dollars per acre</i>			
Small	27	20	25	26
Medium	48	34	32	27
Large	87	160	161	168

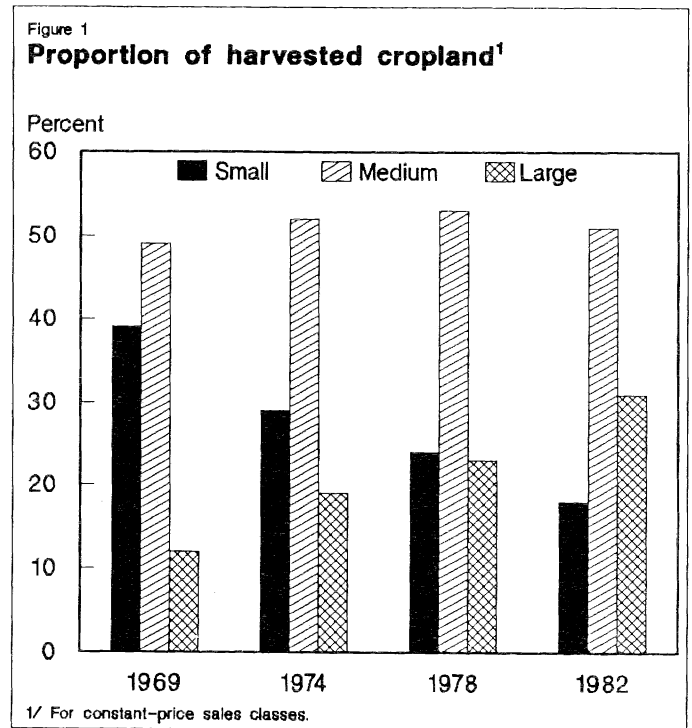
If large and medium farms continue acquiring harvested cropland at the same average rate as during 1974-82, large farms will have as much harvested cropland as medium farms by 2006 (appendix 2 describes the choice of base years for the projections). Harvested cropland acreage on medium and large farms has changed at different rates over the study period. Medium farms gained harvested cropland, but at a declining rate. Harvested cropland on medium farms decreased from 1978 to 1982. Large farms have consistently acquired more harvested cropland, with the largest increase occurring in 1978-82. If these rates of change continue, large farms may acquire the largest share of harvested cropland sometime before 2006 (see appendix 2).

Changes in the distribution of harvested cropland are important, because harvested cropland is the best general measure of productive cropland available for the three sales classes. The share of harvested cropland on small farms fell substantially, while the share on large farms grew substantially (fig. 1). The share on medium farms did not change significantly.

Changes in shares of land by land use highlight differences in structural change among the three sales classes (fig. 2). The distribution of land use on large and small farms underwent more change than that on medium farms. Harvested cropland acquired by large farms dominated these changes, with the largest percentage change in land in a particular use. Small farms lost their shares of all five land use categories, particularly the more productive and intensive land uses, harvested cropland and irrigated land. Medium farms had relatively little change in the share of land use. However, the

shares of extensive uses on medium farms, such as pastureland and rangeland, cropland pastured, and wooded farmland, increased more than the share of intensive uses. Medium farms lost shares of the most intensive land use, irrigated cropland.

Structural change in extensive land uses is less apparent (fig. 2). Large farms had little increase in shares of extensive land uses, except for cropland pastured. Small farms lost shares of land in extensive uses, while medium farms gained shares.



**Table 6—Share of land use by constant-price sales classes and land use categories, 1969 and 1982**

Constant-price sales class (1969 prices) and year	Land use categories				
	Intensive uses		Extensive uses		
	Harvested cropland	Irrigated cropland	Permanent pastureland and rangeland	Cropland pastured	Wooded farmland
<i>Percentage of land in category</i>					
<b>Small farms:</b>					
1969	39	20	27	59	56
1982	18	9	22	49	50
<b>Medium farms:</b>					
1969	49	45	42	34	33
1982	51	37	47	42	38
<b>Large farms:</b>					
1969	12	35	30	6	10
1982	31	54	31	9	12

## The Role of Land in Concentration of Sales

There are important differences in the relationship between changes in land use and changes in sales for each sales class (figs. 3-5). We cannot infer that land is converted from one use to another on farms in a sales class when the amount of land decreases in one use and increases in another. Net change in land in each category is known, but the mechanism of change is unknown and there is no information on conversion.

### Large Farms

Changes in the amount of land in different uses (the mix of land use) on large farms are more important than changes in total land on farms for understanding changes in sales on large farms. The simple correlation between sales concentration and farmland concentration on large farms between 1969 and 1982 is not apparent when change in sales and farmland is compared between census years. The largest increase in sales on large farms took place between 1969 and 1974, while farmland on large farms decreased by 13 percent (app. table 8). Farmland on large farms increased most in 1978-82, when the share of sales on large farms increased least (app. tables 9 and 11).

Changes in land use on large farms between 1969 and 1974 explain the paradox of increasing sales with decreasing land (fig. 5). Although total land on large farms decreased, harvested cropland on large

farms increased substantially while permanent pastureland and rangeland declined. The share of permanent pastureland and rangeland on large farms decreased 32 percent in 1969-74 (app. table 19). The 58-percent increase in the share of harvested cropland on large farms in 1969-74 (app. table 16) about equaled the 55-percent change in the share of total sales in the same period (app.

Figure 2  
Change in total land use, 1969-82<sup>1</sup>

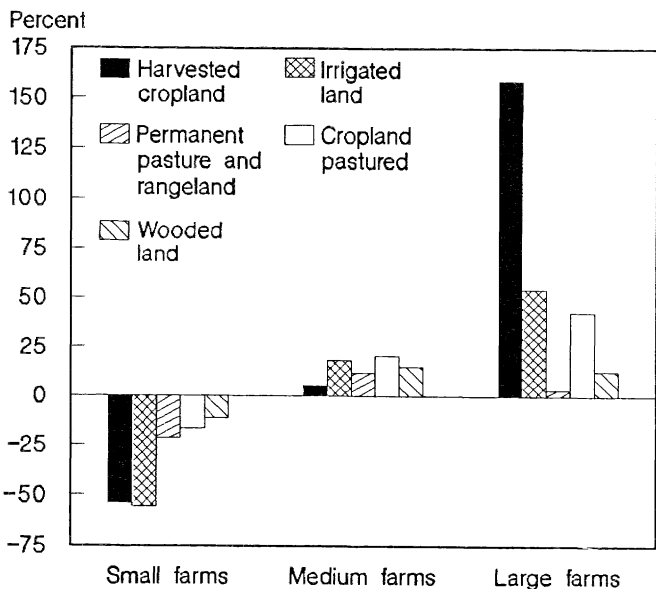


Figure 3  
Change in land use on small farms<sup>1</sup>

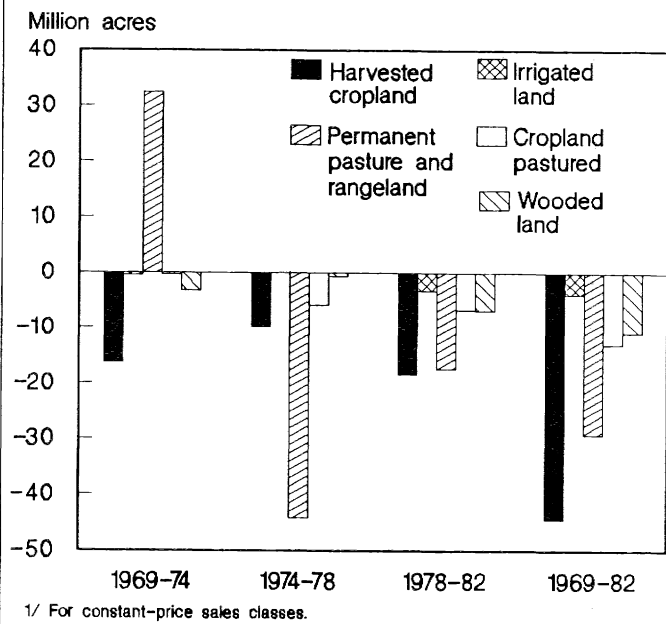


Figure 4  
Change in land use on medium farms<sup>1</sup>

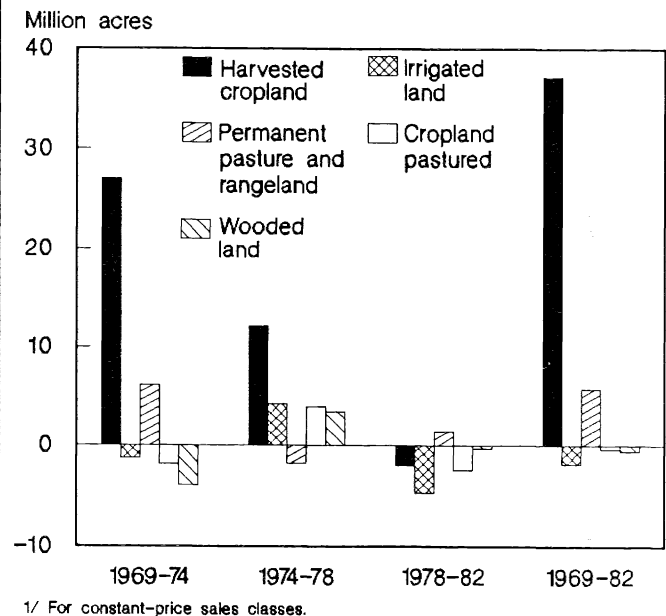


table 9). In other words, changes in the mix and distribution of land appear to have played an important role in sales concentration. The available data do not allow us to sort out exactly how increases in sales per acre and in harvested cropland contribute to increases in the share of sales on large farms. However, the increases in harvested cropland on large farms may account for most of the increased share of sales by large farms.

Changes in acreage in different uses also explain the apparent increase in sales per acre on large farms (table 5). The apparent increase in sales per acre was due to a large decrease in acreage in permanent pastureland and rangeland at the same time that harvested cropland increased: sales per acre for specific categories of land use did not change substantially.

The increase in sales per acre was smaller in 1978-82 than in 1969-74. The 38-percent increase in harvested cropland on large farms in 1978-82 (app. table 15) was accompanied by only a 22-percent increase in sales (app. table 8). Therefore, large farms may have acquired less productive cropland or farmed their land less intensively in 1978-82. It is likely that the substantial gains in sales and income by large farms in 1969-78 contributed to land acquisition by large farms in 1978-82.

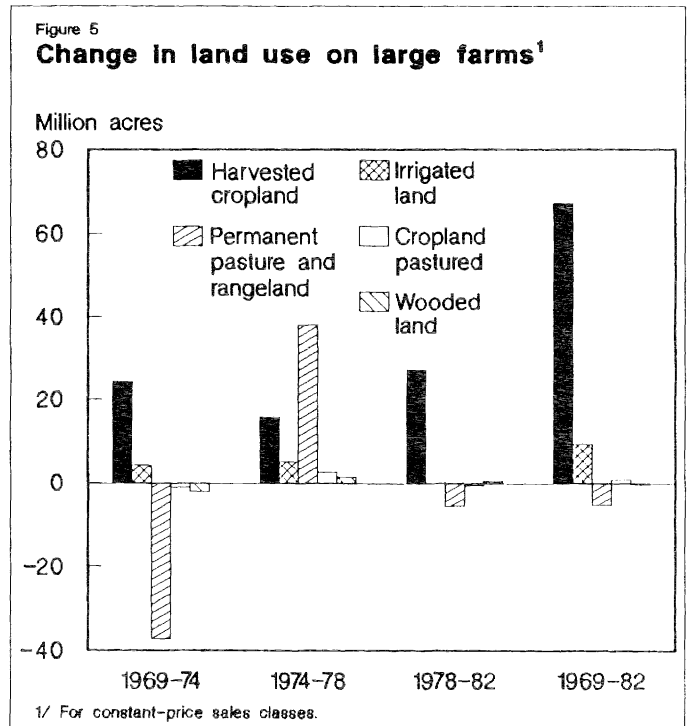
### Medium Farms

Harvested cropland increased 21 percent on medium farms between 1969 and 1974, while total sales decreased 27 percent (fig. 4 and app. table 8). There was a real shift in livestock production from medium farms to large farms in this period. Most livestock production on medium farms does not require extensive land use; feedlots and poultry and pig houses do not require much land in relative terms. The shift in production from medium to large farms, therefore, resulted in a large decrease in livestock sales from medium farms without a comparable shift in land.

Medium farms had the largest share of land on farms and the largest share of sales in 1969. However, sales from medium farms declined 39 percent between 1969 and 1982 (app. table 8). Acreage in different uses changed less on medium farms than on large and small farms, especially in 1978-82 (fig. 4).

### Small Farms

The overall picture for small farms is one of decline. Acreage in each land use category, except



permanent pastureland and rangeland, decreased on small farms in 1969-74 (fig. 3). Changes in relative prices have apparently had little effect on land use acreage on small farms. The one exception is contrary to the expected positive relationship between prices and land on farms: permanent pastureland and rangeland increased in 1969-74 at the same time that livestock prices fell sharply relative to crop prices.

### Changes in Land Tenure by Sales Class

Rented land accounts for about 45 percent of land on farms. Information on changes in land by tenure and sales class provides additional insight into structural change in land. Farmland often may be acquired more easily, cheaply, and rapidly by renting additional land than by buying it, especially during periods of tight credit and high interest rates. Therefore, changes in rented land acreage are likely to play an important role in structural change in land. This section reviews trends in acreage in land owned and land rented and the share of land rented as a percentage of land owned.

Small farms had the largest share of land owned by operators in 1969. By 1982, medium farms held the largest share of land owned (app. table 19). Small farms had the largest share of land rented out in both years.

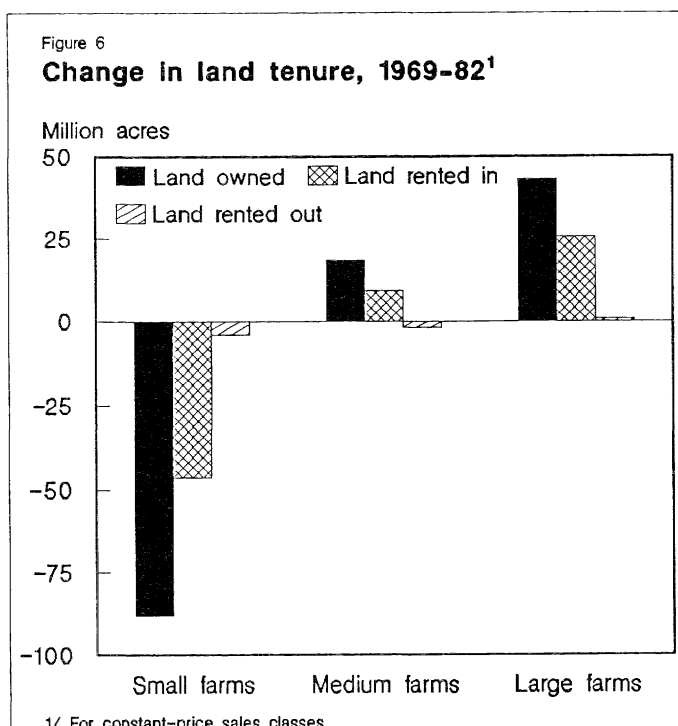
Although medium farms had the largest share of farmland owned and rented in, the two largest

tenure categories, those categories are becoming concentrated on large farms. Land owned and land rented on large farms increased at more than twice the rate as on medium farms (fig. 6).

Changes in land rented appear to be the means by which structure rapidly changes. Changes in land rented relative to changes in land owned were largest in the years in which increases in the amount and share of farmland on medium and large farms were largest (table 7). Both the increase in farmland acreage and the increase in acreage of rented land as a percentage of the change in acreage of land owned by medium farms were largest in 1974-78. Acreage of rented land on large farms formed a larger portion of land owned in 1969-74 and 1974-78, the years of the largest change in farmland, than in 1978-82, the years of the smallest change.

**Table 7—Change in rented land as a share of land owned**

Constant-price sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82	Percent				
Small	53	50	55	53					
Medium	17	185	120	50					
Large	74	85	36	59					



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## Appendix 1: Supplementary Tables

Appendix table 1—Number of farms by nominal-price sales classes

Sales class	1969	1974	1978	1982
	<i>Number</i>			
Small farms:				
\$2,500-4,999	357,922	257,263	300,699	278,208
\$5,000-9,999	390,425	296,373	314,088	281,802
\$10,000-19,999	395,472	310,011	299,215	259,007
Medium farms:				
\$20,000-39,999	330,992	321,771	299,175	248,825
\$40,000-99,999	169,695	324,310	360,093	332,751
Large farms:				
\$100,000-199,999	35,308	101,153	141,050	180,689
\$200,000-499,999	12,608	40,034	62,647	93,891
\$500,000 or over	4,079	11,412	18,453	27,800
Total	1,696,501	1,662,327	1,795,420	1,702,973

**Appendix table 2—Number of farms by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
	<i>Number</i>			
Small farms:				
\$2,500-4,999	357,922	173,912	226,217	236,321
\$5,000-9,999	390,425	360,612	329,730	246,808
\$10,000-19,999	395,472	345,830	335,149	291,991
Medium farms:				
\$20,000-39,999	330,992	254,185	261,425	253,165
\$40,000-99,999	169,695	189,601	219,569	209,153
Large farms:				
\$100,000-199,999	35,308	44,163	60,314	75,706
\$200,000-499,999	12,608	14,580	20,345	27,889
\$500,000 or over	4,079	3,990	5,126	6,357
Total	1,696,501	1,386,873	1,457,875	1,347,391

**Appendix table 3—Land on farms in nominal-price sales classes**

Sales class	1969	1974	1978	1982
	<i>1,000 acres</i>			
Small farms:				
\$2,500-4,999	75,868	53,342	37,289	30,721
\$5,000-9,999	106,832	65,728	55,537	45,124
\$10,000-19,999	171,209	102,408	84,158	64,838
Medium farms:				
\$20,000-39,999	207,286	160,706	133,076	101,254
\$40,000-99,999	185,285	246,640	245,240	213,537
Large farms:				
\$100,000-199,999	81,990	131,432	162,266	184,835
\$200,000-499,999	56,055	91,541	125,283	141,436
\$500,000 or over	33,787	53,844	89,530	103,590
Total	918,313	905,640	932,381	885,335

**Appendix table 4—Land on farms in constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
	<i>1,000 acres</i>			
Small farms:				
\$2,500-4,999	75,868	53,451	44,989	44,508
\$5,000-9,999	106,832	118,547	93,502	67,403
\$10,000-19,999	171,209	169,339	151,175	124,666
Medium farms:				
\$20,000-39,999	207,286	188,180	186,489	175,705
\$40,000-99,999	185,285	213,739	239,817	228,917
Large farms:				
\$100,000-199,999	81,990	85,059	111,276	132,081
\$200,000-499,999	56,055	49,416	65,249	71,653
\$500,000 or over	33,787	27,909	39,883	40,400
Total	918,313	905,640	932,381	885,335

**Appendix table 5—Sales of all commodities by nominal-price sales classes**

Sales class	1969	1974	1978	1982
<i>Million dollars</i>				
Farms with sales under \$2,500	916	697	705	558
Small farms:				
\$2,500-4,999	1,318	982	1,191	999
\$5,000-9,999	2,756	2,138	2,361	2,009
\$10,000-19,999	5,576	4,460	4,425	3,694
Medium farms:				
\$20,000-39,999	9,077	9,247	8,788	7,142
\$40,000-99,999	9,867	20,072	23,059	21,642
Large farms:				
\$100,000-199,999	4,647	13,758	19,477	25,101
\$200,000-499,999	3,582	11,636	18,302	27,681
\$500,000 or over	6,783	18,305	29,561	42,764
Total	44,521	81,295	107,869	131,590

**Appendix table 6—Sales of all commodities by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
<i>Million dollars</i>				
Farms with sales under \$2,500	916	463	495	402
Small farms:				
\$2,500-4,999	1,318	1,174	1,167	742
\$5,000-9,999	2,756	2,344	2,467	1,920
\$10,000-19,999	5,576	3,462	3,608	3,187
Medium farms:				
\$20,000-39,999	9,077	5,311	5,000	3,807
\$40,000-99,999	9,867	8,610	9,200	7,689
Large farms:				
\$100,000-199,999	4,647	4,923	5,902	6,322
\$200,000-499,999	3,582	3,999	4,744	5,367
\$500,000 or over	6,783	15,005	22,397	28,690
Total	44,521	45,289	54,980	58,127

**Appendix table 7—Total farm sales by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
<i>Billion dollars</i>				
Small farms, \$2,500-19,999	9.6	6.9	7.2	5.8
Medium farms, \$20,000-99,999	18.9	13.9	14.2	11.5
Large farms, \$100,000 and over	15.0	23.9	33.0	40.4
Total	43.6	44.8	54.5	57.7

**Appendix table 8—Change in total farm sales by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	-28	4	-19	-39
Medium farms, \$20,000-99,999	-27	2	-19	-39
Large farms, \$100,000 and over	59	38	22	169

**Appendix table 9—Change in the share of total farm sales by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	-30	-15	-24	-54
Medium farms, \$20,000-99,999	-29	-16	-24	-54
Large farms, \$100,000 and over	55	14	15	103

**Appendix table 10—Total land on farms by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
	<i>Million acres</i>			
Small farms, \$2,500-19,999	354	349	289	224
Medium farms, \$20,000-99,999	393	407	439	422
Large farms, \$100,000 and over	172	149	205	240
Total	918	906	932	885

**Appendix table 11—Change in the total land on farms by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	-1	-17	-23	-37
Medium farms, \$20,000-99,999	4	8	4	7
Large farms, \$100,000 and over	-13	38	17	40

**Appendix table 12—Number of farms by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
	<i>Number</i>			
Small farms, \$2,500-19,999	1,143,819	880,355	891,096	775,121
Medium farms, \$20,000-99,999	500,687	443,786	480,994	462,318
Large farms, \$100,000 and over	51,995	62,733	85,784	109,952

**Appendix table 13—Change in the number of farms by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	-23.0	1.2	-13.0	-32.2
Medium farms, \$20,000-99,999	-11.4	8.4	-3.9	-7.7
Large farms, \$100,000 and over	20.7	36.7	28.2	111.5

**Appendix table 14—Harvested cropland by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
	<i>1,000 acres</i>			
Small farms, \$2,500-19,999	102,975	86,634	76,843	58,460
Medium farms, \$20,000-99,999	127,302	154,320	166,471	164,457
Large farms, \$100,000 and over	30,860	55,180	70,873	98,096

**Appendix table 15—Change in the amount of harvested cropland by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	-15.9	-11.3	-23.9	-43.2
Medium farms, \$20,000-99,999	21.2	7.9	-1.2	29.2
Large farms, \$100,000 and over	78.8	28.4	38.4	217.9

**Appendix table 16—Change in the share of harvested cropland by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	-25.81	-16.40	-25.54	-53.82
Medium farms, \$20,000-99,999	6.90	1.68	-3.31	5.09
Large farms, \$100,000 and over	57.68	21.06	35.47	158.58

**Appendix table 17—Land in permanent pastureland and rangeland on farms by constant-price sales classes**

Sales class (1969 prices)	1969	1974	1978	1982
	<i>1,000 acres</i>			
Small farms, \$2,500-19,999	106,816	139,212	94,926	77,563
Medium farms, \$20,000-99,999	165,230	171,294	169,510	170,951
Large farms, \$100,000 and over	117,447	79,727	117,681	112,040

**Appendix table 18—Change in the share of permanent pastureland and rangeland on farms by constant-price sales classes**

Sales class (1969 prices)	1969-74	1974-78	1978-82	1969-82
	<i>Percent</i>			
Small farms, \$2,500-19,999	30.08	-30.36	-13.41	-21.56
Medium farms, \$20,000-99,999	3.47	1.06	6.88	11.77
Large farms, \$100,000 and over	-32.25	50.74	.90	3.05

**Appendix table 19—Share of land owned, rented in, and rented out by constant-price sales classes**

Sales class (1969 prices)	Farmland owned		Land rented in		Land rented out	
	1969	1982	1969	1982	1969	1982
	<i>Percent</i>					
Small farms, \$2,500-19,999	43	29	33	32	51	48
Medium farms, \$20,000-99,999	39	45	47	51	34	34
Large farms, \$100,000 and over	18	26	20	28	14	18

## Appendix 2: Method

This report examines structural change on farms by sales classes. The analysis also includes information on land use. Land use by sales class provides a measure of land use in an economic context. Land use and sales are considered in the same frame of reference, that of 1969 constant-price sales classes (adjusted for inflation). Prior studies that used constant-price sales classes to analyze farm numbers, sales, and income have not included information on land use. Integrating sales and land use in an economically consistent framework allows us to see the basic relationships between the distribution of sales and land use.

Previous studies of land use on farms have presented their findings in terms of acreage classes of farms as reported by the census of agriculture. However, farms are included in census acreage classes without regard to land use or land productivity. For example, large ranches consisting of grazing land with low to moderate sales volumes are in the same acreage classes as large cash grain farms and large irrigated vegetable farms with large sales volumes.

Grouping farms into sales classes organizes farms according to productive capacity. Acreage classes in the Corn Belt, for example, are relatively closely related to sales potential. However, the range of sales per acre of farmland is much higher in such regions as the West and South, where livestock or forestry dominate but where there is also high-value cropland. Sales classes are likely to be better units of analysis in these regions.

This report uses a longer time span than most other studies that use constant-price sales classes and, therefore, provides better insight into the process of structural change. For example, this report captures structural changes that occurred during the rapid price increases in the early 1970's and the lower price increases in the late 1970's and early 1980's.

This report adapts the Lin, Coffman, and Penn method to adjust farm numbers, sales, and acreage for inflation (3). The method is based on the relationship between the inverse cumulative distribution of farm numbers and the size of farm sales classes. The inverse cumulative distribution of farm numbers by sales classes is such that the number of farms in a given sales class is the sum of the farms that fall in that class and all farms with higher sales. There-

fore, the smallest sales class in the inverse cumulative distribution has the total number of U.S. farms, while the highest sales class has only the number of farms that actually had sales at that level. The inverse cumulative distribution of farm numbers is inversely related to the size of the sales classes; that is, the number of farms decreases as the size of sales class increases (for example, \$10,000-19,999 being larger than \$20,000-29,999, and so on). This relationship is hypothesized to be well represented by a polynomial regression equation.

Equation 1 estimates two polynomial regression equations with the same functional form for each census period. For example, to compute the amount of adjustment for farm numbers in 1974, the analyst must first regress the inverse cumulative distribution of farm numbers in 1974 on the nominal lower bounds of sales classes (the price change factor,  $I_y = 1$ ). Then, the same distribution of farm numbers must be regressed again on a set of sales class bounds that have been shifted by a price change factor ( $I_y$ ) proportional to the amount of inflation in agricultural prices between 1969 and 1974.

$$FNA_y(L) = I_n \alpha + \sum_{u=1}^N \beta_u (I_n L \cdot I_y)^u \quad (1)$$

$FNA_y(L)$  = Inverse cumulative number of farms that had sales in excess of  $L$  in a census year ( $y$ )

$L$  = Lower bound of a census sales class in nominal prices

$N$  = Degree of polynomial function

$I_y$  = Deflation (inflation) adjustment factor; the ratio of the index of prices in the base year to the census year ( $y$ )

$\alpha, \beta$  = Parameters of the distribution

The two estimated distributions are then compared with each other to estimate the net change due to price changes (equation 2). Subtraction of the distribution of net changes in farm numbers due to price changes from the nominal-price distribution of farms produces an estimate of the constant-price number of farms.

$$\begin{aligned} \text{Net change} & \\ \text{due to price} & \\ \text{changes} & = \text{Gain due to} \quad \text{Loss due to} \\ & = \text{price changes} - \text{price changes} \quad (2) \\ & \quad (NB_n - NA_n)_y \quad - \quad (NB_{n+1} - NA_{n+1})_y \end{aligned}$$

NB = Estimated number of farms in sales class n, in year y prices

NA = Estimated number of farms in sales class n in year y, in base year prices

n, n + 1 = Sales class, the next higher sales class

This report extends the Lin, Coffman, and Penn method by adjusting estimates of sales, land in tenure, and land use categories based on the assumption that these attributes can be shifted in proportion to the shift in farm numbers resulting from the adjustment method. Extension of the adjustment method of sales, land use, and tenure attributes has been shown to be accurate in comparison with constant-price class data on total sales for 1974-82 derived from direct reclassification of census farm records (5). Each land use and land tenure category in this report has been adjusted independently using separate distributions of farms. For example, the number of farms with harvested acreage is adjusted independently from the number of farms with land rented-out to other operators.

Estimation of the actual number of adjusted acres requires an additional reconciliation step. The total number of adjusted acres for each year is reconciled with the total number of unadjusted acres by multiplying the number of adjusted acres in each class by the ratio of the adjusted and unadjusted totals. This is generally necessary since the total number of acres on farms has decreased as much as the total number of farms in constant-price terms. The

total number of unadjusted acres used as the basis for the reconciliation is reduced in proportion to the higher nominal lower bound on the small sales class for 1974, 1978, and 1982. This exclusion of acreage results from the fact that the real lower bound of \$2,500 in 1969 prices corresponds with a higher nominal lower bound in the subsequent years. The index of all prices received by farmers was used as the index for adjustments of farm numbers for farms with each land use, land tenure category, and total sales.

Farm numbers cannot be adjusted to compensate for deflation as well as they can be adjusted for inflation. Adjustments that inflate farm numbers in earlier years (for example, using 1982 constant prices) require that farms enter the estimated distribution in a regression relationship from the lower end of the distribution of farm numbers. However, the distribution of farms below the lower bound of the farm definition (\$2,500 in nominal sales) does not follow the fitted relationship accurately. Use of a specification that requires introduction of low-sales-class farms into the overall distribution of farms can affect the whole distribution of farms, since the bulk of farms are located at the lower sales class end of the distribution. This report uses 1969 as the base year. Farm numbers in subsequent years are, therefore, shifted toward the lower bound of the distribution (and over that bound to some extent). This downward shift avoids the extrapolation of the relationship between sales classes and farm numbers into an area of high uncertainty. Using 1969 as the base year yields the most accurate results. But readers may want to interpret the farm size categories in terms of current price levels in order to put the information into the perspective of current farm sizes. For example, table 1 shows farm sales classes in both 1969 and 1984 farm prices.



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