

# 2.

## *Changes in the Structure and Organization of Agriculture*

THE PROCESS of economic development is characterized by technological change, capital accumulation and improvements in managerial and labor skills.<sup>1</sup> Improved technology introduces new and improved inputs which have high productivity relative to conventional resources. Consequent structural changes in resource demand and production functions increase the supply of products. In industries such as agriculture characterized by a low elasticity of commodity demand, the increasing product supplies depress prices and signal the need to transfer resources from agriculture to other sectors. If resource supply conditions permit rapid introduction of highly profitable and productive capital inputs and prohibit rapid outmovement of less productive resources such as labor, returns to the latter may be chronically depressed. Also, conditions associated with economic development and structural change create pressures for farm consolidation. In this chapter a descriptive summary is presented of the substitution of capital for labor, increased productivity, changes in factor returns and other characteristics of agriculture in a growing economy.

### OUTPUT AND PRODUCTIVITY

Physical productivity of agricultural resources has increased rapidly since the mid-1930's. Even in earlier periods, output increased. However, differences exist between earlier and recent periods in two major aspects: (a) the rate of growth in output was much more rapid after 1935 than for the previous 60 years, and (b) a marked increase in the average productivity per unit of resource took place after 1935. Before this, growth in output was accompanied by a growth in total farm inputs, the rate for the latter being only slightly smaller than the rate for the former. Since 1935, however, the increase in aggregate inputs has been slight while the growth in output has been great. The result has been a sharp upturn in average productivity of inputs. These facts are illustrated in Figure 2.1 for the period 1870-1961. Output grew

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<sup>1</sup>See Heady, Earl O. *Agricultural Policy Under Economic Development*. Iowa State University Press. Ames. 1962. Chap. 2.

## CHANGES IN AGRICULTURE

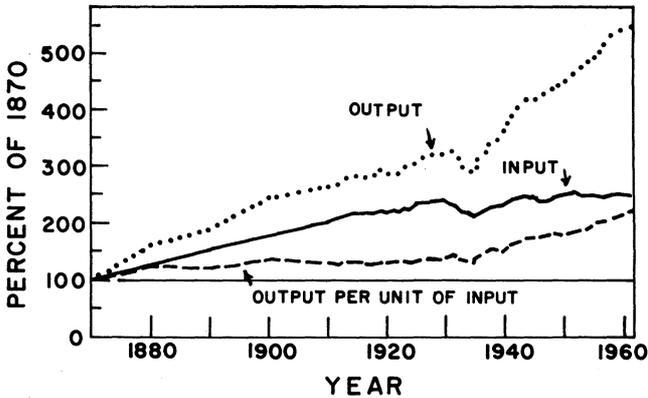


Figure 2.1. Trends in aggregate output, input and resource productivity for U.S. agriculture, 1870-1961. (Source: Based on USDA Tech. Bul. 1238 and USDA Stat. Bul. 233.)

quite rapidly up to 1900. This was a period in which demand conditions favored growth in farm output and slow rates of technological improvement encouraged use of more total resources in agriculture. Labor, land and capital were drawn into agriculture as a means of extending output to match demand growth. The supply of new land furnished agriculture was quite restrained, however, and growth in inputs stemmed largely from the increase in the farm labor force and in capital used.

Labor employment reached its peak around 1920, a time when land had become largely a fixed restraint. Total inputs still increased up to 1930, at somewhat the earlier rate. Capital representing new technology evidently was added in amounts to offset small reductions in the work force. Following 1930, inputs dropped somewhat as the depression caused some labor to flow back into agriculture but new capital investment declined greatly. With recovery and World War II, asset accumulation and relative prices of farm products and resources caused a large growth in nonreal estate capital items and a decline in labor used in agriculture. Since 1940, increase in inputs has been very slight, with the addition of capital inputs representing new technology being almost offset by the decline in labor inputs.

With relative constancy in inputs since 1940 and an accentuated growth in output, productivity per unit of input has grown rapidly. With output growing by 55 percent and input by only 5 percent, output per unit of input increased by nearly 45 percent between 1940 and 1961. Growth in productivity per unit of input was greater in agriculture than for the average of nonfarm sectors over the period 1929-57; productivity nearly doubled for agriculture and increased by 75 percent for the nonfarm economy.<sup>2</sup>

<sup>2</sup>Cf. Historical Statistics of the United States; Colonial Times to 1957. Bureau of the Census. Washington. 1960. P. 599.

## FACTOR LEVELS AND PROPORTIONS

Table 2.1 indicates the tremendous growth in farm capital inputs since 1910. Only two major input categories declined in magnitude. While labor continued to increase up to 1920, input of this resource was more than halved over the next 40 years. While it declined slightly after 1930, cropland input has remained highly stable as compared to other input categories. Decline in cropland would have been even greater in the absence of price support programs, growing public stocks and special foreign disposal programs. It has been estimated that the nation's food needs can be attained in 1980 with a further reduction of 10 percent, 51 million acres, in cropland.<sup>3</sup> Except for buildings, the capital items included in Table 2.1 increased by several hundred percent between 1910 and 1960. Even with an increase in total farm output, farm consolidation lessened building needs and growing farm size allowed better attainment of scale economies associated with this capital resource.

The categories of inputs shown in Table 2.1 are broad aggregates. Changes for individual capital were even more extreme. Capital items such as feed additives, weed-killing chemicals and others had tremendous growth rates even in the last 10 years. Similarly, other forms such as horses and open-pollinated seed corn declined at nearly parallel rates. In mix of agricultural resources, the major change has been

Table 2.1. Index of Major Categories of Inputs for Selected Years, 1910-1960, U.S. (1947-49 = 100)\*

Resource Category	1910	1920	1930	1940	1950	1960
Farm labor	135	143	137	122	90	62
Machinery and power	28	44	55	58	118	142
Farm buildings †	99	116	111	98	106	128
Fertilizer and lime	20	28	36	48	118	192
Tractors	†	9	32	55	119	133
Combines	†	1	12	37	137	205
Cornpickers	†	†	17	36	151	251
Feed, seed and livestock purchased	22	32	37	63	101	149
Miscellaneous capital operating items	71	85	96	93	108	138
Cropland	87	95	103	100	100	92

\*USDA Stat. Bul. 233. 1961.

† Index of value of farm buildings is based on census enumerations and includes the farm dwelling.

‡ Less than 1.0.

<sup>3</sup>Cochrane, W. W. Needs for products of land and water. USDA. Mimeo. 1962.

in growth of the capital/labor ratio. This ratio has increased both because of growth in capital and decline in the farm work force. As indicated in Table 2.2, land input per person employed in agriculture has increased by 150 percent from 1910 to 1960 and by 70 percent from 1940 to 1960. This trend has continued at an accelerated pace as mechanization has allowed each worker to handle more acres and as farms too small for efficient utilization of labor, even under earlier technology, have disappeared.

Table 2.2. Magnitude of the Farm Labor Force, Land, Assets and Related Resource Quantities, 1910-60, U.S.\*

Item	1910	1920	1930	1940	1950	1960
Work force (mil.)	13.6	13.4	12.5	11.0	9.9	7.1
Man-hours used (bil.)	22.5	24.0	22.9	20.5	15.1	10.3
Total land in farms (mil. acres)	879	956	989	1060	1159	1158
Value of production assets						
Current dollars (bil. \$)	†	†	†	38.7	95.9	156.8
1947-49 dollars (bil. \$)	†	†	†	83.3	95.9	107.8
Acres per worker	64.6	71.3	76.5	96.4	117.1	163.1
Value of productive assets per worker (\$)						
Current dollars	†	†	†	3413	9625	21235
1947-49 dollars	†	†	†	7347	9625	14599
Capital input per labor input (\$)	.87	1.00	1.17	1.41	2.41	3.96

\*USDA Agr. Info. Bul. 232. 1961.

†Not available.

The rate of increase in capital per worker has been even more rapid than for land acreage. Physical capital per worker more than doubled between 1940 and 1960 while value of capital per worker increased by nearly seven times. In terms of annual capital input (including real estate) per unit of labor input, the ratio of 1960 was 4.5 times that of 1910 and 2.8 times that of 1940. The annual value of capital inputs began to exceed that of labor inputs by 1920 and the ratio is expected to continue increasing rapidly with further economic development.

The sum effect of alteration in demand by farms for resources, of course, results in a great change in the proportion of total inputs furnished by particular resource categories. Figure 2.2 emphasizes how these proportions have changed for some resource categories in a period of less than 20 years for U.S. farming. The percentage contribution of labor was almost halved in this period while that of items such as machinery, purchased seeds and fertilizer more than doubled. Over a longer period, 1910-60, as illustrated in Table 2.2, the relative value of inputs furnished by the aggregate categories of labor and capital have largely reversed positions, while land has remained almost constant.

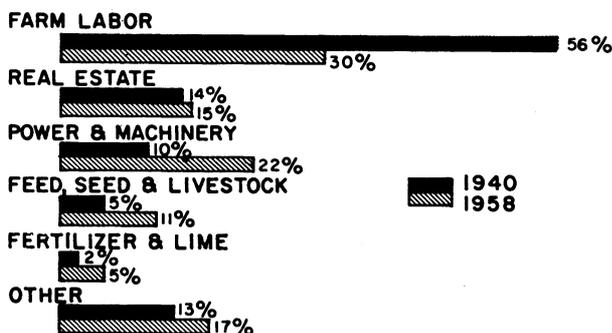


Figure 2.2. Major input groups as a percent of total inputs for the U.S., 1940 and 1958. (Source: USDA.)

These figures again emphasize the extent to which technical and economic development have caused the position of the dominant agricultural resource to shift from labor to capital.

#### Farm Size and Numbers

With American farming still centered around the farm family, and particularly the labor of the farm operator, the increase in ratio of capital and land per worker has been paralleled by a large increase in farm size. The average acreage of all census farms increased by 70 percent between 1940 and 1960 (Table 2.3). The acreage increased by a similar percentage for all commercial farms. Decline in number of farms has been greatest for units too small to (a) provide an adequate family income and (b) realize scale economies from mechanization. The number of farms less than 100 acres in size nearly halved between 1940 and 1960 while the number of all farms decreased by only a third. Similarly, mortality was greatest for farms operated by nonwhite persons, most of these being share-cropper or similar farms providing low family income. As a result of both (a) inflation and (b) increased physical volume encouraged by income pressure and scale economies, the number of farms with sales of \$10,000 and over increased rapidly between 1940 and 1960. The number with sales of less than \$10,000 decreased by a similarly rapid rate. The rate of decline in farm numbers also was greatest in the South where units generally have been small and family income has been low.

Further change in farm size has several possible implications in the use of, and demand for, resources in agriculture. Obviously, decline in farm numbers will be accompanied by further reduction in the work force, especially if farms which add acreage are those with an underemployment of labor and a surplus capacity of farm machinery. For example, studies by Heady and Hoffmann indicate that in a commercial farming area such as southwest Iowa, farm consolidation can

Table 2.3. Numbers and Sizes of Farms, 1910-60, U.S.,  
by Indicated Classes\*

Item	1910	1920	1930	1940	1950	1960
Number of all farms, U.S. (1000)	6,362	6,448	6,289	6,096	5,382	3,704
With white operators	5,441	5,498	5,373	5,378	4,801	3,422
With nonwhite operators	921	950	916	719	581	282 †
In the South	3,097	3,206	3,223	3,007	2,652	1,646
Rest of U.S.	3,265	3,242	2,966	3,089	2,730	2,058
Under 50 acres	2,254	2,300	2,417	2,286	1,863	1,051
Under 100 acres	3,692	3,775	3,792	3,577	2,911	1,708
Under 260 acres	5,369	5,839	5,597	5,373	4,601	2,897
20 acres and over	4,108	4,148	3,872	3,810	3,519	2,646
100 acres and over	2,670	2,673	2,497	2,286	2,222	1,995
260 acres and over	693	619	692	724	781	807
With sales of \$10,000 and over	‡	‡	252	312	484	794
With sales less than \$10,000	‡	‡	6,037	5,784	3,138	1,582
Acres per farm, U.S.						
All farms	147	137	157	174	215	302
Commercial farms	‡	‡	‡	220	300	371

\*U.S. Census, printed in year reported and enumerated in previous year.

† Estimated from number of nonwhite operators in the South.

‡ Not available.

take place with only a slight increment of labor by farms which add land and a complete replacement of the operator labor on farms being consolidated.<sup>4</sup> But other changes in resource demand also are posed. Consolidating farms have relatively "largest demand" for land and its biological capital complements such as seed and fertilizer. The demand of the consolidating farm simply replaces that of the liquidating farm for land and, to an important extent, for items such as seed. Since remaining operators, as compared to those who leave agriculture, often are better blessed with management and capital, they tend to use more fertilizer per acre. However, their investment in machinery need not correspond with their additions of land. The Iowa study shows that after consolidation the total machinery investment is less than for the two sets of farms before consolidation.

During the period 1944-54, U.S. farmers purchased \$24 billion in new machinery, power and equipment. The net investment was \$7

<sup>4</sup> See Hoffmann, R. A., and Heady, Earl O. Production, income and resource changes from farm consolidation. Iowa Agr. Exp. Sta. Bul. 502. Ames. Feb. 1962.

billion, since depreciation charges on old equipment were \$17 billion. In 1954, however, the depreciation on machinery began to exceed addition through purchases, suggesting not a net increment but a slight decline in machinery, power and equipment investment.<sup>5</sup> An important reason why individual farms have added acreage since 1940 has been that of using existing machinery, equipment and labor more effectively. Thus as some farms are absorbed by others, output tends to increase with the use of more inputs such as fertilizer, but with smaller inputs of machinery and labor on the combined unit. Consequently, in aggregate effect, resources such as the former are substituted for categories such as the latter. Also, substitutions may take place within categories such as machinery and equipment. The Iowa consolidation study showed a net addition expected in feed handling equipment but a decline in power and machinery for crop operations.

### Purchased Inputs

In a somewhat similar vein of substitution, economic development encourages specialization which, in turn, causes inputs produced off the farm to be substituted for those produced on the farm. Classical examples are tractors for horses, tractor fuel for horse feed, chemical fertilizers for manure and legume rotations, purchased seeds for farm-produced seeds, etc. These substitutions take place because the price declines and the productivity increases for inputs supplied from outside of agriculture, relative to their counterpart supplied from within the industry. Since favorable factor prices lead to mechanization and consequent scale economies, farming also moves in the direction of specialization. For techniques oriented towards labor, large enterprises have relatively small scale or cost advantages relative to small ones. Under high mechanization and its greater fixed costs, however, the scale of output over which per unit costs decline rapidly is extended, as compared to labor technology. Hence, within typical capital limitations, the commercial farmer is drawn to fewer enterprises and activities as a means of lowering unit costs, because of the higher fixed costs of mechanization. This development occurs only if the supply price of materials furnished to agriculture by outside sectors is favorable relative to the productivities of these same resources. Within the complex of economic development and factor prices which bring greater capital inputs to agriculture, a broader market results in scale economies for firms which process inputs. These nonfarm industries then

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<sup>5</sup>All of the above estimates are from Nikolitch Radoje, Farm Economies Research Service, USDA. The net extent to which farm consolidation changed the demand for machines (power and machinery reduction versus the addition of handling equipment) is yet to be established with certainty. Brewster and Wunderlich (*Adjustments in Agriculture - a National Basebook*. Iowa State University Press. Ames. 1961) show that net investment (purchases in excess of depreciation) reached a peak in 1954, then remained lower until 1960. These figures parallel our own calculations in later chapters.

can supply capital items such as chemicals, baby chicks and feed additives at lower real cost.

These developments lead to a greater commercialization of agriculture. Fewer inputs are represented by resources furnished directly by the farm and household and a greater proportion represent factors for which a market price is paid. At early stages in economic development, inputs are largely those represented by labor and land owned by the farm family, and by power, seed, feed and other items produced on the farm where used and which do not pass through the market. Under advanced stages of development, and under the conditions of resource pricing and supply discussed previously, the greatest proportion of inputs become those of capital. These are, under a capital-intensive structure, best produced at low cost in specialized firms outside of agriculture. Their volume then is sufficient to allow a more complete realization of inherent scale economies in producing a farm resource of particular quality and productivity.

Under these conditions of direct cash payment for inputs, farmers are expected to be more price responsive than under circumstances where most resources are family furnished and have only an indirect or implicit price. Even as late as 1910 (see Table 2.4) around two-thirds of all inputs used in agriculture were unpaid. By 1960, however, the percentage of unpaid or nonpurchased inputs had fallen to about a third of total inputs.

Increased demand for inputs furnished outside the farm and household is expected to continue as structural change in agriculture progresses further. An important element in decline of the proportion of nonpurchased inputs is the diminution in farm numbers and the agricultural labor force. Small farms depend relatively more on labor and less on capital than do large farms. Since the major reduction in farm numbers is among farms with small volume and inadequate income, the

Table 2.4. Percentage of Paid and Unpaid Inputs Used in American Farm Production, 1910-60\*

Year	Percentage of Total Inputs From:		
	Unpaid inputs	Paid inputs	All inputs
1910	60	40	100.0
1920	56	44	100.0
1930	53	47	100.0
1940	45	55	100.0
1950	35	65	100.0
1960	29	71	100.0

\*USDA Stat. Bul. No. 233. 1961, for basic input data. These figures are based on 1935-39 price weights. If 1947-49 price weights are used, the percent of unpaid inputs is estimated at 72, 67, 64, 54, 43 and 33 respectively for the years above.

amount of unpaid or low paid labor inputs will decline further. Labor released from small units combined with other undersized units, or even with more adequate ones, largely is replaced by machinery and other purchased mechanical inputs. While less apparent, labor also is replaced by biological capital such as fertilizer, improved seeds and livestock, pesticides, ration additives and others which increase output per acre or animal against a relatively fixed labor input per producing unit. Consequently, a given amount of food can be produced with less labor as more of these biological capital items are used. These capital items come largely from purchased sources and have an explicit price. Continued technical improvement through these capital materials also causes the proportion of unpaid inputs to decline.

The same shift and substitution also takes place between these biological capital materials and land. The new technologies increase yield per acre, so that a given output can be obtained from fewer acres. If consumer demand grows at a slower rate than the increase in farm productivity encouraged by these inputs, fewer acres of land are needed for crop production. With surplus land shifted to less intensive uses, as it would do more readily under agricultural policies differing from those of the 1940's and 1950's, the capital innovations mentioned above substitute for it. The proportion of total inputs from purchased sources increases accordingly.

### INCOME CLASS OF FARMS

The extent to which farms can still increase in size, as a method of reducing inadequate units, is suggested by the data of Table 2.5. These classifications, excluding part-time, residential and abnormal farms, indicate that in 1954 only 44 percent of U.S. farms produced over 90 percent of total sales. If only farms with sales exceeding \$5000 are included, less than 30 percent of all farms produced nearly 80 percent of

Table 2.5. Number and Percentage of Commercial Farms by Income Class (1000 Farms), 1954 and 1959\*

Class in Dollar Sales per Farm	1954			1959	
	Number of farms	Percent of farms†	Percent of industry sales†	Number of farms	Percent of farms†
\$10,000 and over	583	12.2	58.2	795	21.4
5,000 - 9,999	707	14.8	20.5	654	17.7
2,500 - 4,999	812	17.0	12.1	618	16.7
2,500 and less	1,225	25.7	7.1	348	9.4
Total	3,327	69.7	97.9	2,415	64.5

\*U.S. Census.

† Percent of all farms, including the noncommercial classes of part-time, residential and abnormal farms.

the nation's farm product sales. It has been estimated that in 1959 the 21.4 percent of all farms with sales over \$10,000 made more than 70 percent of the industry sales.<sup>6</sup> Farm numbers obviously could be cut by half or more, without material effect on the output of U.S. agriculture.

If reduction came from farms with less than \$5,000 in sales, total value of output could, starting from the 1954 distribution, be maintained with only an 8 percent increase in sales per farm. This slack and more exists over the total of farms with sales equal to \$5,000 or more. In fact, as pointed out previously, if land were relinquished by the one group and added by the other, it is likely that total output would be increased from total inputs of equal or smaller magnitude than formerly. But on a gross value of sales, even \$5,000 is too little to provide an adequate net income, or one consistent with the current stage of economic development and per capita income in the United States. With production expenses subtracted, sales of this magnitude leave a family income much smaller than the labor return from employment in other industries. With further time, knowledge and vocational guidance of farm children, few commercial farms with gross income of \$6,000 or less are likely to be maintained. Accordingly, farms will be even fewer and larger and will depend more on capital and purchased inputs. By 1960 (Table 2.6) a large proportion of farmland purchases was for consolidation purposes, and the percentage for these purposes was increasing.

These changes in farm size, associated with changes in the resource structure of farming, help relieve the low income and productivity problem which arises because of the small ratio of land and capital per unit of labor on many farms of the nation. Other than a few specialized fruit and vegetable farms, those which use an input mix

Table 2.6. Percent of Farm Land Transfers for Farm Enlargement, 1950-55 and 1960, by Regions and Type\*

Region and Type	1950-55 Average	1960
Northeast dairy	14	21
Lake states	16	31
Eastern cotton	26	37
Western cotton	30	46
General	19	29
Range livestock	31	47
Corn Belt	28	53
Wheat	48	69

\*USDA Outlook Charts, 1961.

<sup>6</sup> Estimate from Brewster, John. Changing organization of American farming. USDA Econ. Res. Serv. Mimeo. Oct. 1961.

Table 2.7. Distribution of Farm Families by Net Income Class, U.S., 1958\*

Net Family Income	Number Farm Families (1000)	Percent Farm Families	Percent Nonfarm Families	Farm Families as Percent of Nation
Under \$2,000	1,777	25	6	33
\$2,000 - 2,999	834	18	6	26
\$3,000 - 4,999	1,242	26	24	12
\$5,000 - 9,999	1,160	24	47	6
\$10,000 and over	336	7	17	5
Total	4,749	100	100	--

\*U.S. Dept. of Commerce.

based mainly on labor generally have low income. Farming possesses a disproportionate number of the nation's low-income families. Most of these low-income farm families are on undercapitalized and small units. As the data of Table 2.7 indicate, a fourth of farm families had incomes under \$2,000 in 1958 while 43 percent had incomes of less than \$3,000. Of total U.S. families with income less than \$2,000, a third were in agriculture.

These changes in farm size and composition do not threaten the U.S. structure of family farming, however. Hired labor has been declining at a slightly more rapid rate than family labor, leaving agriculture based more on the latter as machine capital substitutes for the former. Defining a family farm as one using less than 1.5 man-years of hired labor and "larger than family farms" as one using 1.5 man-years or more of labor, Brewster has arranged the figures in Table 2.8.<sup>7</sup>

Table 2.8. Classification of Commercial Farms by Family and "Larger Than Family" Units for Specified Years (1000)\*

Class of Commercial Farms	Number			Percent Change
	1949	1954	1959	1949-59
Family size				
Adequate	334	440	680	104
Inadequate	3,138	2,698	1,582	-50
Total	3,472	3,138	2,262	-35
Larger than family				
\$10,000 or more sales	150	142	114	-24
Less than \$10,000 sales	84	47	36	-57
Total	234	189	150	-36
All commercial farms	3,706	3,327	2,412	-35

\*See footnote 7 for source.

<sup>7</sup>Brewster, *ibid.*

Adequate family farms are those with over \$10,000 sales per year. Under this classification (except that adjustment still needs to be made for declining value of the dollar), the number of adequate family farms almost doubled between 1949 and 1959. Extending this criterion further, only 30 percent of family farms had increased to an "adequate stage" by 1959. In contrast, the number of "larger than family farms" decreased between both census periods.

#### CHANGES IN COMPOSITION AND LOCATION OF INPUTS

As previous data indicate, change in land inputs over the past several decades has not paralleled change in demand and use of labor and capital. The aggregate supply elasticity of land is, of course, much lower than for capital. Mobility of farm labor to other sectors is slower than for other nonfarm intersector transfers of this resource. Farm labor does, however, have long-run opportunity to migrate, not only to other economic sectors but also to other geographic sections of the country. Extended disparity of farm returns, as compared to other employment opportunities, has caused large-scale migration from farms since 1940. Similarly, capital items for agriculture also have high supply elasticity as compared to land in general. Capital fabricated at one location can be moved to other locations where demand is greater in agriculture. While some capital already in agriculture is "fixed" in the short run, it eventually becomes depreciated or obsolete and is supplied continuously to agriculture only if producer demand is sufficiently high. In contrast, land in aggregate has very low supply elasticity or opportunity for increasing its quantity.

Table 2.9 illustrates the differential adjustment which has taken place in land inputs for crop production by census regions. A large amount of land has moved out of production into less intensive and non-food crops such as forestry and into pasture in the Northeast, Appalachian, Delta, Southeast and Southern Plains regions. Land also has gone into urban and industrial uses, especially in the East. These changes have decreased land in farms by more than half in Massachusetts and Connecticut. Others of the states in Table 2.10 also had large losses of land to urban uses since 1900. Land for farming decreased by more than half for all of New England and by nearly half for the Middle Atlantic States.

Farm output and fertilizer inputs increased in all ten regions of Table 2.9. Labor used also decreased universally. Land in crops decreased in only five regions. Fertilizer and other capital inputs obviously serve as a substitute for both labor and land in all regions. The 1939 level of output could have been produced by using less land, as well as less labor, in all regions. Substitution of capital for land is not expressed directly and explicitly in any regions. In aggregate over the nation, however, use of more capital representing new technology increases output in some areas while marginal land goes out of crops or

Table 2.9. Percent Changes in Output and Major Input Categories by Regions, 1939 to 1960\*

Region	Total Output	Cropland Used for Crops	Plant Nutrients	Man-Hours of Labor
Northeast	42	-21	106	-49
Lake States	52	-3	1,379	-46
Corn Belt	59	8	1,146	-48
Appalachian	33	8	179	-49
Southeast	58	-34	164	-57
Delta	35	-25	339	-61
Southern Plains	60	-17	1,500	-55
Northern Plains	136	6	6,780	-46
Mountain	79	38	1,642	-39
Pacific	75	11	747	-56
U.S.	61	-6	314	-50

\*USDA Stat. Bul. No. 233, 1961. Figures are 1939-60 for all items but plant nutrients which are for 1939-59. Output data for Northern and Southern Plains in 1960 are slightly above trend line.

farming in other areas. The substitution takes place in fact for the nation, even if by round-about methods.

Regionally, the greatest change in farming structure has occurred and will continue in locations with the largest proportion of small, low-income farms and underemployed labor. The number of farms could be reduced by two-thirds in the Delta, Appalachian and Southeast regions,

Table 2.10. Land in Farms in Specified States and Regions (1000 Acres)\*

State or Region	1900	1920	1940	1960†
Massachusetts	3,147	2,494	1,938	1,142
Connecticut	2,312	1,899	1,512	884
New York	22,648	20,633	17,170	13,490
Pennsylvania	19,371	17,658	14,594	11,862
Virginia	19,908	18,561	16,445	13,126
West Virginia	10,655	9,570	8,909	6,063
North Carolina	22,749	20,022	18,845	15,886
Tennessee	20,342	19,511	18,493	16,081
New England	20,549	16,991	13,371	9,315
Middle Atlantic	44,860	40,573	33,639	26,731
South Atlantic	104,298	97,775	92,555	83,408

\*Statistical Abstract of the U.S. Volumes 44, 63, 71 and 82.

† Preliminary 1959 U.S. Census estimates.

without placing great pressure on national commodity supply. The problem of adjustments in this direction are, of course, those resting on resource supplies. On the one hand, many farm families continue to "supply" their labor to agriculture because they lack knowledge or skills for alternative employment, are reluctant to move to new locations and industrial experiences or lack funds for transfer. The supply of knowledge and funds is too high in price or is too low in elasticity to allow them to compete effectively for nonfarm employment and to reduce sufficiently the supply quantity of labor in agriculture. Accordingly, they stay in agriculture and maintain inadequate farm units which might otherwise be made available to their neighbors.

But many who will or should remain in farming find the supply price for credit and capital to be too high. Consequently, they cannot "effectively express demand" for additional land and other resources for

Table 2.11. Comparison of Inputs, 1937-41 and 1960, for Specified Types of Farms in the United States\*

Type of Farm and Location	Land (acres)		Labor (days)		Nonreal Estate Capital (dollars)		Power and Machinery (index, 1947-49=100)	
	1937-41	1960	1937-41	1960	1937-41	1960	1937-41	1960
Cotton								
So. Piedmont	158	214	526	440	1,010	3,550	54	140
Black Prairie, Tex.	140	190	475	284	1,580	5,840	61	111
High Plains, Tex.	258	426	431	316	2,530	8,450	78	115
Delta (small)	53†	58	375†	320	1,540†	3,690	100†	201
Peanut-cotton								
So. Coastal Plains	122†	177	404†	395	1,820†	4,500	100†	326
Poultry								
New Jersey	10†	10	590†	570	8,840†	8,880	100†	167
Corn Belt								
Hog-dairy	155	178	507	442	4,690	17,440	69	123
Hog-beef cow	181	249	328	350	3,540	15,900	70	145
Hog-steer	178	216	425	415	6,280	27,430	71	110
Cash grain	209	248	380	323	4,910	11,950	69	101
Dairy farms								
Central northeast	176	226	533	440	4,100	19,400	75	159
Eastern Wisconsin	115	146	578	415	3,720	17,150	42	117
Southern Minnesota	135	163	482	399	3,460	16,530	56	121
Tobacco								
Coastal Plain (large)	170†	170	1,084†	898	6,630†	8,310	100†	103
Coastal Plain (small)	50†	50	381†	335	1,900†	2,250	100†	102
Wheat								
Northern plains (stock)	497	715	340	281	3,420	16,720	51	123
Northern plains (corn)	427	515	374	354	3,220	19,000	44	106
Southern plains	586	773	272	304	2,860	17,610	57	117
Washington (pea)	416	576	389	347	6,600	21,280	73	120
Ranches								
Northern plains (cattle)	3,322	4,380	412	406	9,090	32,960	65	106
Intermountain (cattle)	1,573	1,735	487	521	14,050	53,060	84	128
Southwest (cattle)	8,316†	11,150	395†	371	26,460†	36,720	100†	149
Northern plains (sheep)	4,721	6,838	657	882	10,500	36,540	58	114

\*Farm costs and returns, USDA Agr. Info. Bul. 176. Washington. Revised, 1959; and USDA Agr. Info. Bul. 230. Washington. Revised, 1961.

†1947-49 average; estimates unavailable for 1937-41.

increasing productivity of these resources and for extending operations to attain greater scale economies and income. If these forces which condition resource supply and demand in low-income farming regions are lifted sufficiently, these same areas likely will have a proportionately greater change in farm organization during the period of 1960-80 than will those such as the Corn Belt, Lake States and Western regions.

Changes for typical farms scattered over the above regions are indicated in Table 2.11. Since these are farms which "remained in production," their changes are less extreme than the changes for entire regions where many small farms, not classified by type, shifted out of existence.

Important differences prevail between the adjustments of agriculture in aggregate and for individual farms. The data of Tables 2.9 and 2.11 cause the adjustment to appear much greater for the farm than for the regional sectors since the former includes all farms regardless of type, while the latter includes only "staying-in" farms. There are some changes which are much greater for the average of farms than for the industry — capital investment is an example. Aside from changes in land price, disappearance of one farm which is added to another may not cause acreage or investment to increase for the industry, but it does for the individual remaining farm. As an example of this difference, value of all farm assets (in constant 1947-49 dollars) used in production for the whole of U.S. agriculture increased by 29 percent or from 83.3 to 107.6 billion dollars in the period 1940-61. The per farm average for the nation increased by 85 percent or from \$13,118 to \$24,185 in the same period.

### REGIONAL CHANGES IN PRODUCTIVITY

Changes in productivity and resource use have taken place in all farming regions of the nation. As Tables 2.9, 2.10 and 2.11 suggest, adjustments in resource mixes have been by somewhat different proportions and directions. In all regions greater absolute amounts of capital are being used while smaller amounts of labor are employed. In all regions too, the ratio of capital to both land and labor is increasing. The capital/labor ratio is increasing faster than the capital/land ratio, because either (a) labor is decreasing rapidly while land is constant or increasing only slowly in some regions, or (b) labor is decreasing more rapidly than land in regions such as the Northeast, the Plains and the Southeast.

The substitution of capital for labor and land increases the average and marginal physical productivity of land and labor in all regions. While comparison between two discrete years gives rise to problems of trend deviation due to weather abnormalities, the comparison of productivity change between 1939 and 1960 in Table 2.12 suggests the gross magnitude of changes in land and labor productivity by regions as

## CHANGES IN AGRICULTURE

Table 2.12. Percent Increases in Crop Production per Acre and in Labor Productivity, U.S. by Regions, 1939 to 1960\*

Region	Crop Production per Acre	Labor Productivity
Northeast	47	178
Lake States	45	185
Corn Belt	43	206
Northern Plains	134	331
Appalachian	47	164
Southeast	70	276
Southern Plains	90	259
Mountain	39	189
Pacific	48	191
U.S.	52	225

\*Based on USDA Stat. Bul. 233. Revised July 1961.

altered by the resource mix. Yields in the Plains and Southern regions were abnormally high in 1960 due to favorable weather. In these very regions, however, labor productivity has increased rapidly due to the rapid (a) exodus of workers and (b) creation of farms with higher capital/labor ratios. No region lacked rapid growth in gross productivity of land and labor. As illustrated in Figure 2.3, average labor productivity for the United States has grown rapidly. Real estate productivity, including both land and improvements, has grown less rapidly because decline in land input has been relatively minute for the nation

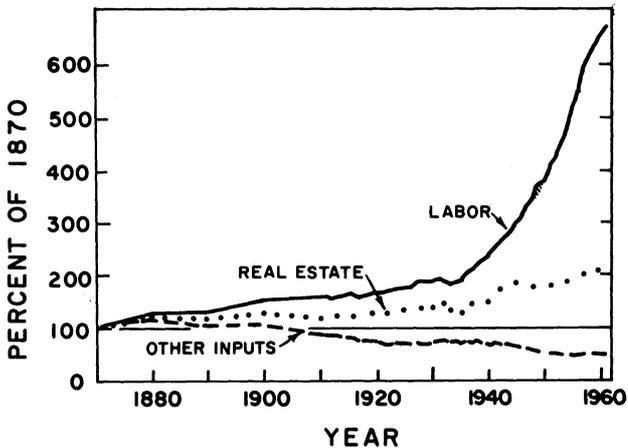


Figure 2.3. Average productivity of three farm resource categories, U.S., 1870-1961. (Source: Based on USDA Tech. Bul. 1238 and USDA Stat. Bul. 233.)

(improvements increasing slightly). Productivity of other inputs or capital items evidently has declined since 1900 as their use has been stepped up. For conventional types of inputs, such as capital, marginal and average productivity is expected to decline as their use is extended along a scale line or as they are substituted for other resources due to change in price relatives. On the other hand, highly productive capital investments representing innovations might be expected to increase the productivity of conventional capital items which remain in use. Evidently, however, declining productivity of capital due to its greater use may have dominated.

For two classical resource categories such as capital and labor (or land), Figure 2.4 can be used to illustrate a major source of the growth in gross productivity of labor. Lines  $q_1$ ,  $q_2$  and  $q_3$  are isoquants representing equal increments in output from the capital and labor production function. If only one resource is increased, its marginal and average productivity will decline. For example, if capital is increased by quantities denoted along the line  $c_2e$ , its incremental productivity decreases among the isoquants since  $\Delta q/be < \Delta q/ab$  where  $\Delta q$  is the constant increment in output. Increasing capital input, with labor input held constant at  $oc_2$ , raises average productivity of labor from  $q_1/oc_2$  to  $q_2/oc_2$  and then to  $q_3/oc_2$ . Its marginal productivity will increase accordingly, depending on the algebraic nature of the production function. A change of this nature, with labor constant, is hardly expected, however. More typical is a change in both factors due to a change in

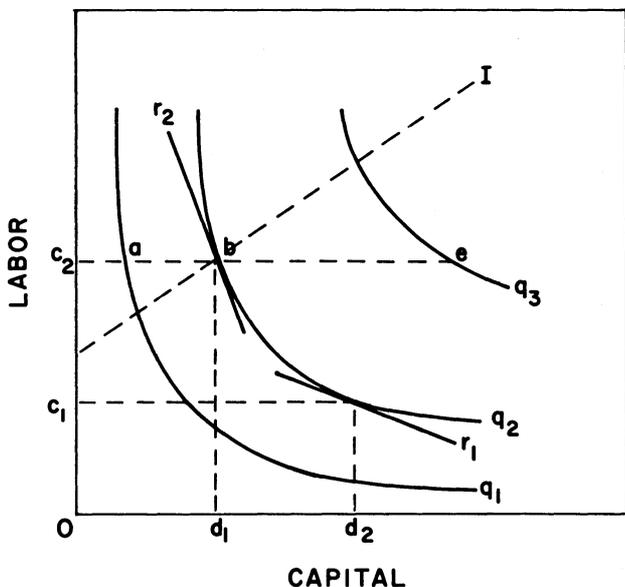


Figure 2.4. Effect of factor substitution on resource productivity.

the factor/factor price ratio, or in the factor/product price ratio. With a change in the factor price ratio to favor capital use, as represented by the slope of the isocost line  $r_1$  as compared to  $r_2$ , the resource combination theoretically would shift for an output of  $q_2$  level, from  $oc_2$  of labor and  $od_1$  of capital, to  $oc_1$  of the former and  $od_2$  of the latter. Average productivity then will decline from  $q_2/od_1$  to  $q_2/od_2$  for capital and increase from  $q_2/oc_2$  to  $q_2/oc_1$  for labor. (Generally, however, we might expect some "expansion effect" so that output would increase above  $q_2$  and capital input would extend beyond  $od_2$ , and labor might not fall to  $oc_1$ .) If only the product/factor price ratio increases, more of both factors would be used and physical productivity of both would decline. The substitution effect evidently has dominated the expansion effect, in causing labor and land productivity to increase and capital (aggregate) productivity to decrease.<sup>8</sup>

### SOURCES OF OUTPUT GROWTH

Growth in farm productivity can come from increased quantities or productivities of resources. The greater productivity arises under the realm of aggregate capital as one specific form of capital is substituted for another, or under the realm of aggregate labor where one specific skill of labor is substituted for another. Both sources of productivity change have occurred in U.S. agriculture. While approximate methods, rather than imputational procedures based on marginal productivities and elasticities, are used by Loomis and Barton (Table 2.13) they estimate that nearly the entire growth in farm output of recent years has come from increased productivity of general resource categories; the aggregate input having increased very little.<sup>9</sup> In contrast, most of the output increments of earlier decades is ascribed to greater inputs, with the productivity of inputs declining from 1910-20. Prior to 1870 an even greater proportion of output growth was attributable to input increase since, at this time, the land area of the nation was being increased and large increments in the farm labor force were bringing it into production. Evidently, even over the period 1911-20, the main increase in output was from use of more capital and labor, without major changes in the agricultural production function to boost input productivity. But after 1920, when a greater tempo in farm research and communication was attained in both the public and private sectors, the production function changed sufficiently to allow (a) given output with a smaller value-aggregated input, and (b) increased output to match population and

<sup>8</sup> Figure 2.4 refers to a "fixed production function." The production function also has changed with time, causing the slope of the isoquants to change in the direction of increased marginal rates of substitution of capital for labor. Changes in proportions of capital and labor, as the factor/product price ratio declines, will depend on the exact nature of the isoclines.

<sup>9</sup> Loomis, R. A., and Barton, G. T. Productivity of agriculture, United States, 1870-1958. USDA Tech. Bul. 1238. 1961.

Table 2.13. Sources and Percentage Rates of Change in U.S. Farm Output for Selection Periods\*

Period	Change in Output Imputed to:		Average Annual Rate of Change in:		
	Input quantity	Input productivity	Output	Input	Input productivity
1870-1911	72	28	2.45	1.77	.67
1911-20	129	-29	.70	.89	-.19
1920-39	16	84	1.08	.17	.91
1939-45	34	66	3.05	1.04	1.99
1945-50	49	51	.81	.40	.41
1950-56	-9	109	1.89	-.17	2.06
1939-56	22	78	1.98	.42	1.55
1911-56	31	69	1.34	.41	.93
1870-56	56	44	1.86	1.05	.80

\*Loomis and Barton, *ibid.* (See footnote 9.)

demand growth requiring only a modest increase, and perhaps even a decrease, in inputs. Through this increase in the output/input ratio, a change encouraged by national economic development and the change in configuration of consumer demand and relative factor supplies and prices, resources have been freed from agriculture in order that still greater growth can be experienced in nonfarm sectors. Had resource productivity in agriculture declined over the period 1911-61 as suggested for 1911-20, the industry would have had to add a large amount of resources (see Chapter 5), thus detracting from national economic development.

A more detailed and technical estimate of sources of increases in farm output is presented in Table 2.14. These imputations refer to specific resources, but technical change or innovation is embodied in each. From 1919 to 1940 the main source of output increase came from release of resources represented by farm-produce power and in the shift to resources representing tractors and their technical complements. After 1940 the main source was in the collection of capital resources representing new technology for crop production. In the later period, the second important source was the technology and specific resource changes adopted for livestock. Being more specific, the estimates suggest that the index points in yield increases for crops came roughly 10 percent from hybrid corn, 45 percent from fertilizer, 6 percent from irrigation and 37 percent from improved seeds, cultural practices and similar practices for all other crops.<sup>10</sup>

<sup>10</sup>Based on the midpoint of the range given by Durost and Barton, (see footnote to Table 2.14). For additional discussion of past sources and future potential for increasing farm output see Nelson, L. B. Physical potentials for crop production. Chap. 8. In Iowa State Center for Agricultural and Economic Development. Dynamics of Land Use - Needed Adjustments. Iowa State University Press. Ames. 1961.

Table 2.14. Average Annual Change in Index Points of Total Output and Percent Change in Total Output From Specified Sources, 1919-55 (1947-49 = 100)\*

Source of Change	Change in Index Points per Year		Percent of Total Output Increased Due to Source	
	1919-21 to 1938-40	1940-41 to 1955	1919-21 to 1938-40	1940-41 to 1955
Shift from farm to tractor power	.39	.44	51	23
Change in technology and product added livestock	.12	.47	15	25
Change in pasture consumed by livestock	.03	.04	4	2
Shift in use of cropland	-.03	.13	-4	7
Change in crop technology	<u>.26</u>	<u>.82</u>	<u>34</u>	<u>43</u>
Total change in index per year	.77	1.90	100	100

\*Based on Durost, D. D., and Barton, G. T. Changing sources and farm output. Prod. Res. Report No. 36. USDA 1960.

Returning to a more aggregate comparison, Figure 2.5 suggests the changing composition of inputs to produce a unit of output over the period 1935-60. These figures do not, of course, indicate changes in the portion of total product, or in portion of growth in total product, imputable to different resources. They suggest more nearly the relative changes for the particular resource in respect to its contribution to unit output, rather than the relative importance among inputs.

#### IMPACT OF FACTOR DEMAND STRUCTURE ON COMMUNITY SECTORS

Economic growth and change in the structure of an industry does not necessarily distribute gains and sacrifices of progress symmetrically over all resource and commodity groups which attach to this progress. Gaining directly are those who own or produce resources which increase in farm use because of changes in prices or marginal productivities which favor their use. Sacrificing as part of this progress are owners or producers of resources which decrease in magnitude because price ratios and substitution ratios change, causing the demand for particular inputs to decline. In this complex of those who benefit and sacrifice also are farmers and the nation's consuming society in a market characterized by (a) commodity supply growing more rapidly than commodity demand and (b) a low short-run supply elasticity of selected resources in agriculture. Under these conditions, and with low price elasticity of demand as in agriculture, revenue of agriculture declines but the total real cost of food is lessened for

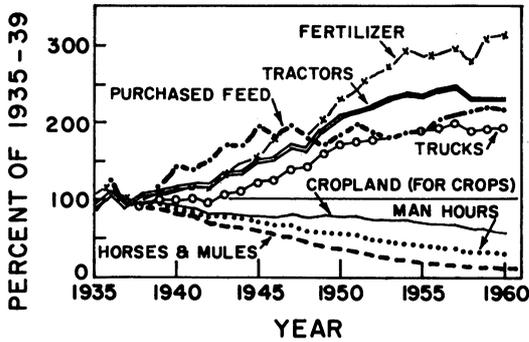


Figure 2.5. Index of resources used per unit of output, 1935-60. (Source: USDA.)

consumers. In contrast to those who gain from greater demand for particular resources, are individuals and firms selling consumer goods to farm people. As the agricultural labor force declines, the farm population also declines. The nonfarm sectors in these communities thus often find the demand for their commodities and services declining.

While farm employment and population decreased for all regions (Table 2.15) but the Pacific from 1940 to 1960, the decline was more extreme in some regions. (Farm employment and population increased in the Pacific region up to 1940 but decreased after that.) The farm population and employment decline was most rapid in purely agricultural regions where greatest change took place in growth of farm size and in substitution of capital for labor. In these purely rural areas, total population declined along with farm population because there were fewer farm families to be serviced. Change in the pattern of resource demand in agriculture thus also causes change in demand for resources in related sectors. The extent of this adjustment is generally greater

Table 2.15. Percent Decrease in Farm Employment and Farm Population by Census Regions, 1920-60\*

Region	Employment	Population
New England	48.7	31.8
South Atlantic	51.3	34.0
Middle Atlantic	50.0	22.2
E. North Central	36.4	24.4
W. North Central	37.2	38.7
E. South Central	58.6	33.8
W. South Central	26.5	51.4
Mountain	37.2	34.4
Pacific	+12.1	+15.6

\*Agricultural Marketing Service, USDA.

in particular areas and counties than in states as a whole because some growing industrial areas can absorb displaced farm and farm-related population. Table 2.16 suggests the magnitude of some of these adjustments within states. States whose economies rest most on agriculture have a majority of counties with a decline in total population.

Both farm and nonfarm sectors in commercial farming communities geographically detached from industrializing urban centers have problems associated with economies of scale and the need to spread fixed costs over more production units. Capital prices which are low relative to labor price have caused farmers and other types of businesses and activity units in the rural community to become more mechanized. The situation is then the same as in farming: volume must be large if unit costs are to be sufficiently low for profitable operation. Hence, there is room for fewer businesses in the market of the trade area or community. Less labor and fewer families are required for the particular retailing or service sector of the farm community. This aspect of economic growth, the change in factor prices and technology to favor

Table 2.16. Number of Counties With Population Decrease and Increase, Selected States 1940-60

State	Number of Counties With:		
	Decline in population	Increase of less than 10%	Increase of 10% or more
Colorado	35	6	22
Idaho	21	6	17
Illinois	51	16	35
Indiana	16	19	57
Iowa	61	22	16
Kansas	70	6	29
Michigan	13	13	57
Minnesota	41	20	26
Missouri	77	10	18
Montana	30	6	21
Nebraska	73	7	13
North Dakota	44	3	6
Ohio	12	9	67
Oklahoma	65	1	11
South Dakota	50	6	12
Texas	144	11	102
Utah	13	2	14
Washington	9	5	25
Wisconsin	34	10	27
Wyoming	10	3	11

substitution of capital for labor and consequent cost economies lead to larger and fewer units in most major phases of rural community life. It is reflected in grocery retailing as well as in farming. Grocery retailing now involves a large investment in capital equipment and labor-saving or self-serve devices. For a volume sufficiently large to provide low cost and some profit per unit, there is room for only one supermarket in many rural towns. In smaller towns, the traditional trade area contains too few consumers to support even one grocery store; at least with competitive returns to labor and management.<sup>11</sup>

These consequences of factor prices and scale economies which emerge at high levels of national economic development are repeated in all important economic and social sectors of rural areas even though they are separated geographically from the major growth industries. They "bite deeply" in rural communities because industrial development is lacking at rates to absorb the labor and families released in the more general substitution of capital for human effort. Because of the scale economies and the thinning of labor force and population, the boundaries of the rural trading areas must expand. This applies not only in the farm production and consumer retailing sectors, but also in sectors providing public and social services. Schools must be on a larger scale in respect to geographic coverage. Churches and other institutions similarly find it desirable to extend their bounds in rural communities. Together, these sum effects of economic development and structural change in agricultural and surrounding sectors of farming communities cause severe social and adjustment problems.

### FARM FINANCIAL STRUCTURE

The changing pattern of agriculture not only changes the mix of specific resources used by farmers but also changes the fiscal and financial structure of agriculture. As pointed out previously, the substitution of capital items for land and labor increases the proportion of inputs which are purchased. Cash costs rise relative to sales. Because of declining gross returns, greater managerial skill and detail are required to meet cash expenses and costs for family living. The value of assets required per dollar of net income has increased also in the highly commercialized agriculture. Table 2.17 shows that value of assets per dollar of net income rose from \$4.73 in 1944 to \$11.54 in 1959, with the latter somewhat above the trend because of depressed income. In the same period cash expenditures as a percentage of cash farm income rose from 50.8 to 75.3. While management input is not easily quantified and expressed, it is certainly growing in relative importance in agricultural production. In assets used per worker, growth was from \$3,400 in 1939 to \$21,235 in 1960, an amount greater than for the

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<sup>11</sup> For the nation, scale in sales volume doubled per store and increased by 50 percent per worker from 1948 to 1958.

## CHANGES IN AGRICULTURE

Table 2.17. Production Assets, Net Farm Income and Ratio of Assets to Net Income in the U.S. for Selected Years\*

Year	Production Assets	Net Farm Income	Assets per Dollar of Net Income	Cash Expenditures as a Percent of Cash Farm Income
	mil. \$	mil. \$	\$	percent
1944	61,933	13,080	4.73	50.8
1949	98,043	14,276	6.87	66.2
1954	121,842	14,223	8.26	68.5
1959	154,767	13,407	11.54	75.3

\*USDA Outlook Charts, 1961.

average of U.S. manufacturing which increased from \$5,300 in 1939 to \$19,900 in 1960. In contrast, however, total capital of the agricultural industry rose by only 307 percent, against 341 percent for manufacturing industry in the period 1939-60. Yet it is still true that management is much less a specialized resource in agriculture than in many other industries which are less capital intensive but have broader opportunities in credit supply through equity financing and lower price of borrowed funds.

Table 2.18 depicts additional changes in the financial structure of

Table 2.18. Assets, Liabilities and Equity of U.S. Agriculture, 1930-60 (Current Dollars)\*

Item	1930	1940	1950	1960
Total assets (bil. \$)	68.4	53.0	130.8	202.9
Real estate (bil. \$)	47.9	37.6	75.3	129.1
Percent of total assets	70	63	58	64
Nonreal estate physical (bil. \$)	16.3	15.2	39.6	55.5
Percent of total assets	24	29	30	27
Financial (bil. \$)	4.2	4.2	15.9	18.3
Percent of total assets	6	8	12	9
Total liabilities (bil. \$)	14.6	10.0	12.5	24.1
Real estate debt (bil. \$)	9.6	6.6	5.6	12.3
Percent of total debt	66	66	45	51
Nonreal estate debt (bil. \$)	5.0	3.4	6.9	11.8
Percent of total debt	34	34	55	49
Proprietor's equity (bil. \$)	53.8	43.0	118.3	178.8
Equity ratio (equity/liabilities)	3.4	4.3	9.5	7.4

\*Economic report of the President. U.S. Government Printing Office. Washington. 1961. P. 208; and USDA Agr. Info. Bul. 247. 1961.

farming from 1930 to 1960. Estimates of assets, liabilities and equity are given in current dollars, hence inflationary trends in the data preclude comparisons in the real quantities over time. However, some comparisons among asset "quantities" within a given year are possible. The relative importance of real estate in the asset structure declined from 1930 to 1950, then increased in 1960. The increase may perhaps be explained by the tendency to capitalize into land values (a) residual returns from profitable inputs such as fertilizer and (b) economies of scale associated with farm mechanization. Trends in the value of real estate may also reflect growing competition among large numbers of potential beginning farmers for available farms. The rising importance of nonreal estate assets from 1930 to 1950 results primarily from the growing investment in farm machinery.

The real estate debt declined from two-thirds of total liabilities in 1930 to one-half in 1960 (Table 2.18). Because of large capital requirements for purchases of livestock, machinery, seed, fertilizer and other nonreal estate capital, a growing share of farm loans became of the short-term type.

The monetary value of farm liabilities rose appreciably from 1940 to 1960 (Table 2.18). The increase in the value of farm assets was much larger, however, and consequently the equity ratio (equity/liabilities) increased from 4.3 in 1940 to 7.4 in 1960. The rising equity ratio resulted from inflated values of farm assets and also from a decade of especially favorable farm incomes which enabled farmers to pay off mortgages and other debts in the 1940's. The equity ratio, as a measure of financial health, indicates that the credit structure of the farm industry by 1960 vastly improved over 1930 but became less favorable than in 1950.

### INCOME EFFECTS

The foregoing analysis indicates major change in the resource organization and structure of agriculture over the past several decades, especially since 1940. Change of important magnitude has been made in the mix of resources used by the industry and in the quantity of particular factors employed. This change in use of resources has greatly increased the productivity and supply quantity of the industry. While the aggregate quantity of all inputs scarcely increased in the 1950's, output increased by 26 percent. Even with large-scale foreign surplus disposal and price support programs, with the latter backed up by mammoth public accumulation of stocks, farm prices and income were depressed during that time.

The exodus of labor has been large, with employment in agriculture declining by 43 percent between 1930 and 1960 and by 27 percent between 1950 and 1960. The decline in the farm population since 1910 has been large, and the population of agriculture as a percent of the national population declined from 34.9 in 1910 to 24.9 in 1930 and to 11.4 in 1960

(8.7 percent in 1960 by the new definition of the farm population). Similarly, the proportion of the total national income originating in agriculture was 16.3, 8.4 and 4.3 percent in 1910, 1935 and 1960, respectively. The rate of labor outflow was not enough to give earnings comparable with labor and other resources in nonfarm sectors. With an increase in purchased production factors and general inflation, farm expenses increased more rapidly than sales in the postwar period (Table 2.19).

Table 2.19. Average Annual Gross Income and Expenses of Agriculture; and per Farm and per Capita Incomes, 1941-60\*

Years	Gross Farm Income	Production Expense	Net Income		Per Capita Farm Income		Per Capita Income of Nonfarm Population
			Amount	Percent of gross	From farming	All sources	
	bil. \$	bil. \$	bil. \$	percent	\$	\$	\$
1941-45	21.2	10.8	10.4	49	440	586	1,147
1946-50	32.7	17.6	15.1	47	649	840	1,464
1951-55	36.1	22.0	14.0	39	677	936	1,909
1956-60	36.5	24.7	11.8	32	652	959	2,247

\*USDA Agricultural Statistics and Outlook Charts.

With farm output increasing more rapidly than food demand, income from farming has declined even in the presence of price supporting policies. Production expenses have absorbed a growing percentage of gross farm income, and per capita income has been maintained only through growth in off-farm employment by farm families. At the end of 1960, farm income per capita was about as low relative to nonfarm income as it was two decades before. The structural revolution characterized by the use of new resource forms and more capital did not relieve the income problems arising from the interrelated large commodity supply and low supply prices of land and labor for agricultural use.

Earnings of agricultural labor have been extremely low as indicated in Table 2.20. In 1958 and 1959, hourly earnings of factory workers were respectively \$2.07 and \$2.13. The average rate went up to \$2.29 in 1960. In 1960 average annual farm income per worker was \$2,056 as compared to an average annual wage for nonfarm workers of \$4,727. Capital in the form of new technologies has moved into agriculture rapidly and increased the gross productivity of farm labor (see Table 2.6). Labor has declined rapidly but its input is so large relative to needs *vis-a-vis* the low short-run demand elasticity for farm commodities, that its return is meager.

The economic development of agriculture has, of course, contributed greatly to national and consumer welfare. As shown in Table 2.21, the real cost of food at the "farm gate" has declined greatly since 1940 — about two-thirds as measured against factory worker annual wage rates and by over one-third in the amount of inputs to produce a unit of output.

Table 2.20. Return per Hour of Labor by Types of Farm\*

Type of Farm	Return per Hour of Labor	
	1958	1959
Dairy farms		
Northeast	.79	.70
Eastern	.46	.16
Corn Belt farms		
Hog-dairy	1.02	1.22
Hog-beef raising	.65	.87
Hog-beef fattening	1.25	2.19
Cash grain	.73	.59
Poultry, New Jersey	-.12	-.13
Cotton farms		
Piedmont	.24	.49
Black Prairie, Texas	.13	.57
High Plains, Texas	1.89	2.60
Delta, small	.28	.25
Delta, large	.62	.98
Tobacco		
Kentucky	.56	.69
North Carolina	.45	.78
Wheat		
Spring (average)	.79	1.17
Winter (average)	1.88	1.85
Ranches		
Cattle (average)	.27	1.18
Sheep (average)	.15	1.17

\*USDA Agricultural Statistics 1959. P. 489.

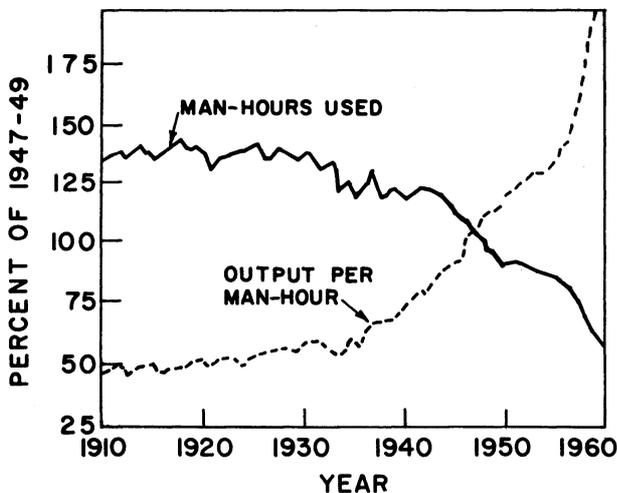


Figure 2.6. Index of man-hours worked in agriculture and output per man-hour (USDA Stat. Bul. 233).

Table 2.21. Index of Real Cost of Farm Products and Index of Input per Unit of Output, and Persons Supplied by One Farm Worker, U.S. 1910-60

Year	Real Cost of Farm Products*	Input per Unit of Output†	Persons Supplied per Farm Worker‡
	1910-14=100	1910-14=100	
1910	104	96	7.07
1920	85	87	8.27
1930	57	97	9.75
1940	43	86	10.69
1950	45	73	14.56
1960	28	59	26.21

\*Index of factory wage rates relative to prices of farm commodities. The measure is in terms of food price at the "farm gate" and not at retail including processing services. Computed from USDA Agricultural Statistics.

†Index of input required per unit of output. Conditions of individual years cause figures to deviate from trend which is downward with certainty over the period. Computed from USDA Stat. Bul. 233. 1961.

‡From USDA. Changes in farm production and efficiency. Stat. Bul. 233. 1961.

Nearly four times as many persons were supplied by one farm worker in 1960 as in 1910. Hence, the consumer can allocate a smaller proportion of his budget to food and a greater proportion of the nation's resources can be allocated to more general economic development and to commodities of greatest marginal consumer urgency. The real gain from the change in the forms, mixes and structure of resources used in agriculture has been great for society as a whole.

The decline in the proportion of total consumer disposable income spent on food was not nearly as spectacular as the decline in what farmers received for their products. The proportion spent on food dropped approximately 1 percent during each of the decades from 1910-60 and stood at 20 percent by 1960. Consumers are spending an increasingly greater proportion of their food budget on processing and packaging services originating in the nonfarm sector. In 1960 the farmers' share of consumer food expenditures dropped to 39 percent. The income elasticity is relatively high for additional processing of food, consequently the processing and marketing industries for farm products have not experienced depressed returns similar to the farm sector. This fact is substantiated by the following estimates: for 1960 the average hourly earnings of farm workers was \$.82 per hour, of workers in food marketing industries \$2.14 per hour and of workers in factories \$2.29 per hour. Hence the wage structure of nonfarm food industries is more nearly similar to other nonfarm industries than to agriculture.

Farm income per worker, as a percent of factory income per worker, was 63 in 1910, 38 in 1930, 52 in 1950 and 44 in 1960. If the gains in farming efficiency had been retained by farm workers (a suggested policy in industry labor-management negotiations according to national pronouncements), workers in agriculture would have been prosperous

indeed. Although the market structure of agriculture dictates that gains in productivity be passed on to the consumer, Table 2.22 indicates that the current of economic development has not completely eluded farmers.

Table 2.22. Measures of Living Standards of Farmers, 1940 to 1960 (U.S. Average in 1945 = 100)\*

Year	Level of Farm Living†					Real Farm Income‡
	North-east	North-central	South	West	U.S.	U.S.
1940	115	104	49	102	79	48
1945	138	128	65	127	100	100
1950	152	147	92	145	122	78
1956	169	165	119	167	145	74
1960	§	§	§	§	§	85

\*Statistical Abstract of the U.S. 1961. P. 634; and USDA. The farm income situation. FIS-183. P. 38.

†Based on percent of farms with electricity, telephone and automobiles and on returns from products sold.

‡Index of average annual farm income per worker deflated by the index of prices paid by farmers for items used in family living.

§Not available.

Although it may be concluded that the relative farm income is low, Table 2.22 indicates that the absolute or real level of farm income improved markedly from 1940 to 1960. The level of living in the South was appreciably lower than in other regions throughout the entire period, but the differences among regions are declining. The region with the highest level of living in 1940, the Northeast, experienced the least increase, 47 percent, by 1956. The South, the region having the lowest standard of living in 1940, increased 143 percent by 1956, the greatest percentage increase among areas. For the entire United States, Table 2.22 indicates a continual increase in level of farm living as measured by the number of household conveniences and income. An alternative measure of real farm income, the net income per farm worker deflated by prices paid by farmers for items used in living, provides a less "optimistic" trend. The index of real farm income is considerably higher in 1960 than in 1940 but the general postwar trend has been downward. The higher value in 1960 than in 1956 indicates that this trend may be reversing, but it may not be possible to generalize from a single observation.

The aggregate measures of income do not reflect the gains that have existed for farmers able to change the quantity and form of their resources sufficiently to realize innovation gains. For the farm industry in aggregate, however, agricultural development with high supply elasticity and demand for some resources and low supply elasticity for other resources has caused relative price and income depression. Hence, it is important to analyze further the conditions of supply and demand which surround resources and give rise to this dilemma.