PART II

Changing Capital Structure in Agriculture

- ► Effects of Technology
- ► Factor and Product Price Changes
- ► Vertical Integration
- ► Role of Farm Family
- ► Regional Agricultural Adjustments



Chapter 6

WILLIAM H. SCOFIELD

GLEN T. BARTON

Agricultural Research Service, USDA Technology and Changes in Capital Structure

THE STRUCTURE of U.S. agriculture has changed greatly since 1940. An important feature of this structural transformation has been the change in kind and quantity of capital used in farming. The main purpose of this chapter is to trace the major changes in aggregate use of capital in agriculture since 1940, and to relate these changes to changing technology and economic forces. These developments and relationships for agriculture as a whole will be appraised, and important variations for southeastern agriculture to the extent permitted by available data will be noted.

Attention is focused on the assets of agriculture that contribute directly to farm output. Thus, the value of operators' dwellings and household furnishings, the value of automobiles chargeable to family living, and certain farmer financial assets that are logically included in a balance sheet, are excluded. Productive assets are valued in both 1959 and 1947-49 prices to exclude the effects of price changes, and thus permit comparisons with various measures of annual input and output that are arrived at similarly.

MAJOR STRUCTURAL CHANGES AND ECONOMIC FORCES AFFECTING USE OF CAPITAL

Two important and interrelated aspects of structural change have had a dominant influence on changes in aggregate kinds and quantities of capital used. These are (1) the substitution of nonfarm inputs for both farm labor and farm land and (2) the marked decrease in number and increase in size of farms.

Two major economic forces are also basic to an understanding of the changes that have occurred in aggregate kinds and quantities of capital used in agriculture. The rising price of labor relative to other inputs, together with the general availability of nonfarm employment opportunities, has influenced greatly the composition of agricultural inputs and the use of capital in farming.

Also, throughout most of the years between 1940 and 1959, farmers had strong economic incentives to adopt improved production practices and lower unit costs of production. These incentives prevailed primarily because of a continuing reserve of unused technology and favorable price relationships. In the immediate postwar years, cash reserves that were accumulated during World War II were used to replace obsolete and inefficient machines and equipment. New items of equipment flowed from laboratories and assembly lines of the industries that supply agriculture with its working tools. In the late forties, price relationships were especially favorable for adoption of the new techniques, but commercial farmers continued to feel the pressure to further improve their physical plant when prices of farm products declined. Thousands faced the choice of keeping pace with the technological revolution or withdrawing from farming.

CHANGES IN AGGREGATE USE OF CAPITAL

The value of productive assets used in farming has increased substantially since 1940. Dollar value of assets by January 1, 1959, totaled \$155 billion – four times the value on January 1, 1940. The value of total productive assets showed a fairly steady growth throughout the period (Table 6.1). Farm real estate dominated the capital picture, accounting for 65 percent or more of the value of all assets during each of the periods.

Only the value of farm machines and motor vehicles rose more percentagewise than did the value of real estate during the two decades. Investment in machines and motor vehicles accounted for 10 percent of the value of all productive assets in 1959, compared with less than 7 percent in 1940-42. The impact of increasing mechanization on the capital structure of agriculture is further emphasized if changes in the composition of livestock inventories are considered. Horses and mules made up a fourth of the value of livestock on farms in 1940, but accounted for less than 2 percent of the inventory value in 1959.

Price changes accounted for more than 80 percent of the rise in value of all productive assets used in agriculture from 1940 to 1959. Changes in price were responsible for almost 90 percent of the increase in value of farm real estate during the period. When productive assets are revalued at 1947-49 prices, an increase of only 25 percent between 1940 and 1959 is indicated (Table 6.2). Farm real estate dominates the capital picture on this basis also, but the percentage increase in the two decades was exceeded by the increase in value of all other capital groups shown except livestock.

Although present estimates show a relatively small increase in the constant-dollar value of land and service buildings, the dominant position of real estate in the total capital picture warrants further attention. A part of the increase in the value of land (1947-49 dollars) between 1940 and 1954 is attributable to the 97-million-acre increase in land counted as "in farms" by the agricultural censuses. This increase in acreage has added about \$4.5 billion (1947-49 dollars), and net investment in service buildings an additional \$4 billion to the volume of

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Period	Farm real estate ^a	Livestock	Machinery and motor vehicles ^b	Feed crops inventory	Working capital ^c	Total, excluding real estate	Total
			(billion do	ollars)			
1940-42	29.3	5.8 ·	2.8	2.2	1.5	12.3	41.6
1944-46	46.0	9.5	4.9	4.6	2.8	21.8	67.8
1947-49	61.9	13.2	6.2	5.9	3.9	29.2	91.1
1950-52	73.3	16.5	11.4	5.9	4.5	38.3	111.6
1953-55	83.0	12.6	13.8	6.0	4.7	37.1	120.1
1956-58	95.5	12.0	14.6	5.5	4.6	36.7	132.2
1959	110.8	18.1	15.7	5.9	4.9	44.6	155.4
	×.		Compositi	on of assets			
			(perce	ent)			
1940-42	70.4	14.0	6.7	5.3	3.6	29.6	100.0
1944-46	67.9	14.0	7.3	6.7	4.1	32.1	100.0
1947-49	67.9	14.5	6.8	6.5	4.3	32.1	100.0
1950-52	65.7	14.8	10.2	5.3	4.0	34.3	100.0
1953-55	69.1	10.5	11.5	5.0	3.9	30.9	100.0
1956-58	72.2	9.1	11.0	4.2	3.5	27.8	100.0
1959	71.3	11.6	10.1	3.8	3.2	28.7	100.0

 Table 6.1. Productive Assets Used in Agriculture, in Current Prices, United States, Specified Periods, 1940-59

^aExcludes value of dwellings.

^bExcludes 60 percent of value of automobiles.

^cA portion of total demand deposits held by farmers derived by adjusting the deposits of January 1, 1942, by an index of production costs.

real estate since 1940. These two items together account for the increase of 15 percent since 1940 in the constant-dollar value of land and service buildings.

A sizable but unmeasured net increase in the productive value of land resulted from expenditures for irrigation, drainage, clearing, and other land improvements that contribute to farm output. Capital outlays in 1955 for land and water improvements totaled \$562 million.¹ Expenditures under Soil Conservation Service and Agricultural Conservation Program Service programs for practices that increased the productive value of land have totaled several hundred million dollars annually. Sizable capital outlays under other federal and state

¹ Farmers' Expenditures in 1955, USDA, and Dept. of Commerce, AMS-354, Washington, D. C., Dec., 1959.

Period	Farm real estate	Livestock	Machinery and motor vehicles	Feed crops inventory	Working capital	Total, excluding real estate	Total
			(billion	dollars)			
1940-42	57.9	13.3	4.4	5.8	2.8	26.3	84.2
1944-46	60.4	15.0	4.4	6.0	4.0	29.4	89.8
1947-49	62.0	13.2	6.2	5.9	4.0	29.3	91.3
1950-52	63.6	13.6	9.5	6.2	4.3	33.6	97.2
1953-55	64.7	14.5	10.7	6.2	4.2	35.6	100.3
1956-58	65.5	14.5	10.4	7.0	4.1	36.0	101.5
1959	65.8	14.8	10.2	8.2	4.1	37.3	103.1
		Ī	ndex number	s, 1940 = 100] -		
1940-42	101	103	108	104	109	105	102
1944-46	106	116	108	109	155	117	109
1947-49	108	102	149	108	155	117	111
1950-52	111	106	232	113	164	134	118
1953-55	113	112	261	113	163	142	122
1956-58	115	112	254	128	157	143	123
1959	115	115	249	149	158	149	125

Fable 6.2.	Productive Assets Used in Agriculture, 1947-49 Prices	3,
	United States, Specified Periods, 1940-59 ^a	

^aSee footnotes to Table 6.1.

programs and projects ranging from flood control to highways have added indirectly to the value of farm real estate. If all such investments in land (both private and public), less allowance for depletion and other losses in capital values, could be included, the net increase in the productive value of farm real estate would likely be greater than is indicated by our present estimates.

The quality of other productive assets has also been improved, particularly in the case of machinery, equipment, and livestock (cf. Chapter 7). Constant-dollar valuations fail to reflect adequately these increases in the quality of productive assets. The same limitation applies to the measures of real estate inputs and other production inputs discussed below. The important influence of increases in quality of assets and inputs is reflected, however, when changes in volume of farm output are related to changes in volume of assets and inputs. In most instances, changes in quality are synonymous with advances in technology. Technological improvement, in turn, has been the chief factor in the rise in productivity of assets and inputs.

The most outstanding change in the capital structure of agriculture

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has been the great increase in productive assets per farm. From 1940 to 1959, the number of farms decreased by 1.7 million, or 27 percent. This contributed to the large increase in volume of assets per farm (Table 6.3). Although volume of productive assets rose only 25 percent from 1940 to 1959, assets per farm increased more than 70 percent. During the period, the volume of real estate and livestock inventories per farm increased by more than half, feed-crop inventories and working capital doubled, and numbers of machines and motor vehicles more than tripled. In terms of dollars, the increase in assets per farm was substantially greater; by January 1, 1959, the average value of all productive assets per farm exceeded \$33,000, about five and one-half times the average value in 1940.

Period	Farm real estate	Livestock	Machinery and motor vehicles	Feed crops inventory	Working capital	Total, excluding real estate	Total ^b			
(dollars)										
1940-42	9,216	2,117	701	923	446	4,187	13,403			
1944-46	10,125	2,514	738	1,006	671	4,929	15,054			
1947-49	10,691	2, 277	1,069	1,017	690	5,053	15,744			
1950-52	11,491	2,457	1,716	1,120	777	6,070	17,561			
1953-55	12,445	2,789	2,058	1,192	808	6,847	19,292			
1956-58	13,483	2,984	2,141	1,441	844	7,410	20,893			
1959	14,190	3, 192	2,200	1,768	884	8,044	22, 234			
			Index number	s, 1940 = 10	<u>0</u>		•			
1940-42	102	104	109	107	109	106	103			
1944-46	112	124	114	116	164	125	116			
1947-49	119	112	165	117	169	128	121			
1950-52	128	121	266	129	190	154	135			
1953-55	138	137	319	138	198	173	149			
1956-58	150	147	331	166	206	187	161			
1959	158	157	341	204	216	203	172			

Table 6.3. Productive Assets Per Farm in 1947-49 Prices, United States,Specified Periods, 1940-59

^aSee footnotes to Table 6.1. Numbers of farms used in computing averages are as estimated by the USDA.

^bThese estimates differ slightly from those shown in the Balance Sheet of Agriculture because of downward revisions in the constant-dollar value of farm land and service buildings.

RELATION OF PRODUCTIVE ASSETS TO INPUT AND OUTPUT

Changes in the volume and composition of the stocks of productive assets on farms have been closely interrelated with the marked changes in the input structure of agriculture.

Farm real estate dominated the asset structure of agriculture from 1940 to 1959, accounting for about two-thirds of the stocks of all productive assets. However, when real estate inputs are considered in relation to all inputs, real estate becomes a relatively minor factor. Real estate input — chiefly the constant-dollar value of interest on investment in real estate and depreciation and repairs of service buildings — accounted for approximately 15 percent of total inputs throughout the period since 1940.²

Whereas farm real estate dominated the stocks of productive assets, farm labor dominated the input structure of agriculture. In contrast to real estate, however, the relative importance of farm labor decreased substantially during these two decades. In 1940 farm labor made up more than half (56 percent) of total inputs. By 1958 the proportion had declined to 30 percent.³

The data in Table 6.4 indicate a major feature of structural change in agriculture — the substitution of nonfarm inputs for both farm labor and farm land. Inputs of farm labor decreased by almost half since 1940. The absolute volume of real estate inputs showed a moderate increase in contrast to a near doubling in volume of inputs other than labor and real estate.

Changes in stocks of productive assets and in inputs used in agriculture can be contrasted in another important respect. Stocks of all productive assets increased 25 percent from 1940 to 1959, but the decline in labor inputs largely offset the increase in nonreal estate

Other annual real estate inputs include grazing fees, depreciation, accidental damage, and repairs of service buildings, all expressed in 1947-49 dollars.

Real estate inputs measured in this way increased 7 percent from 1940 to 1956-58. This contrasts with an increase during the same period of 15 percent in the 1947-49 dollar value of real estate assets. The difference in rate of change in real estate assets and inputs is due partly to differences in concepts of the two measures. The major difference, however, arises from revisions in the estimates of value of land and service buildings in 1947-49 dollars.

If the revised estimates of the constant-dollar value of real estate presented in this chapter had been used in the input calculations, inputs of real estate would have risen from 1940 to 1958 by 12 instead of 7 percent. However, the revised estimates of real estate input would change the index of total production inputs for 1958 by less than 1 percent.

³ The data on farm inputs presented here and elsewhere in this chapter are taken from R. A. Loomis and G. T. Barton, Productivity of Agriculture, United States, 1870-1958, USDA Tech. Bul. (In press.)

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² The measurement of inputs of real estate is based on the concept of annual flow of real estate services, in contrast to the concept of stock of capital goods used in measuring the the volume of real estate. The bulk of the real estate input consists of an interest charge on investment in land and buildings exclusive of operators' dwellings. Such an interest charge was calculated for the average of the period 1947-49. This interest charge was multiplied by an index of the physical volume of real estate (converted to a 1947-49 base) to derive annual charges for the period beginning in 1940. The index used was based chiefly on a series developed by Alvin S. Tostlebe in cooperation with the National Bureau of Economic Research.

Period	Farm labor	Real estate ^b	Power and machinery	Feed, seed, and livestock purchases ^c	Fertilizer	Miscellaneous	Total, excluding farm labor and real estate	Total
			Inc	lex numbers, 1	.940 = 100 ^a			
1940-42	100	99	106	110	110	101	105	101
1 94 4-46	93	96	129	152	170	104	124	103
1 94 7-49	82	10 2	172	159	208	107	143	103
1950-52	73	106	217	172	266	119	169	106
1953-55	65	108	233	184	313	126	180	105
1 956 -58	56	107	237	211	338	134	192	104
1959	54	d	d	d	đ	d	d	d

Table 6.4. Inputs Used in Agriculture, United States, Specified Periods, 1940-59ª

^a1947-49 price weights were used in combining inputs. The concept of flow of resource services is used in calculating the input measures; this contrasts with the "stock" concept used in measuring value and volume of productive assets.

^bThe index of inputs of real estate differs from the index of capital stock of real estate shown in other tables. The two measures differ in concept and also in other respects described in a text footnote. ^CExcludes value of interfarm transactions.

^dNot available.

capital and other nonfarm inputs, thus resulting in little change in total inputs over the period.

Resource adjustment, technology, and other structural changes have brought about significant changes in productivity of the assets and inputs used in agriculture. Volume of farm output rose by more than 50 percent in the two decades following 1940. As the volume of productive assets used in agriculture increased by a smaller proportion and the total quantity of inputs changed relatively little, average productivity of total assets and inputs rose significantly over the period (Table 6.5).

Output per unit of total productive assets increased by more than one-fifth from 1940 to 1959. Volume of nonreal estate assets increased in about the same proportion as output. The process of combining an increased quantity of other assets with a relatively fixed amount of real estate contributed to the rise in average productivity of all assets.

Gains in productivity per unit of total inputs were even more striking. By 1956-58 output per unit of total inputs was almost 40 percent larger than in 1940. Shifts in the composition of inputs, advances in technology and other structural changes, including a large increase in average size of farms, combined to bring about this substantial gain in resource efficiency.

Substitution of Nonfarm Inputs for Farm Labor and Farm Land

The growing importance of nonfarm inputs in agricultural production and their impact on the capital structure and productivity of agriculture merits further appraisal and analysis. The rapid substitution

	Farm output per unit of										
	Pro	ductive ass	etsª		Inp	uts					
Period	Real estate	Other	Total	Farm labor	Real estate	Other	Total				
		Ind	ex numbers	s, 1940 = 10	2						
1940-42	106	102	104	107	108	10 2	105				
1944-46	111	100	108	127	123	95	115				
1947-49	113	105	110	149	119	85	118				
1950-52	115	95	108	175	120	76	120				
1953-55	119	95	110	209	125	75	128				
1956-58	125	100	116	255	134	75	138				
1959	132	102	122	281	b	b	b				

Table 6.5. Average Productivity of Assets and of Inputs Used in Agriculture, United States, Specified Periods, 1940-59

^aBased on 1947-49 prices. See footnotes, Table 6.1. ^bNot available.

"Not available.

of capital and nonfarm inputs for farm labor was perhaps the most outstanding change in agriculture during the two decades.

The volume of total productive assets per man-hour of farm labor used in 1959 was more than twice as great as in 1940. Similar increases occurred in real estate assets and livestock inventories per man-hour. Stocks of machinery and motor vehicles per man-hour were more than four and one-half times as great at the end of the 20year period as at the beginning.

A similar picture prevails when the various categories of inputs are related to man-hours of farm labor. The volume of all inputs other than farm labor and real estate used per man-hour in 1956-58 was almost three and one-half times the amount used per man-hour in 1940. Especially noteworthy were the increases in inputs of fertilizer and lime, and in the amount of mechanical power and machinery per manhour.

Farmers responded to some powerful economic incentives in substituting capital and nonfarm inputs for labor. Throughout the two decades, a substantial differential between farm and nonfarm earnings persisted (Table 6.6). This economic "pull," plus the existence of nonfarm employment opportunities throughout most of the period, resulted in a large migration of workers from farm to nonfarm jobs. An important corollary development was a sharp rise in farm wage rates to a level in 1959 more than four and one-half times that of 1940.

The rise in the price of labor from 1940 to 1959 was substantially greater than that for any other input (Table 6.6). This encouraged farmers to substitute capital and other inputs for labor. The decline in

	Ratio of farm	Prices		Ratio of farm wage rates to prices paid for					
Period	income per capita ^a	by farmers	Parity ratio	Motor vehicles	Farm machinery	Fertilizer	Real estate per acre		
		Ī	ndex numb	ers, 1940 = 1	100				
	(percent)								
1940-42	43	128	115	118	123	122	122		
1944-46	56	213	136	208	239	228	167		
1 94 7-49	58	271	134	187	214	226	162		
1950-52	54	283	127	173	188	235	150		
1953-55	48	244	109	180	193	246	146		
1956-58	47	238	103	178	192	275	142		
1959	b	240	100	180	193	303	136 ·		

Table 6.6. Relative Prices of Farm Labor, and Related Data, United States, Specified Periods, 1940-59

^aBased on incomes from all sources.

^bNot available.

the general level of prices received and in the parity ratio during the period had little effect upon the pace at which other inputs were substituted for farm labor. The continued high relative price of labor and a continuing reserve of unused technology enabled farmers to lower unit production costs on their own farms by replacing labor with capital and other inputs. This means of lowering costs was available to farmers as individuals and was subject to their decisions, but owing to the economic structure of agriculture, an individual farmer cannot affect prices received for his commodities through his own production decisions. The adjustments in resource use made by farmers in their efforts to lower costs generally, also increased volume of output (cf. Chapter 10). The aggregate effect of this was to lower prices received during much of the post-World War II period.

The large decline in number of farms and the sharp increase in average size of farms were directly related to the substitution of capital and nonfarm inputs for farm labor and farm land (cf. Chapter 7). Moreover, the need for adjusting farm size to the changing requirements for assets and inputs had an important influence on real estate values. With a fixed supply of operator and family labor and a growing stock of machines and mechanical power, some farmers found it possible to reduce unit costs of production substantially through enlarging their farms by renting and buying land. This demand for land for farm enlargement contributed significantly to the rise in value of real estate per acre, particularly after the end of World War II.

In one important respect, real estate is unique among the various productive assets and inputs used in agriculture. Although demand for farm land for nonfarm uses and purchases by nonfarm residents are important in many areas, the value of farm real estate is determined largely by forces within agriculture itself. Except for purchased feed, seed, and livestock, prices of other productive assets and inputs (including labor) used in agriculture are determined mainly in the nonfarm sector of the economy.

The rise in the market value of farm real estate per acre rivaled the increase in wage rates over the 20-year period under consideration. By 1959 per-acre values were three and one-half times the 1940 level. As a consequence, the price of real estate increased relative to the prices of most other assets and inputs except labor. The increase in relative price of real estate thus provided an economic incentive for substituting other assets and nonfarm inputs for farm land, as well as for farm labor. Other productive assets, except total livestock, increased relative to farm real estate. The same relationship exists when the various categories of inputs other than labor are compared with real estate. Especially impressive is the rapid increase in the quantity of fertilizer and lime used per unit of farm real estate.

CHANGES IN THE CAPITAL STRUCTURE OF SOUTHERN AGRICULTURE

Many of the economic forces responsible for changes in the capital structure of agriculture in the nation also have been present in the South.⁴ There are several changes that are either unique to the southern region or that have occurred at slower or faster rates than elsewhere. Major shifts in land use are perhaps the most striking. In contrast to the national picture of little change in total acreage of cropland, the Southeast shows a decline since 1940 of about a third — the Appalachian region, a fourth. Despite the sharp trend away from crop production and an increase in output of livestock and livestock products, the increase in total farm output has lagged behind the national trend (cf. Chapter 1).

The tenfold increase in the value of machinery and equipment in the two southern regions since 1940 documents the conversion from horse and mule to mechanical power that had largely occurred in most other regions a decade or so earlier. This delayed process of mechanization, together with the sharp decline in acreage of crops requiring a great deal of labor, contributed to somewhat greater reductions in labor inputs in the two regions than in other regions.

Another basic characteristic of southern farms has been their small acreages and low capital investments in both land and nonland resources (cf. Chapter 14). Before mechanization occurred, land was by far the major item of productive capital in the South, and it still accounts for about 70 percent of total assets — about the same as for the nation. Although asset values per farm have risen sharply under the combined effect of fewer and larger farms, more assets, and rising

⁴ Two production regions – the Appalachian and the Southeast – are included in the statistical analysis that follows. The former region includes Virginia, West Virginia, North Carolina, and Tennessee; the latter includes South Carolina, Georgia, Florida, and Alabama. The terms "South" and "southern regions" refer to both regions collectively.

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prices per unit, productive assets per farm in the South are still less than half the national average (Table 6.7).

Part-time, residential, and other noncommercial farms represent a substantially greater proportion of all farms in the South than in most other regions. The inclusion of such farms in the "all farm" totals distorts comparisons with other regions and with national averages. Values of real estate are affected most because of the relatively high per-acre value of noncommercial farms. More than a fifth of the total value of farm land and buildings in the two southern regions was included in part-time and residential farms in 1954. Nationally, the proportion was about 10 percent, but nearly a third of this was

	1	Productive asse (current dollar	ets ^a rs)	Productive assets ^b (1947-49 dollars)		
Area and period	Per farm	Per dollar net income	Per dollar ^c labor input	Per farm	Per man-hour of labor	
		(doll	ars)			
United States 1940–42	6,628	5.92	7.56	13,403	4,13	
1947-49	15,734	5.90	7.71	15,744	5.45	
1953-55	23, 102	9.58	11.10	19,292	7.57	
1956-58	27,281	10.55	12.93	20, 893	8.80	
1959	33,455	13.16	14.26	22,234	9.33	
Appalachian 1940-42	3,129	4.50	6.73	6,578	2.50	
1947-49	7,109	4.48	5.67	7,113	2.87	
1953-55	9,450	5.75	7.56	7,952	4.19	
1956-58	10,994	6,88	9.05	8,624	5.46	
1959	13,028	8.10	d	9,365	đ	
Southeast 1940–42	2,762	4.15	4.71	5,218	2.23	
1947-49	6,596	4.39	4.96	6,589	3.53	
1953-55	10,845	6.00	8.12	8,893	6.49	
1956-58	14,479	7.65	11.52	10,106	9.15	
1959	18,590	8.72	đ	11,184	d	

Table 6.7. Selected Measures of Capital Investments, United States, Appalachian Region, and Southeast, Specified Periods, 1940-59

^a Market value of farm land and service buildings (March 1), inventory values (January 1) of machinery and equipment (less family share of automobiles), livestock, feed crops stored on farms, and working capital.

^bEach class of asset was revalued in terms of 1947-49 prices.

^c Market value of labor input was derived by multiplying total man-hours by the average cash wage rate per hour for hired labor (without room and board). ^d Not available. concentrated in the South. Estimates of nonreal estate capital are probably not distorted as much by the inclusion of noncommercial farms, but total investments per farm for the commercial group would be substantially higher than are shown by the averages for all farms. However, the rates of change may not be affected this greatly because noncommercial farms have remained about the same proportion of all farms over time.

The estimates of productive assets in both current and constant dollars calculated for the Appalachian region and the Southeast are reasonably comparable with the national estimates discussed earlier in this chapter. Valuations of nonreal estate assets in 1959 dollars were converted to 1947-49 dollars by applying the same changes in prices that were used in calculating the national series. The regional or state indices of average value of farm real estate per acre were used to deflate the 1959 dollar valuations of land and service buildings in each of these regions. Changes shown in the constant-dollar valuations are assumed to reflect primarily changes in the physical quantities of productive assets.

Changes in the value of productive assets for the Southeast are influenced strongly by the inclusion of Florida in the region. Market values of farm real estate have increased more in Florida than in any other state, and between 1940 and 1954 about 10 million acres were added to land in farms. The remaining three states (Alabama, Georgia, and South Carolina) showed an increase of only 800,000 acres. A part of the increase in market values per acre in Florida can be attributed to the substantial increases in citrus acreage, improved pasture, drainage, and land-clearing that represent real gain in productive assets. However, as a result of the rapid growth in population and expectations of future growth, market values also have been strongly influenced by nonfarm demands. Although trends in values of nonreal estate assets are similar to those shown by other states in the region, when possible, Florida was excluded from the estimates for the Southeast.

Changes in Real Estate and Nonreal Estate Assets

As at the national level, land and service buildings in each of the two southern regions represented about 70 percent of the total productive assets of the regions in 1959. Although between 1940 and 1950 the value of real estate in the South did not rise as much as did values of nonreal estate assets, real estate increased more than have other assets in the late 1950's. Within the nonreal estate group, machinery, motor vehicles, and livestock showed the largest gains.

Increases in the value of livestock were substantially greater in the two southern regions than in the country as a whole from 1940 through 1950-52, but both regions showed declines from 1950-52 to 1956-58 (Tables 6.8 and 6.9). Estimates for 1959, however, indicated a sharper increase in these two regions since 1956-58 than nationally.

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Period	Farm real estate	Livestock	Machinery and motor vehicles	Feed crop inventory	Working capital	Total, excluding real estate	Total, all assets			
(million dollars)										
1940-42	2,538	457	150	201	124	932	3,470			
1944-46	3,799	717	280	392	209	1,598	5,399			
1947-49	5,226	954	446	484	289	2,173	7,399			
1950-52	5,928	1,093	908	463	339	2,803	8,731			
1953-55	6,295	815	1,140	346	369	2,670	8,965			
1956-58	7,036	789	1,228	359	358	2,734	9,770			
1959	7,907	1,127	1,331	372	370	3,200	11,107			
		Ī	ndex numbers	s, 1940 = 100	2					
1 94 0-42	103	106	109	128	113	111	105			
1944-46	154	166	204	250	190	191	164			
1947-49	212	220	326	308	263	260	224			
1950-52	241	252	663	295	308	335	2 65			
1953-55	256	188	832	220	335	319	272			
1956-58	286	182	896	229	325	327	296			
1959	321	260	972	237	336	382	337			

Table 6.8. Appalachian Region: Productive Assets Used in Agriculture, in Current Prices, Specified Periods, 1940-59^a

^a See footnote a, Table 6.7.

Total investment at current prices in 1956-58 amounted to about \$11,000 per farm in the Appalachian region and \$14,500 in the Southeast, compared with the national average of \$27,300. Further increases in market values of both real estate and nonreal estate capital items since 1956-58 have raised average investments per farm to about \$13,000 in the Appalachian region and \$18,600 in the Southeast.

A revaluation of assets in 1947-49 dollars shows that most of the gains occurred in the nonreal estate sector. The constant-dollar value of real estate declined 10 percent in the Appalachian region between 1940 and 1956-58, but increased nearly 50 percent in the Southeast, chiefly because of Florida (Tables 6.10 and 6.11). If an adjustment is made for the atypical acreage change in that state, the real increase in real estate for the Southeast is only about 10 percent.

Between 1940 and 1956-58, the volume of nonreal estate assets increased by about 50 percent in the Appalachian region and 72 percent in the Southeast, compared with 42 percent for the nation. On a perfarm basis, the increases were 88 and 127 percent, respectively. Total assets per farm increased by a third in the Appalachian region and

Total. Farm excluding Total. Machinery Feed Working real and motor crop real all Period estate Livestock vehicles inventory capital estate assets (million dollars) 1940-42 1,041 232 68 83 68 1,492 451 1944-46 1,630 366 138 179 125 808 2,438 2,350 426 232 170 166 994 1947-49 3,344 1950-52 2,687 482 476 169 206 1,333 4,020 1,336 1953-55 3,020 385 596 114 241 4,356 1956-58 3,508 368 652 137 241 1,398 4,906 1959 4,104 543 703 127 250 1,623 5,727 Index numbers, 1940 = 1001940-42 106 105 111 124 105 109 107 226 267 192 195 1944-46 167 165 175 254 1947-49 240 192 380 255 240 240 275 217 780 252 317 321 289 1950-52 1953-55 309 173 977 170 371 322 313 166 204 371 337 352 1956-58 359 1,069 1959 420 244 1,152 190 385 391 411

Table 6.9. Southeast Region, Excluding Florida: Productive Assets Used in Agriculture in Current Prices, Specified Periods, 1940-59^a

^a See footnote a, Table 6.7.

almost doubled in the Southeast, compared with a 60 percent increase nationally.

Capital-Income and Capital-Labor Coefficients

The level of capital investments in relation to net farm income and changes in this relationship over time have meaning with respect to the marginal efficiency of capital and the valuation of assets, particularly real estate. Future adjustments in size of farm and entry into agriculture are affected also by the amounts of capital associated with given levels of net income.

Although throughout the period the amount of investment in productive assets per dollar of net income has remained a little lower in the South than in the nation as a whole, both show a substantial increase since 1947-49. In 1940-42 and 1947-49, about \$6 of capital was associated with a dollar of net income nationally, compared with about \$4.50 in each of the southern regions (Tables 6.12 and 6.13). By

Period	Farm real estate	Livestock	Machinery and motor vehicles	Feed crop inventory	Working capital	Total, excluding real estate	Total
			(million o	dollars)			
1940-42	5,521	781	241	534	226	1,782	7,303
1944-46	5,308	871	252	528	288	1,939	7,247
1947-49	5,226	957	438	500	288	2,183	7,409
1950-52	5,156	1,091	756	502	308	2,657	7,813
1953-55	4, 996	986	884	363	315	2,548	7,544
1956-58	5,086	950	874	464	300	2,588	7,674
1959	5,004	1,297	864	524	296	2,981	7,985
		I	ndex numbers	, 1940 = 100			
1940-42	99	93	107	116	107	102	100
1944-46	95	104	112	114	136	112	99
1947-49	93	114	194	108	136	126	101
1950-52	92	130	336	109	145	153	106
1953-55	89	118	393	78	148	146	102
1956-58	91	114	388	105	142	149	104
1959	89	155	384	113	140	172	109

 Table 6.10. Appalachian Region: Productive Assets Used in Agriculture, in

 1947-49 Prices, Specified Periods, 1940-59^a

^aSee footnote a, Table 6.7.

1956-58 the capital-income ratio had increased to about \$10.50 for the country as a whole, and to about \$7 in the South. Ratios for 1959 showed a further increase, chiefly because the value of real estate continued to rise while farm income declined.

Productive assets may be related also to the market value and the physical quantity of the labor input.⁵ If current-dollar values of assets are divided by the market value of the labor input, the resulting measure retains changes in both quantities and prices of assets and labor. The increase in capital investment per dollar of labor input provides further evidence of the extent to which capital has been substituted for labor. The capital-labor ratio calculated in this way can aid also in projecting possible future capital requirements under varying assumptions as to trends in wage rates and labor requirements.

About \$7.50 of productive assets was associated with a dollar input of farm labor in 1940-42 nationally, about \$6.75 in the Appalachian

⁵ Total man-hours used in farm production were multiplied by the cash wage rate per hour for hired farm workers (without room and board) to obtain the market value of the labor input.

	Farm rea	l estate					Southeast region	
Period	Alabama, South Carolina, Georgia	Alabama, South Carolina, Georgia Florida		Machinery and motor vehicles	Feed crop Working inventory capital		Total, excluding real estate	Total, all assets
			(1	nillion dollars	3)			
1940-42	2,183	545	437	143	232	168	980	3,708
1944-46	2,241	708	532	159	251	242	1,184	4,133
1947-49	2,349	802	527	277	182	224	1,210	4,361
1950-52	2,420	917	660	476	189	253	1,578	4,915
1953-55	2,350	1,125	653	556	126	285	1,620	5,095
1956-58	2,398	1,258	629	560	190	280	1,659	5,315
1959	2,381	1,261	901	551	238	276	1,966	5,608
	•		Index	numbers, 1940	= 100			
1940-42	101	110	94	109	114	101	101	102
1944-46	103	143	114	121	124	145	122	114
1947-49	108	162	113	211	90	134	125	120
1950-52	112	185	142	363	93	151	163	135
1953-55	108	227	140	424	62	171	168	140
1956-58	110	254	135	427	94	168	172	146
1959	110	255	193	421	117	165	203	154

Table 6.11. Southeast Region: Productive Assets Used in Agriculture in 1947-49 Prices, Specified Periods, 1940-59^a

^aSee footnote a, Table 6.7.

region, and only \$4.75 in the Southeast. By 1956-58 the capital investment for the nation had increased to about \$13 per dollar of labor, whereas capital investment for the Appalachian region had increased to only \$9. In percentage terms, these are gains of 70 and 34 percent, respectively. The increase to about \$11.50 in the Southeast is substantially greater (145 percent), but again, it was strongly influenced by the large rise in total value of real estate in Florida. Perhaps the most significant conclusion pertains to the Appalachian region, in which the level of capital appears to be relatively low in relation to the labor input. Despite large absolute increases in total capital, it has not increased as much in this region relative to labor costs as has the national average or the level in the Southeast.

The effects of changes in price are removed if the constant-dollar values of assets are related to man-hours of labor. Investment per hour of labor shows the extent to which physical quantities of productive assets associated with an hour of labor have increased over time. The increases shown by this measure are substantially greater than those shown by the same measure expressed in 1959 dollars because the number of man-hours of labor declined at about the same rate at which wage rates per hour increased. As a result, the market value of the labor input has remained relatively stable since 1950. Thus, the increase in capital investment associated with a dollar of labor input results chiefly from the increases in value of total assets. The increase in quantities of productive assets per man-hour is due primarily to the substantial decline in total man-hours as assets changed relatively little.

	Average	e investment p	er farm	Invest: dolla: inc	Investment	
Period	Real estate	Nonreal estate	Total	Real estate	Nonreal estate	of labor input
			(dollars)			
1940-42	2, 288	841	3,129	3.31	1.19	6.73
1944-46	3, 582	1,508	5,090	2.47	1.04	4.55
1947-49	5,020	2,089	7,109	3.16	1.32	5.67
1950-52	5,896	2,790	8,686	3.40	1.60	6.86
1953-55	6,636	2,814	9,450	4.05	1.71	7.56
1956-58	7,918	3,076	10,994	4.96	1.92	9.05
1959	9,275	3,753	13,028	5.77	2.33	
		Index	numbers, 18	40 = 100		
1940-42	104	113	106	78	83	91
1944-46	163	202	173	59	73	61
1947-49	229	280	242	75	92	77
1950-52	269	373	295	81	112	93
1953-55	302	377	321	96	120	102
1956-58	361	412	374	118	134	122
1959	423	502	443	137	163	

 Table 6.12. Appalachian Region: Selected Measures of Capital Investments, in Current Prices, Specified Periods, 1940-59^a

^aSee footnote a, Table 6.7.

^bNet income of farm operators, including changes in inventories.

A LOOK AT THE FUTURE

Further significant changes in the capital structure of agriculture can be expected. Some perspective as to the direction and magnitude of such changes for the nation can be gained (1) by using 1975 as a target date, and (2) by utilizing previous USDA projections of farm output, labor productivity, and number of commercial farms.⁶ Using 1957 as a base year, these projections indicate that a needed increase of 40 percent in farm output could be attained with a third less farm labor. The

⁶G. T. Barton and R. F. Daly, "Prospects for agriculture in a growing economy," in Problems and Policies of American Agriculture, Iowa State University Press, Ames, Iowa, 1959; and K. L. Bachman, "Prospective changes in the structure of farming," paper presented at 36th National Agricultural Outlook Conference, Washington, D. C., Nov. 18, 1958.

Averag	Average investment per farm			Investment per dollar of net income ^b	
Real estate	Nonreal estate	Total	Real estate	Nonreal estate	
	(dolla	ars)			
1,669	724	2, 393	2.59	1.11	
2,684	1,332	4,016	2.12	1.05	
3,924	1,660	5,584	2.89	1.19	
4,826	2,394	7,220	2.98	1.48	
5,924	2,618	8,542	3.97	1.77	
7,585	3,021	10,606	5.20	2.08	
9,391	3,787	13, 178	6.10	2.46	
	Index numbers	s, 1940 = 100			
107	110	108	88	89	
173	202	181	72	84	
252	252	252	98	95	
310	363	326	101	118	
381	397	386	135	142	
488	458	479	176	166	
604	574	595	207	197	
	Averag Real estate 1,669 2,684 3,924 4,826 5,924 7,585 9,391 107 173 252 310 381 488 604	Average investment p Real estate Nonreal estate (dollation) (dollation) 1,669 724 2,684 1,332 3,924 1,660 4,826 2,394 5,924 2,618 7,585 3,021 9,391 3,787 Index numbers 107 110 173 202 252 252 310 363 381 397 488 458 604 574	Average investment per farm Real estate Nonreal estate Total Real estate Nonreal estate Total (dollars) (dollars) 1,669 724 2,393 2,684 1,332 4,016 3,924 1,660 5,584 4,826 2,394 7,220 5,924 2,618 8,542 7,585 3,021 10,606 9,391 3,787 13,178 Index numbers, 1940 = 100 108 1173 202 181 252 310 363 326 381 397 386 488 458 479 604 574 595	Average investment per farm Investidular dollar inc. Real estate Nonreal estate Total Real estate 1,669 724 2,393 2.59 2,684 1,332 4,016 2.12 3,924 1,660 5,584 2.89 4,826 2,394 7,220 2.98 5,924 2,618 8,542 3.97 7,585 3,021 10,606 5.20 9,391 3,787 13,178 6.10 Index numbers, 1940 = 100 107 110 108 88 173 202 181 72 252 252 252 98 310 363 326 101 381 397 386 135 488 458 479 176 604 574 595 207	

Table 6.13. Southeast Region, Excluding Florida: Selected Measures of Capital Investments, Current Prices, Specified Periods, 1940-49^a

^a See footnote a, Table 6.7.

^bNet income of farm operators, including changes in inventories.

projection of number of commercial farms in 1975 is 2 million, a third less than the 3.1 million in 1954.

Underlying these projections is a continuation of past trends in substitution of capital and nonfarm inputs for both farm labor and farm land. These trends and other forces that have affected the capital structure of agriculture since 1940 are expected to continue at least until 1975. Approximately the same asset structure for 1975 emerges by assuming either a continuation of the trend in the total volume and composition of productive assets, or alternatively, a continuation of the trend in productivity of assets which, in turn, is related to the projected increase in volume of farm output. Using 1957 as a base, an increase of 20 percent in volume of total assets is expected. This would be consistent with a rise of 15 percent in real estate assets and about 30 percent in nonreal estate assets. The implied increase in productivity, or of output per unit of total assets, from 1957 to 1975 is more than 15 percent. Little change in acreage of farm land is anticipated. Rather, the increase of 15 percent in volume of real estate assets is expected to come chiefly from land improvements and net investment in service buildings and other structures. Further additions to stocks of machine and equipment likely will be a dominant factor in the 30 percent rise in nonreal estate assets. Substantial increases in capital of this kind will be needed to help bring about the projected decrease of a third in inputs of farm labor. Increases in size of farms, however, will make possible more efficient use of machines and other capital items, and will thus hold down the rise in volume of aggregate productive assets.

As was true from 1940 to 1959, the <u>most striking future change</u> in capital structure of agriculture is the expected large increase in vol-<u>ume of assets per farm</u>. The extent of this increase will depend greatly on the magnitude of the change in number of farms. Here, inability to separate available basic data on assets, output, and input between commercial and noncommercial farms prevents more meaningful projections.

Bachman has projected the number of commercial farms at 2 million for 1975, compared with 3.1 million in 1954. If we assume no change in number of noncommercial farms between these two dates, the total number of farms would drop by about 15 percent from 1957 to 1975. An alternative assumption is that the number of noncommercial farms will change by the same proportion as commercial farms. This projection calls for a decrease of a third in the total number of farms from 1957 to 1975.

Either projection of number of farms results in a further substantial rise in volume of assets per farm. Productive assets per farm in 1959 totaled more than \$33,000. By 1975 this figure is expected to increase to \$45,000 or \$55,000 (1959 prices). Stated another way, the average volume of assets per farm would rise above the 1959 level by a third under the first assumption regarding farm numbers, and by two-thirds under the second assumption. Assets per commercial farm in 1975 would be considerably higher than at present. The level may be so high that still greater difficulties in financing will arise and accentuate an already important adjustment problem in agriculture.

Discussion

RAYMOND J. DOLL*

One of the major problems facing economists since the dawn of their profession has been that of measurement. In Chapter 6 the authors have two major measurement problems. First, how can physical units of inputs be used realistically for comparative purposes through time in an economy that is dominated by rapid technological innovation — particularly when the inputs are not homogeneous either at a given time or through time? Second, how can investment in productive assets used by farmers be adequately distinguished from the cost of inputs per given unit of output for the purpose of analyzing the changing capital structure of agriculture?

The first of these measurement difficulties is always handled by economists in the only way that is available to them — namely, by applying price and converting all inputs into a common denominator. This method, however, has serious limitations which need to be recognized. Scofield and Barton recognize these limitations. Almost everyone recognizes that the general price level changes from time to time and that a dollar's worth of input at one time is not necessarily comparable to a dollar's worth of input at another time. Under these conditions, the solution usually suggested is to convert prices so they are measured in dollars with a constant purchasing power through time.

Unfortunately, the problem is not this simple. A relatively minor problem is that of deciding how the variable prices should be made constant. A more important difficulty, however, is that a physical unit of input in the technology of 1959 is not the same as was a unit similarly identified in the technology of 1940 or 1950. For example, the 1959 gallon of gasoline and tractor or truck are not comparable with the prewar gallon of gasoline, tractor, or truck, and, to the best of my knowledge, there is no way for making these unlike units comparable for comparative purposes.

The second problem of distinguishing between investment in productive assets and the cost of inputs per unit of output also was well handled. This problem has important implications insofar as financing agriculture is concerned. Barton and Scofield emphasize the fact that, even though farm real estate dominates the asset structure of agriculture, real estate inputs, in relation to all inputs, become a relatively minor factor. Thus, much of the financing done in agriculture is real estate financing, even though in terms of inputs it is a minor factor.

A significantly larger proportion of the dollars that farmers used in 1959 for livestock and machinery, compared with 1940, probably

^{*}Agricultural Economist, Federal Reserve Bank of Kansas City.

should be classified as production expenses rather than investment in productive assets. Animal products not only are produced more rapidly, but specialization has tended to cause more steps to be introduced into the productive process and, thus, each farmer handles the livestock for a shorter period of time. In the case of machinery and equipment, specialization and the trend toward larger farms result in more intensive use of the machinery and equipment and also in the use of more machinery and equipment rental and hire. Both of these developments tend to create a need for more operating capital in relation to investment capital.