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CHAPTER 1

Introduction and Summary of Findings

Purpose and Scope

THE primary purpose of this study is to measure and analyze the growth of farm capital over the eighty-year span from 1870 to 1950, to analyze for as much of this period as possible the financing that accompanied it, and to extract from this historical survey suggestions as to prospective future trends in capital formation and financing in agriculture.

Although this study is mainly concerned with the growth of capital (including land), it is enlightening also to trace the concurrent growth of farm labor and farm output. Indeed, it is hardly possible to give a meaningful account of the growth of farm capital without relating it on the one hand to the human factor that put it to work, and on the other hand to the product which resulted from its use. Much of the analysis of capital growth, therefore, centers on the interrelationships of three variables—farm capital, labor, and product—and on the past and prospective changes in the interrelationships of these three items.

This study is concerned with the growth of both financial and physical capital used in farming. Working balances of currency and demand deposits held by farmers are regarded as indispensable to farm operation, while other financial assets, like savings bonds, are considered to be reserves which were accumulated mainly for purposes not directly related to farming. These reserves are, however, also important to this study since they represent a potential source from which capital for use in farming may be drawn.

Unfortunately, basic data pertaining to financial assets of farmers and to their debts are not available before 1900. However, lack of estimates of the financial holdings of farmers from 1870 to 1900 is probably of no great consequence so far as analysis of capital growth is concerned. In 1900 all financial assets held by farmers appear to have been less than 5 per cent of total assets, while cash working balances constituted but 2 per cent. Since the proportion of financial assets before 1900 was probably even smaller, the absence of information about them can hardly be serious insofar as measurement of capital growth is concerned.

“Real,” or physical, capital used in farming is represented in this study by four major types of physical assets: (1) farm land and

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buildings; (2) implements and machinery, including automobiles, motor trucks, and tractors; (3) livestock; and (4) stored crops.

These four categories exclude certain items that undoubtedly are farm capital. For example, no account is taken of inventories of mill feed, insecticides, or other supplies that farmers may have on hand. They are omitted because information about such inventories is insufficient to warrant estimates for the years in question. It is believed that the amount would in any case be relatively small.

On the other hand, it may be thought that the four categories include too much. Should farm land be included in an inventory of capital? Or the farm residence? Or the automobile? In the case of land, the question is raised because of its origin; in the case of the farm residence and of the automobile, because of their use.

In economic theory, land and buildings are often classified separately, and, although both are durable producers' goods, only the buildings are classified as capital. The basis for the distinction lies in what are regarded as fundamental differences in the origin and supply of land and of other forms of durable producers' goods. Land has often been referred to as a gift of nature, unalterable in amount, whereas capital has been defined as a product, the supply of which responds readily to decisions regarding spending and investment. Thus a clear line is drawn between durable producers' goods that are themselves products of economic effort and responsive to economic decisions and those which are provided by nature and whose supply is therefore essentially fixed.

The differences between land and other durable producers' goods are easily exaggerated. Granted that the gross acreage of a country or region cannot be altered, it is still possible to change greatly the *productive* acreage and the productivity of the acreage already in agricultural use by means which closely resemble the methods by which buildings and equipment are increased.

To the extent that land derives its value from its usefulness in agricultural production (and not from its potential use as urban real estate or in mining), its value can be raised by the investment of effort and of money to fertilize, drain, clear, or irrigate it, to prevent erosion and soil depletion, or to bring it closer to markets by building roads, railroads, and the like. In short, land as well as buildings can be "increased" through the investment of current labor and capital if the measure of growth is not area but usefulness or productivity—more basic economic characteristics than physical dimension.

Much formerly barren land has been brought into use since 1870 not only through projects undertaken at public expense, but through

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the farmers' own efforts, which included draining wet land, irrigating dry land, and clearing away brush, stumps, and stones. The productivity of acreage already in use has also been increased by such methods. The increase in "improved" land in farms and in the number of farms gives some indication of the magnitude of this gain. There is no record of the amount of time, effort, and actual cash that was invested in such improvements, but investment of this kind has nevertheless been a factor in raising land values.

A second reason for including land in the inventory of farm capital is that farm financial operations are influenced as much by the value of land as by the value of buildings or equipment. Any study that attempts to measure the investment of time and money in the physical assets necessary to farming, or to account for the farm credit outstanding during past years, can hardly ignore the changes that have occurred in so basic an agricultural asset as land. Nevertheless, because for some purposes it may be appropriate to exclude land from total capital, land is shown separately and also totals are derived for "reproducible capital" excluding land.

If it were possible satisfactorily to divide the investment in farm residences on the basis of use in production and in consumption, it would be desirable to include here only that part which is used in production. But such a division encounters two difficulties. The first is that there is no very firm basis on which to separate the value of the farm residence from that of other buildings, and secondly, any division between productive and consumptive uses of the farm residence would be altogether arbitrary and open to question. The farm residence not only provides an abode convenient to the fields and barns for the farmer and his family—main components of the agricultural labor force—but in addition it frequently serves to feed and to house hired help. Moreover, such office space as a farmer may have for keeping records or transacting business will usually be found in his residence. The farm house is, of course, also used consumptively, but the extent of this use defies all measurement. Hence it seems best to include the entire amount. After all, it would be difficult to show that the investment in housing for a farmer, his family, and hired help is less essential to farm operation than the investment in stables for livestock or sheds for the protection of machinery. A farm residence, however modest, is likely to be among the first structures built on a new farm. Nevertheless, it is clear that by including the full value of the residence in farm capital we are thereby overstating the total in comparison, say, with capital used in industry, where the residences of workers are not included. This overstatement needs to be

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taken into account in any comparisons of this sort. Moreover, there is some overstatement of capital in relation to farm output, inasmuch as the output figures used here do not include the rental value of farm dwellings.

The case for including the full value of the automobile as farm capital is perhaps less clear, expediency weighing heavily in the balance. The Bureau of Agricultural Economics divides expenditures connected with the operation of farm automobiles on a 40-60 basis (50-50 during World War II) between production and family use. Why not a similar split in the capital value of automobiles when calculating farm capital? One reason is doubt that any proportion established for the country as a whole would hold for the various states and regions. Another is the necessarily arbitrary nature of any such division. Particularly when dealing with individual states or regions, an underestimate of the proportion properly chargeable to production might result in as large an error as that involved in including the full value of the automobile.

Capital formation is, of course, not an automatic process but a response to investment of money, effort, and time in new resources or facilities of production. Any study that hopes to explain this process over time must, therefore, consider two broad questions: First, what circumstances induced investment in farm assets, and how did these vary from one period to another in kind and in intensity? Second, what sources provide the financing? In this study we have sought reasons why at some times and in some places investment in farm capital was attractive, and why at other times and in other places the reverse was true. We have attempted also to identify in broad terms the sources that financed new farm capital, or which made its formation possible when inducements to do so were present.

Farming Regions

The direction and rate of growth of farm capital have varied greatly in different parts of the United States. It was highly desirable, therefore, to study this process by some type of geographic division so that the numerous diverse movements that would otherwise be submerged in all-embracing countrywide totals would be revealed. The segregation of data on a geographic basis permits the analysis of numerous special situations and makes possible a more detailed knowledge of the factors that have influenced capital growth.

What geographic divisions best facilitate analysis of farm capital formation? The answer depends largely on what is to be emphasized,

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on the time span to be covered, and, most of all, on the data available for the purpose.

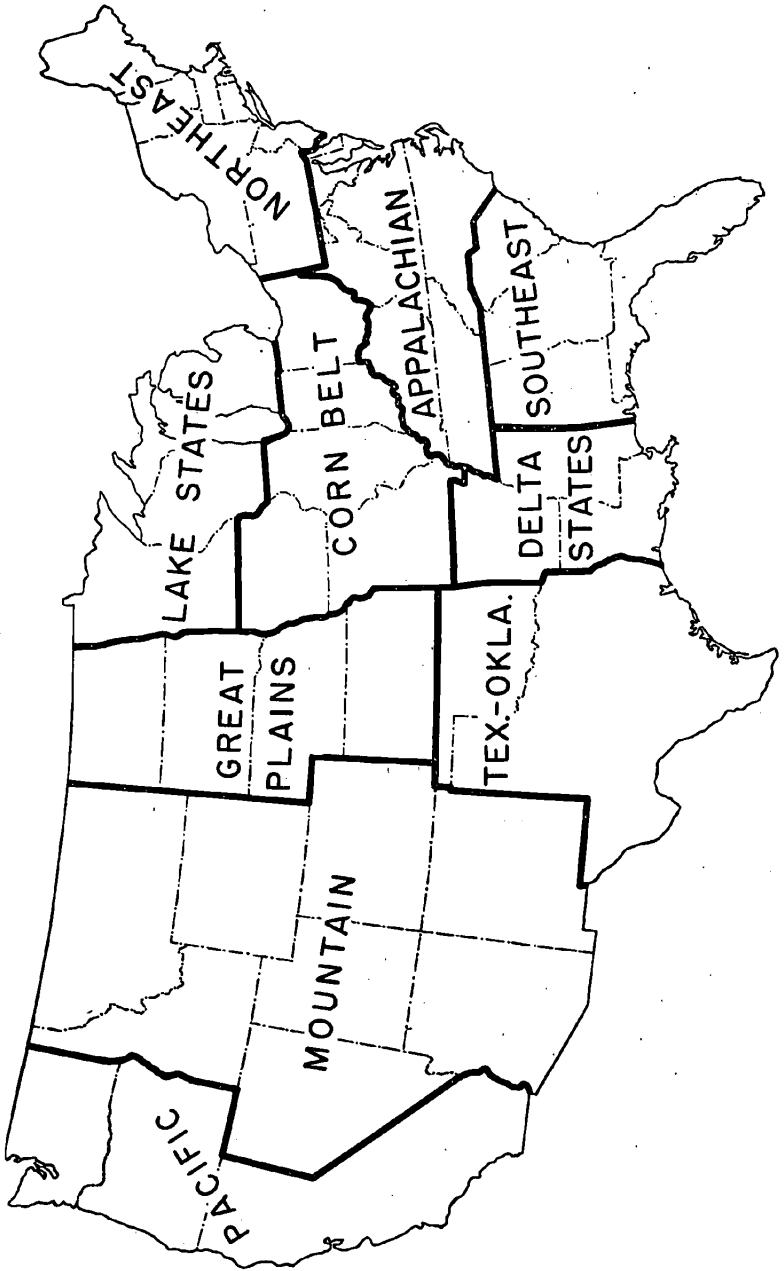
In this study emphasis is on over-all capital formation and on the factors that have determined its growth through an eighty-year span. Many of the data required to measure and to analyze the growth of capital over so long a period had first to be estimated, as in many instances the available data were too meager or too general, lacked comparability, or covered only a part of the period under study. In numerous important instances the data were such that estimates based on them could be regarded as reasonably reliable only if they applied to areas comprising two or more states. Thus there was no real alternative to presentation and analysis at the regional level; a choice could be made only among a number of possible groupings of states. As it was highly desirable to observe how capital formation had proceeded in different types of farming, and as in any event this would have to be done by examining area-wide data, an arrangement of states frequently used by BAE to emphasize type of farming was chosen (black and white map; see page 8).

The black and white map should be compared with the colored map at the back of the book, which indicates the location of certain types of farming. The colored map shows that no state, much less any region, has a completely homogeneous agriculture. And yet, this map makes farming appear more uniform than it is; the nature and organization of farming are such that not even a county is completely homogeneous. Regional data covering two or more states must therefore be regarded as representative of developments in specific types of farming only to a limited degree.

To illustrate, it would be foolish to draw fine distinctions between the investment structure of the average farm in the Corn Belt and in the Lake States and to insist that these distinctions accurately showed differences in investment structure of corn-livestock-feeding farms and specialized dairy farms in the Middle West. There are, for example, too many dairy farms in Iowa, the most homogeneous state in the Corn Belt, to permit this. But it is possible to say that, in the regions dominated by corn-growing and livestock-feeding operations on the one hand and by forage crops and dairying on the other, the capital structure of farms, on the average, showed certain likenesses and differences as indicated by the regional data. Moreover, comparison of the regional data can show in a rough way what would be involved in the way of capital formation per farm if some region that hitherto has specialized in field crops such as cotton or wheat were to change its major interest to dairying or livestock feeding.

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The United States Divided into Ten "Type-of-Farming" Regions



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In most of the ten regions designated in this study there is considerable uniformity in the type of farming (colored map). However, the region comprising the Pacific States defies classification. In California alone important islands of specialized agriculture, including the production of wheat, cotton, dairy products, fruits, and truck crops, are surrounded by larger areas devoted to the production of range livestock. The Great Plains and Texas-Oklahoma regions are also notable for contrasts in type of farming. In the main the Great Plains region is identified with small grain production, but a large segment of the region lies in the Corn Belt and another is in the range-livestock country. In Texas-Oklahoma large areas are devoted mainly to cotton production, but there are also large areas in which range-livestock and wheat production prevail.

Elsewhere there is more uniformity; the organization, techniques, and capital use of the dominant type are prevalent enough to give the data of the region their peculiar characteristics. For example, in the Southeastern region or the Delta States, the production of cotton, although by no means an exclusive enterprise, so far overshadows the other types of farming that state and regional data on farm capital reflect the characteristics that mark the typical cotton-growing farm. Investment per farm and per person engaged in farming is very much lower in these regions than in regions in which livestock enterprises of one kind or another predominate.

The colored map indicates where various types of farming were carried on in 1949. Data reflecting farm operations near the beginning, at the middle, and at the end of the eighty-year period indicate that in most regions the changes in type of farming were not drastic (Table 1). Although some of the percentages in Table 1 change considerably from 1879 to 1949, regions whose proportions of improved land in major crops were above (or below) the countrywide average in 1879, were, with few exceptions, in the same situation in 1909 and in 1949. For example, in the Delta States, where between 1879 and 1949 the percentage of improved land in corn fell 50 per cent and hay and forage rose tenfold, it is still true that in each year the percentage of corn was above the countrywide average and that for hay was far below. Moreover, although the proportion of improved land in cotton changed significantly, cotton remained the dominant crop.

The notable increase in the percentage of improved land devoted to hay and forage doubtless is partly a result of improvement of sloughs and other unimproved parts of farms from which wild hay

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TABLE 1

Percentage of Improved Farmland Devoted to Selected Crops,
and Value of Livestock^a (Other than Horses and Mules)
per Acre in Farms, by Regions, 1879, 1909, and 1949

Region	1879	1909	1949	Region	1879	1909	1949
United States:				Delta States:			
Corn (grain)	21.9	20.6	14.9	Corn (grain)	31.3	27.0	15.5
Wheat	12.4	9.3	14.4	Wheat	2.2	0.3	..
Hay and forage	10.8	15.1	16.0	Hay and forage	0.7	3.8	10.0
Cotton	5.1	6.7	5.1	Cotton	34.7	29.1	25.1
Livestock	\$4	\$3	\$3	Livestock	\$2	\$2	\$2
Northeast:				Great Plains:			
Corn (grain)	5.9	6.4	5.8	Corn (grain)	29.0	19.4	11.5
Wheat	5.2	4.3	5.7	Wheat	19.5	22.1	28.7
Hay and forage	25.9	33.7	42.9	Hay and forage	10.6	16.3	15.3
Livestock	\$5	\$4	\$6	Livestock	\$3	\$3	\$3
Appalachian:				Texas-Oklahoma:			
Corn (grain)	27.2	23.2	18.2	Corn (grain)	19.5	24.7	6.4
Wheat	11.8	6.0	4.5	Wheat	3.0	3.4	23.2
Hay and forage	3.8	8.1	17.2	Hay and forage	0.5	6.0	8.3
Cotton	3.9	3.9	3.6	Cotton	17.2	26.5	20.7
Livestock	\$2	\$2	\$3	Livestock	\$5	\$2	\$2
Southeast:				Mountain:			
Corn (grain)	31.8	27.2	24.6	Corn (grain)	3.2	3.0	1.4
Wheat	4.7	0.5	1.3	Wheat	10.5	8.1	22.1
Hay and forage	0.2	2.5	10.2	Hay and forage	16.8	31.7	17.0
Cotton	33.4	38.2	15.4	Livestock	\$35	\$5	\$1
Livestock	\$1	\$1	\$1	Pacific:			
Lake States:				Corn (grain)	0.6	0.5	..
Corn (grain)	9.6	11.4	15.3	Wheat	17.7	15.2	16.3
Wheat	27.6	9.5	5.2	Hay and forage	7.4	19.1	14.8
Hay and forage	15.3	21.9	23.8	Cotton	3.7
Livestock	\$4	\$4	\$5	Livestock	\$4	\$3	\$3
Corn Belt:							
Corn (grain)	29.7	29.7	30.9				
Wheat	14.2	7.3	7.9				
Hay and forage	10.2	14.9	13.3				
Livestock	\$5	\$5	\$6				

^a Five-year average centered on census year. Values in 1910-14 prices.

Source: Livestock, number on farms for 1878 to 1882 and for 1908 to 1912, and value per head Jan. 1, 1910-14, *Livestock on Farms January 1, 1867-1935*, revised estimates, Dept. of Agriculture, 1938. Number on farms for 1948 to 1950, *Livestock and Poultry on Farms and Ranches on January 1*, revised estimates, Dept. of Agriculture, Stat. Bull. 106; for 1951-52, *Livestock on Farms Jan. 1*, Dept. of Agriculture, Crop Reporting Board Release, Feb. 14, 1952. The value of chickens included in the average is for census years only. For method of estimating for 1880 and 1910 see Appendix 4. Acres in farms and improved land acreage from Table 6. Acreage harvested 1879 and 1909—corn and wheat—from *Census of Agriculture, 1940*, Vol. III, *General Report*, pp. 722 and 736. Hay and forage, *Thirteenth Census of United States*, Vol. V, *Agriculture, General Report and Analysis*, p. 641; cotton, *ibid.*, p. 681. Acreage harvested in 1949, *Agricultural Statistics*, Dept. of Agriculture, 1951, pp. 9, 39, 62, 69, 288.

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was cut in the earlier years, and of greater reliance on seeded meadows on improved land on which crops were rotated.

The regional importance of productive livestock appears to have remained fairly constant except in the Texas-Oklahoma and Mountain regions. The extraordinary declines shown between 1879 and 1909 in the value of livestock per acre in farms of these regions reflect not so much a shrinkage in the importance of livestock in farm operations as a change in the classification of much land used in farming from open range to land in farms. Comparative stability has prevailed throughout the eighty-year span because climate, topography, soil, and, perhaps in lesser degree, markets and other social institutions are the chief determinants of the type of farming that is carried on in any region. As a rule, changes in these factors are either negligible or so slow that the type of agriculture in a given region tends to remain fundamentally the same over long periods of time.

This is not to say that important modifications in operations and in specific crops do not occur within the framework of a given type of farming. Such innovations have in fact been frequent and sometimes spectacular. For example, in some of the Northern States, where dairying has been the dominant type of farming and hay has been a major field crop, through the years covered by this study there has been considerable change in the type of hay which was grown, and especially in the manner in which it has been harvested and preserved. In 1870, when the hay crop was only a little less important than now, there were few, if any, silos. Certainly no part of the hay crop was ensiled. Today silos and other recently developed methods of harvesting and preserving this ancient crop are increasingly used. Changes in caring for and handling the livestock are no less impressive. Thus the type of farming has changed far less than the techniques, and changes in the latter have been especially influential determinants of the use of capital in farming.

Growth of Farm Capital

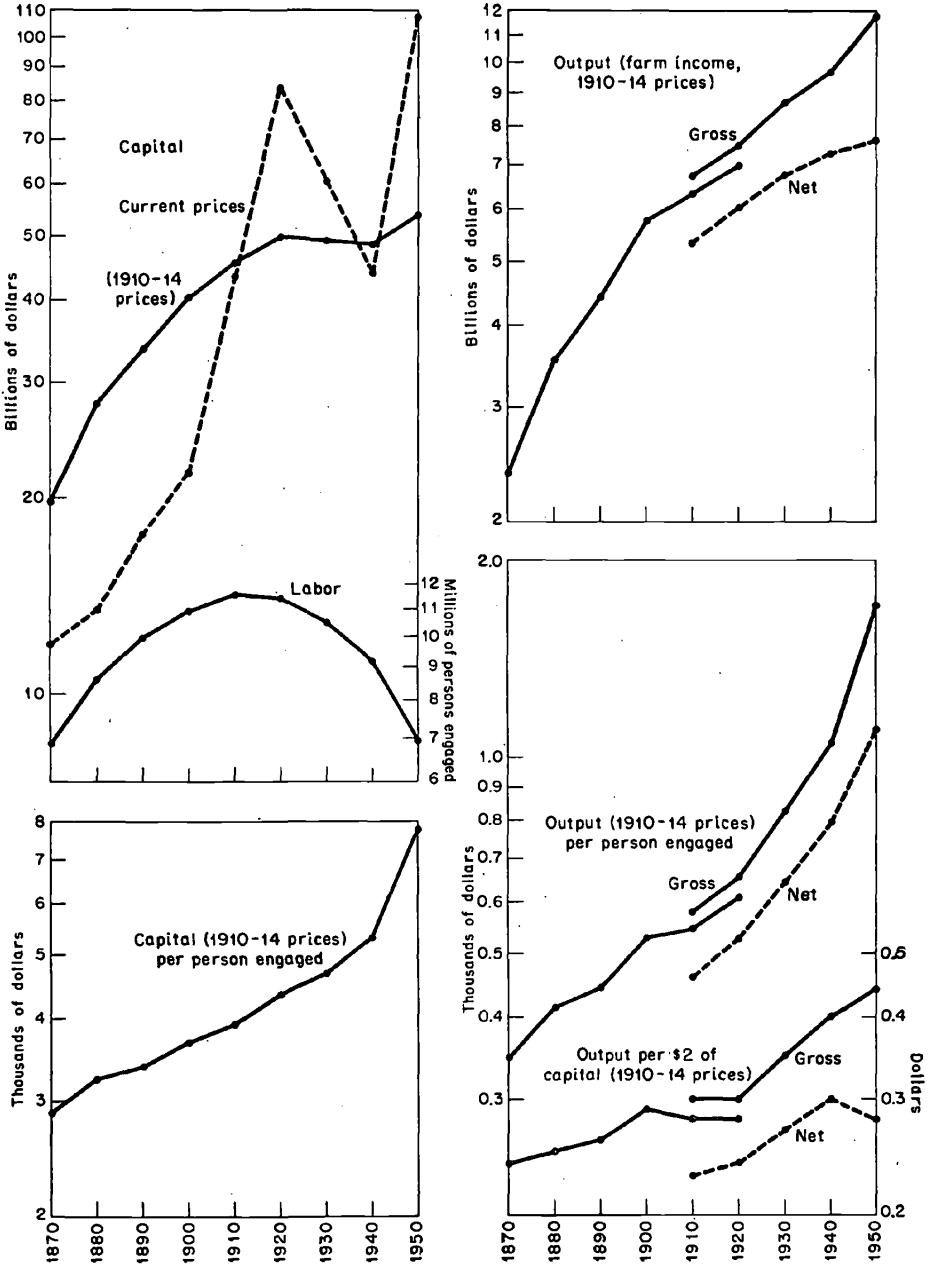
Some of the more basic findings of the study are summarized in Chart 1, which shows for the United States the growth of agricultural physical capital, labor, and output, as well as changes in the basic relations of labor to capital, labor to output, and capital to output.¹ What do these and other data that were developed in this study tell

¹ For the period 1910-50 output is shown in two ways: as gross farm income in 1910-14 prices just as it is shown for earlier years, and as income *net of intermediate products* which were mainly supplied to farmers from nonfarm sectors. Brief descriptions of the income and product series may be found in Appendix H.

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CHART 1

Growth of Capital, Labor, Output, and Related Items, United States, 1870-1950



Source: Tables 4, 7, 9, and 20.

Ratio scales

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us of the growth of capital in the past, and what implications are there that may suggest trends in the years ahead?

Physical capital in agriculture measured in 1910-14 prices grew steadily from 1870 to 1950 except between 1920 and 1935. The countrywide rate of growth decelerated steadily from 41 per cent per decade in the 1870's to about 10 per cent in the 1910's. Then followed two decades of no increase or indeed a slight shrinkage of the agricultural plant. But in the 1940's growth was again at the rate of 10 per cent, just as it had been before 1920. To achieve this rate of growth in the 1940's required a gross investment in physical assets of \$27 billion—an amount roughly one-fourth greater than the entire value of physical assets in 1900 (Table 35). In addition to this farmers added \$5 billion to their cash working balances. Of the \$32 billion total invested in physical assets or added to cash balances used in farming, no less than 90 per cent was supplied from gross income of farmers, i.e. from their savings.

In the early decades, when agriculture was expanding rapidly into new areas, the growth of farm capital as a whole was little influenced by the ups and downs of prices of farm products or by the changing prospects which attended such fluctuations. Between 1870 and 1900 prices paid to farmers were declining much of the time, yet during those years real capital formation proceeded at a faster pace than at any subsequent time.

The main reason for this high rate of capital formation in the early years, despite frequent weakness in the price of farm products, was that much land that was suitable for farming was being made available to farmers by federal and state governments and by railroad and timber companies at very low prices, or entirely without cost if the land was homesteaded.

Plentiful good land, available at little or no money cost, was a powerful inducement to establish new farms even though other forms of farm capital were often relatively scarce in the new regions and high in price. The inducement of cheap land and the related prospect of high net income and capital gains, once the farm was in operation, appealed not only to farmers and their children who were ready to set out for themselves in the older farming regions, but also to men in other occupations and even in other countries who had enough capital or credit to obtain at least the essential materials, equipment, and live-stock with which to make a start. The inducement to establish new farms that cheap or free land provided was probably about as strong in bad times as in good, since the opportunity to establish an independent means of livelihood on such land had widest appeal when

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industrial jobs were hard to get or to hold, and when failure was especially threatening in other lines of business.

However, after 1900 similar opportunities to establish an independent source of livelihood with relatively little cash became increasingly scarce. By 1920 no land of much promise was to be had cheaply, or simply by living on it and by improving it with one's own labor. Hence in the 1920's and 1930's situations were hard to find in which farm capital might be formed even under adverse economic conditions by dissatisfied persons of other sectors who turned to farming as a means of obtaining land cheaply, or by farmers in older regions, discouraged by poor soil, who sought a new start under more favorable conditions. After 1920 capital formation took place almost wholly on established farms which were already more or less adequately improved, stocked, and equipped. It had now to be set in motion by farmers who often strained under heavy debt and tax loads to produce enough money income to meet obligations incurred when prices of farm products were higher and prospects were brighter. So between 1920 and 1940, capital formation—even replacement of durable items that were well worn or obsolete—had often to take second place to the demands of solvency and of family support. This situation was dramatically changed after 1940 by the upsurge of farm income that accompanied World War II. With improved income and credit, and with new strong incentives to increase their capital, farmers and other farm owners invested an amount in new farm capital not matched in any other decade.

EFFECTS OF GROWTH OF FARM CAPITAL ON ITS COMPOSITION

The remarkable growth of agricultural capital has changed its basic composition somewhat over the years. The shifting importance of regions that accompanied expansion of farming into new areas in the earlier decades, as well as the more intensive utilization of resources in later decades, altered somewhat the countrywide proportions in which real estate, machinery and power, productive livestock, and stored crops were utilized (Charts 2 and 3).

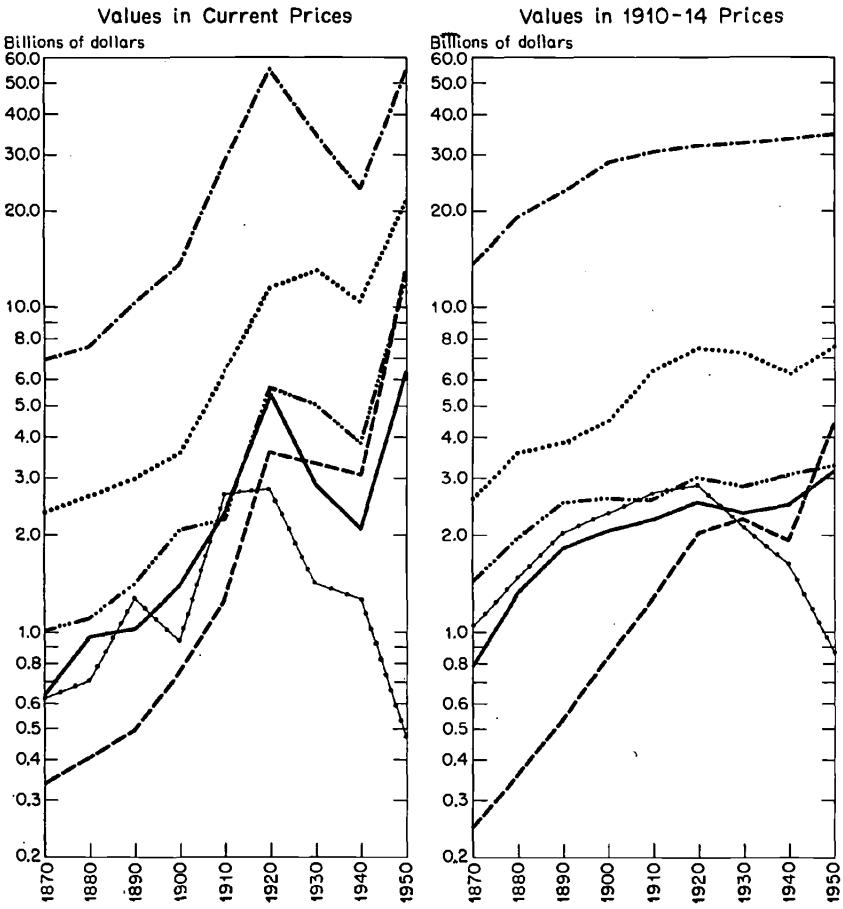
Comparison of constant price values for the entire eighty-year span will show that real estate fluctuated narrowly between 78 and 84 per cent of total physical assets. The increase in machinery's relative importance was continuous, and if taken alone is spectacular; as a percentage of total physical assets the value of implements and machinery rose from 1.3 in 1870 to 8.2 in 1950. But if these percentages are combined with those for horses and mules, whose decline after 1920 is equally notable, the relative investment in machines and

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CHART 2

Types of Capital Used in Farming, United States, 1870-1950

- Land
- Buildings
- Implements and machinery
- Livestock, excluding horses and mules
- Horses and mules
- Crop inventories



Source: Tables 7 and 9.

Ratio scales

CHART 3

Physical Capital Used in Farming, Value in 1910-1914 Prices, by Regions, 1870-1950

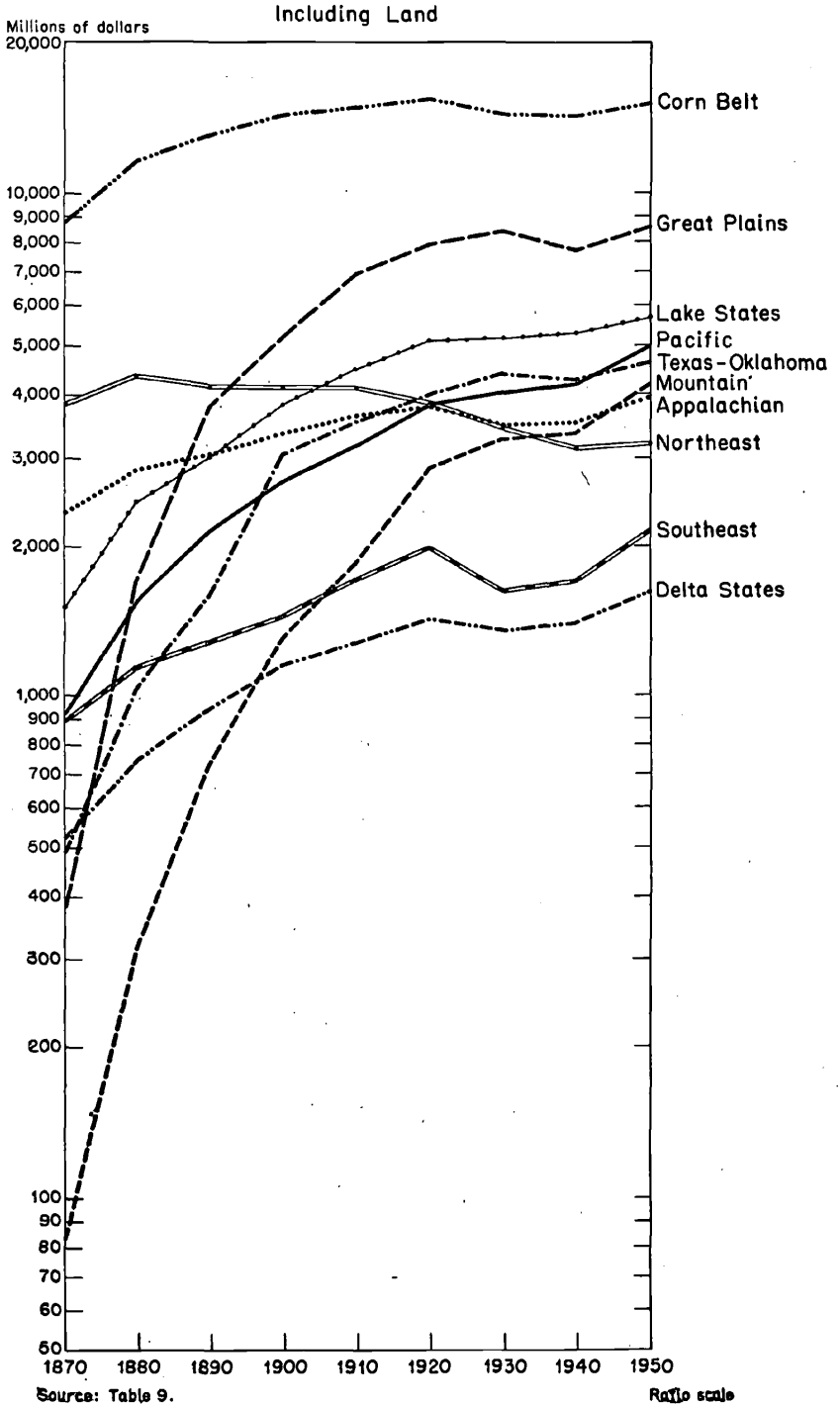
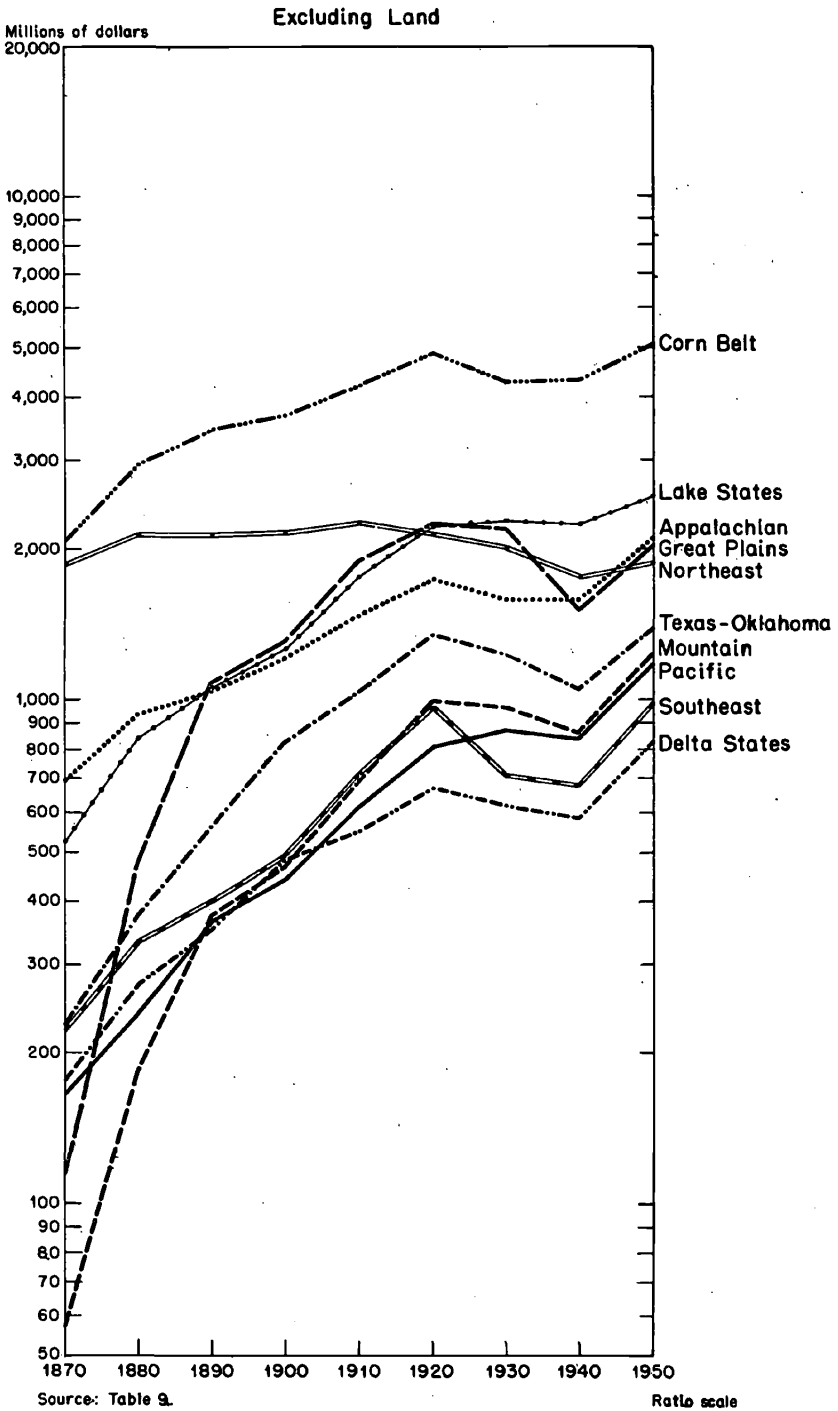


CHART 3 (concluded)



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power changed much less spectacularly—from 6.6 per cent of the total in 1870 to 9.8 per cent in 1950.

Productive livestock appears to have definitely declined in relative importance in the total stock of capital, although there has been little change if we exclude the earlier decades when much livestock was grazed on land not in farms. Nor was the change in stored crops noteworthy. In general the percentages give the impression that real estate has become somewhat less important, machinery and power somewhat more important, in the whole of physical farm capital. And it appears that it is the growth of machinery, influenced perhaps largely by the improvements in the farm tractor and by the substantial migration of farm workers to the cities, that is one of the main reasons for this change in the composition of physical farm capital. The identical exceptionally high percentage of machinery, horses, and mules in 1920 and 1950, when conditions of employment were very similar, supports this view.

While the foregoing analysis has great interest from a technological point of view, an analysis of the changing composition of physical farm capital measured in current prices has more significance from an investment or financial point of view. Measured in current values the investment in farm capital underwent especially interesting changes after 1935. Whereas for twenty-five years prior to that time the value of farm real estate fluctuated narrowly between 79 and 82 per cent of the total, after 1935 it declined consistently and in 1950 stood at only 70 per cent of the total of physical assets—fully 6 percentage points lower than at any time prior to the 1940's. Between 1935 and 1950 current values of productive livestock and machinery gained about equally in importance, and stored crops gained, but in lesser degree. As a result of these developments the problem of financing non-real-estate capital items increased in importance, while that of financing real estate diminished. Moreover, the rise in relative importance of capital items usually financed by non-real-estate credit was accentuated by the continuing rise in prominence of cash balances which, like physical items, are often maintained at a satisfactory level by borrowing. These rose quite consistently from 2.4 per cent of total assets used in farming in 1900—the first year for which we show an estimate of financial assets—to 6.9 per cent in 1950.

The amount of investment in physical assets by individual farmers averaged almost \$20,000 in 1950 in contrast to \$7,200 in 1940. This unprecedented value of physical capital per farm was partly a result of the high level of prices, but it was also partly a consequence of a substantial growth in the size of farms.

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Capital per farm has risen at a particularly rapid rate since 1940. This sharply rising trend has accompanied the growth of mechanization of farming—a development which often is attractive only if the individual farm can be enlarged. To some extent, also, the recent efforts by governmental agencies and others to lift the earnings of low-income farmers to a satisfactory level have contributed to larger units of operation.

Financing of Farm Capital

To a remarkable degree, farmers have financed the increase in farm capital with their own incomes and savings. A comparison of the volume of new capital that was financed by loans and book credits with that which was financed with funds derived from gross farm income and savings shows that in every decade for which we have information, save the one immediately preceding 1920, farmers supplied by far the greater part of the funds that financed the capital acquisitions (Table 2).

TABLE 2
Sources of New Capital in Farming, United States,
by Decades, 1900-1949
(billions of dollars)

<i>Source</i>	1900-09	1910-19	1920-29	1930-39	1940-49
Loans and book credits	2.7	9.7	1.4	0.6	3.0
Financial reserves	0	0	1.5	0.5	0
Gross farm income	6.6	6.6	8.3	8.6	29.4
Total	9.3	16.3	11.2	9.7	32.4

Source: Table 35.

Although the volume of new farm capital financed with credit has usually been small when compared to that which was financed by farmers themselves, such capital has often been substantial in amount and of high importance.

Prior to 1920 such "external" financing, whether based on mortgages or on other security, was provided largely by local banks and individuals or firms. After 1920, largely because the resources of local lenders in agricultural communities were severely reduced by economic developments that followed World War I, other lenders with a wider base of operations, including newly established federal and federally sponsored agencies, made available a larger part of the borrowed money used by farmers. This shift away from local sources

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of credit to lenders who operated over wider territories accelerated in the early 1930's. Even after the banking system, a main source of local loans, was restored following its collapse in 1933, the relative importance of banks as institutional lenders continued to decline. Not until near the end of World War II was the trend definitely reversed. Then the proportion of all institutional non-real-estate farm loans held by commercial banks rose from the lowest point on record, 55 per cent in 1943, to 72 per cent in 1950.

Changing Relations of Capital to Farm Output and Employment

As was to be expected, output of farm products available for human consumption, measured in gross farm income at constant prices, rose about as steeply as capital and the labor force in the years before 1920. Then, despite stagnation in the growth of capital for two decades and a simultaneous decline in labor force which accelerated in the 1940's, output continued to rise about as rapidly as when agricultural labor and capital were expanding. Growth of output in the face of a decline in productive factors emphasized the acceleration in technological changes that characterized this period. That the shrinkage in factors of production had so little effect on the volume of farm products available for human consumption was due in large part to the increasing assumption by nonfarm sectors of the work of providing certain intermediate products used in farming which traditionally had been supplied by farmers themselves. The outstanding example of this was the transfer of the job of providing farm power to the industries that produced tractors and motor vehicles and fuel for their operation.

Although the curves in Chart 1 depicting the growth of agricultural labor, capital, and gross income in constant prices show the importance in recent decades of this shift in the production of intermediate products from farm to nonfarm sectors, they also show that other forces were at work which helped considerably to sustain the rise in output of farm products. The curve depicting income net of intermediate products, based on the estimates of the Department of Commerce, rises notably too, although less rapidly than the curve of gross output. It is certain, therefore, that the rise in output in the face of arrested growth of capital and a declining labor force was sustained in part by changes to methods, equipment, livestock, and crops that were capital-saving as well as labor-saving. And, of course, it was sustained by rising capital in the 1940's, when the decline in the labor force was most pronounced.

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RELATION OF OUTPUT TO CAPITAL²

Output per unit of capital increased slowly until 1920. Then the increase accelerated so that by 1950 output per unit of capital was 40 per cent higher than in 1920. As has already been observed, this rapid rise occurred because output continued to climb at about the rate that had prevailed before 1920, despite no significant growth in capital.

No part of the increase in output per unit of capital resulted from the shifting importance of agricultural regions. On the contrary, the study shows that fuller settlement of the western regions tended to retard the rise (see Table 23 below). Apparently the forces that increased the amount of output per dollar of capital consisted of changes (1) in the character (in contrast to the amount) of physical capital which were capital-saving, (2) in composition of output, and (3) in methods of production which included an increasing reliance on nonfarm sectors to furnish essential intermediate products used in farming.

Although we cannot know with great precision how much of the increase in gross output per unit of capital is attributable to one cause or to another, it is possible to distinguish the effects of some of these influences. In Chart 1 we have related the Department of Commerce estimates of output net of intermediate products to capital. This permits us to observe the trend of output per unit of capital from 1910 to 1950 that resulted from influences other than the transfer to nonfarm sectors of work associated with the production of gross output that was once performed on the farm. As the trend in gross output per unit of capital is also shown in Chart 1, it is possible to note differences in the trends that are attributable to the growing contributions of nonfarm sectors to farm production.

The ratios involving output net of intermediate products are doubtless better reflectors of productivity of capital, and this series should be used to indicate such changes for the period following 1910. For the earlier decades we may use the rougher indicator of productivity that we have in gross output per unit of capital. If the eye follows the countrywide curve of output per unit of capital (see Chart 1) to 1910 or 1920 and then follows the curve depicting output net of intermediate products per unit of capital, the slow but fairly steady gain

² In this summary we speak of "output per unit of capital" instead of "capital per unit of output (product)," as in Chapter 7. The same relationship is dealt with in both places, although here the numerator and denominator have been switched in order to make the presentation uniform with that of other data shown in the summary.

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of output over capital from 1870 to 1940 will be observed.³ That this upward trend in output per unit of capital continued with few interruptions through seventy years is remarkable, since capital per person engaged in farming was increasing quite rapidly at the same time. Under these circumstances, a rise in the output per worker was natural, but a rise in the output-capital ratio was hardly to be expected, unless, indeed, it was made possible by improvements in methods of production. As a matter of fact, the continued rise in output per unit of capital can be explained only in connection with the technological improvements so often referred to in this study. The apparent decline in the output-capital ratio between 1940 and 1950 probably reflects the extremely sharp rise in capital per person engaged which occurred in the 1940's, with consequences which seem to have more than offset the upward pressure of technological improvements and reversed the rising trend. Whether this reversal is temporary, or is the beginning of a new trend, remains to be seen.

CAPITAL AND OUTPUT PER PERSON

The trend of capital and of output per person engaged in agriculture was upward throughout the entire eighty-year span. The rate of increase, which was impressive enough in earlier years, accelerated perceptibly after 1920—an observation that is equally true whether gross output or output net of intermediate products is considered. The increase, and even the acceleration, took place even when allowance is made for some shift in the composition of the farm labor force; i.e. the number of women and especially the number of children engaged on farms has declined more sharply than the number of adult males.

Doubtless the chief factor that accounts for the persistent rise in output per agricultural worker (well shown for 1910 to 1950 by the increase of output net of intermediate products per worker and with tolerable accuracy for earlier years by the increase in gross product per worker engaged) is the simultaneous rise of capital per worker. In the period of expansion, the countrywide average of capital per person engaged in farming, valued at 1910-14 prices, rose from \$2,900 in 1870 to \$4,400 in 1920, an increase of about 10 per cent

³ The data would, of course, show this more neatly before 1910 if output net of intermediate products were available. However, such data, if available, probably would not alter the picture appreciably. We can safely conclude that before 1910 contributions of nonfarm sectors to intermediate products used in farming were small. The great increase in the use of prepared feeds and commercial fertilizers to say nothing of the changes in farm power, came after 1910.

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per decade. This rate of increase was maintained despite a 68 per cent increase in persons engaged.

In the two decades that follow 1920, when capital formation in agriculture was insufficient to maintain the plant, the upward trend of capital per worker was nevertheless maintained at about 10 per cent per decade by reason of a sharp contraction in the labor force. But during the 1940's when vigorous capital formation proceeded simultaneously with a sharp reduction in labor force, the increase in capital per person engaged rose from 10 per cent per decade to 47 per cent. Small wonder that in this decade the rise in output per man broke all previous records.

The increase in capital per worker alone does not fully account for the rise in productivity of farm labor. A close inspection of Chart 1 will show that output per worker rose considerably faster than capital per worker. This is not surprising in view of the upward trend in output per unit of capital even in periods when the labor force was declining. The increasing efficiency of capital arising from improvements in equipment, in livestock, and in crops (in contrast to that which may have sprung from changes in the amounts of capital and the purposes for which it was applied in production), which made possible the rise in output per unit of capital even when the labor force was declining, also contributed something to the increase in output per person engaged in farming.

The large and continuing importance of capital as a determinant of productivity of labor is also strikingly shown by regional comparisons. A high correlation between amount of capital per person and output per person is clearly shown for each of three dates in Chart 4, which reveals the association between these amounts in ten regions at the beginning, middle, and end of the eighty-year span. However, the chart also shows that quite generally, in the regions where the larger amounts of capital per worker were used, output per worker was not proportionately larger than in the regions of smaller capital and output per person engaged in farming. Moreover, the relationship has changed over the years. A line fitted to the data of 1950 would not only be higher but would rise substantially faster than one fitted to the data of 1870 or 1910.

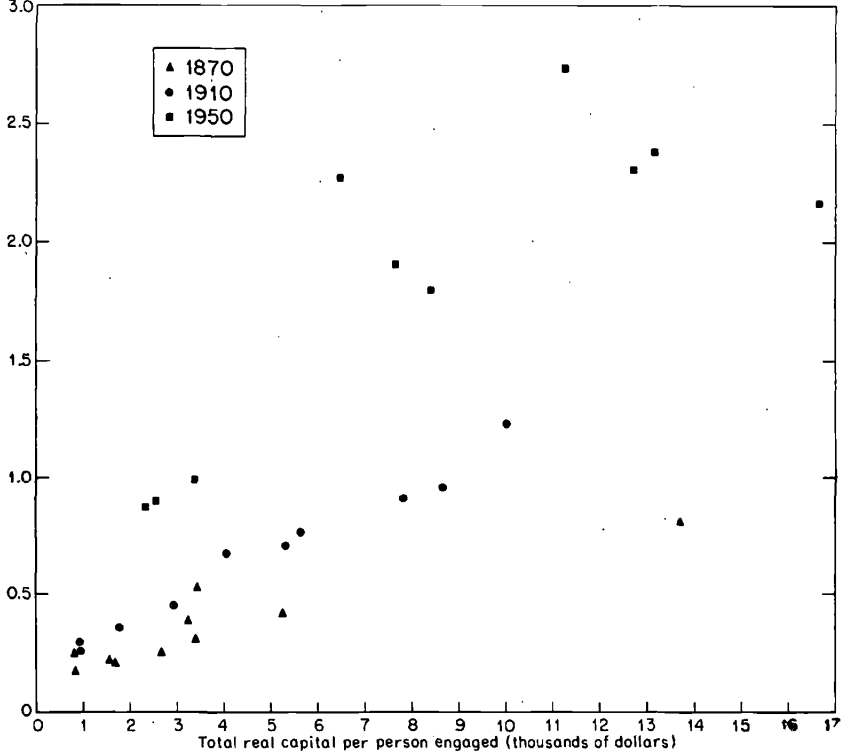
In Chart 5 the basic data of Chart 4 are repeated, but here the points are identified as to region and lines are drawn for each region connecting the points that relate gross income and capital per person engaged for the three dates in question. In every instance there is greater output per person as we move from 1870 to 1910 and then to 1950, and this greater output is generally associated with larger

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CHART 4

Relation of Real Capital per Person Engaged to Gross Farm Income per Person Engaged in 1910-1914 Dollars, Ten Agricultural Regions, 1870, 1910, 1950

Gross farm income per person engaged
(thousands of dollars)



Source: Based on Tables 5, 9, and H-3.

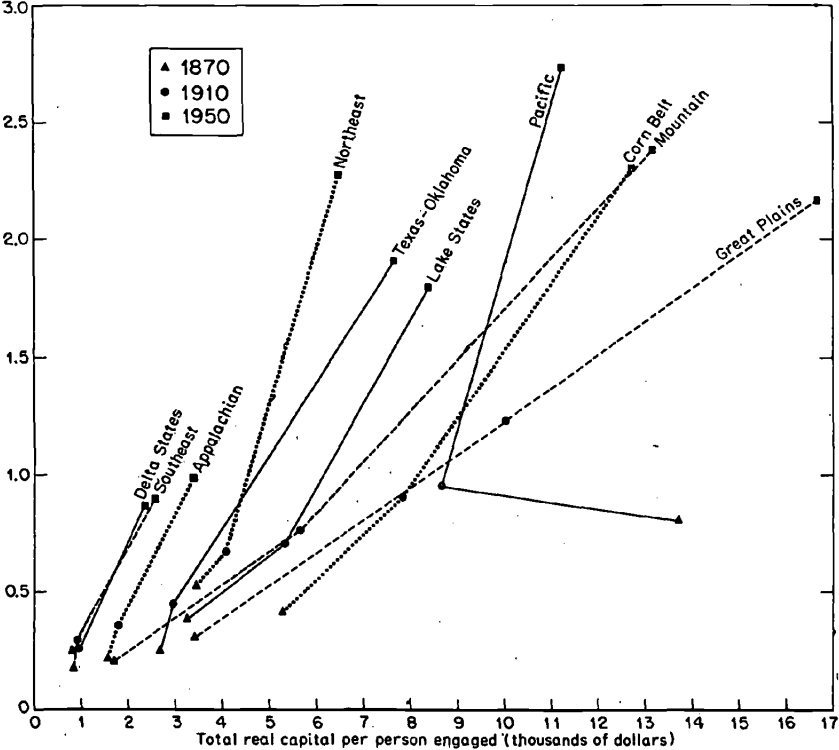
amounts of capital per person. The only instance where larger output was achieved despite a decline in capital per person is that of the Pacific region, where between 1870 and 1910 income per person rose a little despite a sharp drop in capital per person that was associated with the development of smaller farms (see discussion in Chapter 6 and Tables 14 and 15). It is noteworthy also that the relations between capital and output over time were by no means uniform among the ten regions, and that the responses to increased capital were much greater than those indicated when, as in Chart 4, different regions are compared as of a given year. Chart 5 emphasizes once more the secular rise in output that we have associated with in-

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CHART 5

Secular Trends in the Relation of Real Capital per Person Engaged to Gross Farm Income per Person Engaged in 1910-1914 Dollars, Ten Agricultural Regions, 1870, 1910, 1950

Gross farm income per person engaged (thousands of dollars)



Note: The regions are identified and joined by lines.
 Source: Based on Tables 5, 9, and H-3.

creasing productivity of capital arising chiefly from technological improvements, and from increasing assistance from nonfarm sectors that supply intermediate products to agriculture. And while Chart 4 reveals that the regions with larger amounts of capital per worker did not show proportionately larger outputs (particularly in 1870 and 1910), Chart 5 shows that in all regions the increases in capital per person engaged resulted over time in more than proportionate increases in output. In short, over time, technological changes and shifts of work to other sectors made possible a swifter rise in gross output per person engaged in farming than occurred in the resources with which each person in the agricultural labor force worked.

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Prospective Trends

At the outset of this section it is appropriate to consider the limitations on our ability to foresee future developments in capital formation and financing. We may add concreteness to this self-examination by asking how well or how poorly we would have done some thirty years ago had we attempted a similar prediction based on the trends and the prospects as they then appeared. What would we have foreseen with fair accuracy from our vantage point of the early 1920's? What would we have grossly misjudged?

Had we in the early 1920's attempted to predict the amount of capital formation that would occur in the second quarter of this century, it seems likely that we would have assumed a rather steady increase in farm mechanization based on wider adoption of the tractor—until then a novelty except in the West—and on the wider use of electrical power, possibly generated by improved farm plants, possibly furnished by a limited extension of lines from central generating plants. With increased mechanization of farm operations it would have been logical to associate some increase in the size of farms and investment per farm, and to expect a rise in capital per farm worker. In view of the work then being carried on by experimental stations, it would have been natural to expect some improvement in the yields of crops and livestock, so that a rising output would have been expected from a given investment and effort. As the expected shift to mechanical power occurred, a further contribution to a rise in output could reasonably have been expected from crops for human consumption produced on land released from the production of animal power.

Errors in judgment of things to come in the areas so far mentioned would very likely have been errors in foreseeing the *degree* of change, not the direction. Probably few foresaw the full extent to which improvements in machines would make them acceptable substitutes for farm labor and farm-produced power. Similarly, few foresaw unmistakably the extent to which productivity would be bred into crops and livestock, or the additions to output that could be obtained from improved methods of farming. Failing to foresee the full force of expected technological changes, we might quite easily have predicted a falling product-capital ratio for the second quarter of this century instead of the rising ratio that later events sustained.

But very likely the main source of error in a prediction of capital formation made in the early 1920's would have been our inability to foresee either the length or the depth to which agricultural depression was destined to go in the 1920's and the 1930's, and the effect of this

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depression on capital formation in agriculture. Moreover, in all probability we would not have foreseen, or correctly evaluated, the combination of circumstances that developed in the 1940's—unprecedented aggregate demand for farm products at high prices, labor shortages, ample credit, and other factors—that directly and indirectly invited the remarkable expansion of farm capital of that decade and that supplied on a wide scale the income and the credit to finance the increase.

Some concrete evidence of the difficulty of foreseeing the developments of the 1940's may be provided by a brief review of a careful and responsible forecast made in 1940. In *Technology on the Farm* (August 1940) a committee of the Department of Agriculture undertook to appraise the prospects for continued technological advance and its consequences. The predictions were remarkably accurate as to direction, but seriously underestimated the magnitudes. For example, the number of tractors on farms was predicted to increase by 500,000 by 1950, from about 1,600,000 in 1939.⁴ The actual increase was about 2,000,000; there were 3,600,000 tractors on farms in 1950. It was further forecast that each tractor would replace about three horses or mules, leading to reduction of about 1.5 million head of horses and mules. Actually there were about 7 million fewer horses and mules on farms in 1950 than in 1940, a reduction of about 3.5 head per additional tractor. As a further consequence of mechanization it was estimated that at least 350,000 workers, and perhaps as many as 500,000, would be displaced. The actual number of persons engaged in farming declined by more than 2 million between 1940 and 1950 (see Table 4 below).

Total capital needs of agriculture were expected to increase, but by an amount "probably not much more than 25 per cent of the working capital and 5 per cent of the total investment." If working capital is defined to include all physical farm assets other than land and buildings (i.e. implements and machinery, horses and mules, other livestock, and crop inventories), the forecast checks rather closely with our estimate of the actual increase. In 1940 the value of capital other than land and buildings, in 1910-14 prices, was \$9,077,000,000; in 1950, \$11,655,000,000; the increase is 28 per cent. However, the forecast increase in total investment (including land and building) does not check nearly so well; our estimate of the increase between

⁴ A somewhat earlier prediction by the Works Progress Administration indicated that 2.5 million tractors would be in use by 1950 or 1960 (Eugene G. McKibben and Austin R. Griffen, *Changes in Farm Power and Equipment—Tractors, Trucks, and Automobiles*, WPA National Research Project, December 1938).

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1940 and 1950 comes to 11 per cent, just over twice the forecast increase. The source of the inconsistency is difficult to trace, since no details on the method of arriving at the forecasts of these items were published.

A later forecast of some of the above items can also be checked against actual developments. In October 1947 the Department of Agriculture report *Progress of Farm Mechanization*⁵ estimated that, if workstock continued to disappear from farms at the current rate, there would be 7.5 million head on farms January 1, 1955, and 4.0 million in 1975. The number of tractors on farms, assuming that one tractor would replace 3.0 head of horses and mules during 1944-45, and 2.0 during 1955-75, would be 3.5 million in 1955 and 5.0 million in 1975. Actually the number of horses and mules on farms on January 1, 1955 was reported to be 4.6 million, and the number of tractors, 4.8 million. The actual figures for 1955 nearly reached the levels forecast for 1975.

In both these instances the main error was in forecasting the rate of change. In the first case the changes that were predicted to occur by 1950 had actually come about by 1943; changes estimated to occur over a period of ten years were telescoped into three. In the second case the changes predicted to occur by 1975 had largely taken place by 1955; developments believed to require thirty years evolved in ten. It is noteworthy that the *relationships* assumed proved to be remarkably correct, as were the directions of trend. It was the *rate* at which the changes were to take place that was not correctly foreseen.

Since this study does not attempt to evaluate the prospects for farm prosperity, we do not offer the following trends as future developments that are probable come what may. They are reasonable expectations only if prosperity in agriculture, and in the economy as a whole, stands at a level sufficiently high to invite capital formation. Whether this assumption itself is reasonable, is another matter. Moreover, the author who essays to chart future trends from past developments will be well-advised to remind himself and his readers, as the preceding examples do so forcefully, of the grave difficulties of estimating the force of factors like technological change.

Despite these obvious limitations, and despite the caution that must be urged on the reader, it seems worthwhile to set down those trends which seem well enough established so that they may be expected to continue in a prosperous economy. For although we can

⁵ Misc. Pub. 630, by Martin R. Cooper, Glen T. Barton, and Albert P. Brodell.

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be sure that history is likely never to repeat itself precisely, we can be equally confident that there are continuities in basic developments and relationships so strong that it is foolish to ignore them. And these are not without interest even though as events unfold a different level of prosperity should prevail, or one element or another should diverge from its expected trend.

SUMMARY OF TRENDS

Prospective trends related to formation and financing of farm capital that seem reasonable in the light of our findings are, briefly:

1. The volume of farm products per unit of capital will rise, most notably in the case of land.

2. Capital per person engaged in farming will rise, making possible a continuation of the secular rise in output per person engaged.

3. Capital per farm will rise.

4. Growth of capital in the aggregate will occur only in times of reasonable prosperity at an average rate that is likely to be substantially less than 1 per cent per annum.

5. The composition of farm capital will continue to be slowly modified. Machinery, productive livestock, and cash balances will gain in importance; land, buildings, and stored crops will decline, relatively.

6. Funds for investment in agriculture will be provided chiefly by farmers out of gross income, although amounts and proportions provided by creditors may remain above the 1950 level.

7. Non-real-estate credit will represent a larger fraction of the total than in the first half of this century. Long-term mortgage loans will be used relatively less for purposes of capital formation than earlier, and relatively more in transferring ownership of real estate.

PROSPECTIVE RELATION OF OUTPUT TO CAPITAL

It seems likely that gross output per unit of capital will continue to rise, although not necessarily as rapidly as between 1920 and 1950. Foremost among the forces that promise to lift this ratio are the more widespread application of scientific knowledge to farm operation and further improvements in technology that will increase output without requiring corresponding increases in either capital or labor. We may confidently expect further improvements in breeds, feeds, seeds, insecticides, equipment, and management of livestock and crops, with consequences to output per unit of capital as remarkable as any that have yet been seen.⁶

⁶ This optimistic view is not shared by all; see, for example, a note by Harry

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A second factor that is likely to exert further upward pressure on output per unit of capital is an increased use of intermediate products furnished by other sectors. It is true that the substitution of mechanical power for animal power is far advanced and that this revolution in the source of farm power will have far less effect on methods of farming in the future than it has had in the past. But there are astonishing possibilities of transferring to the chemical and other nonfarm industries more of the work of providing feed for productive livestock and fertilizer for crops. Increasing reliance on nonfarm producers for these items could greatly augment the output of farm products without any increase in either farm capital or labor.

On the other hand, there are probable developments which will tend to restrain further rise in output per unit of capital. It seems altogether likely that over the long pull capital per worker will rise. The opportunities for this seem especially favorable in the South. Production is now definitely and rapidly being mechanized in large sections of the Cotton Belt while simultaneously rapid industrialization of the southern regions draws to the cities increasing numbers of persons hitherto engaged in farming. Thus the chief factors that for generations have kept output per unit of capital in southern regions far higher than the countrywide average are undergoing modifications which promise to be permanent. Furthermore, if livestock enterprises continue to gain in prominence in those parts of the South that are suitable for expansion of production of feed crops and pasture, capital inputs in livestock and machinery will increase markedly, and there may be additional downward pressure on the amount of product per unit of capital. On balance, however, the forces that will tend to restrain the rise of output per unit for the country as a whole seem less strong than those that will encourage it.

PROSPECTIVE TREND OF CAPITAL PER WORKER

The rise in capital per person engaged may not continue at the high rate of the 1940's, but there are substantial reasons to believe that it may continue at least at the rate of earlier decades. To begin with, we may not yet have seen the end of absolute shrinkage of the agricultural labor force. Whether or not the number engaged in

C. Trelogan and Neil W. Johnson entitled "The Evitability of Technological Advance" (*Journal of Farm Economics*, November 1953). This note was a rejoinder to Willard W. Cochrane and Harlan C. Lampe's "The Nature of the Race between Food Supplies and Demand in the United States, 1951-1975" (*Journal of Farm Economics*, May 1953), which lists persuasive reasons for optimism in this matter.

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farming will continue to shrink depends basically on the relative productivity and earnings that can be achieved by labor in agriculture and in other parts of the national economy. A slump in the nonfarm sector would probably slow down or stop the migration from farm to urban employment even though simultaneously prosperity of farmers declined. But on the assumption of general prosperity, some further decline in the absolute number engaged in agriculture is possible. A marked decline can be expected in the South as that section continues the rapid industrialization of recent years, with the accompanying drafts on agricultural labor made all the more significant by decreasing racial discrimination in industry. Reduction in labor force alone should raise the amount of capital per worker simply by shrinking the denominator of the capital-worker ratio. In addition, reduction in labor force is likely to be accompanied by investments in labor-saving capital items. If a significant amount of labor is drawn from southern farms into factories, mechanization of farms in these regions will certainly be given special stimulation. Thus the numerator as well as the denominator of the capital-worker ratio will be altered in a way that will raise it.

If the outlook is for some further decline in farm labor, the reverse is true for farm capital. We have just observed that a decline in labor may lead to investment in labor-saving equipment. But perhaps more important is the fact that the contribution that additional investment in the physical assets of farming can make to the income of farmers has never been as widely understood or appreciated by farmers themselves, and by potential lenders, as now. The result is that new incentives to invest in improvement of land, of buildings, of machinery, of livestock have everywhere developed, and the possibilities of assistance through loans are being sympathetically studied by private and public lenders alike. This growing awareness of the possibilities of further investment should encourage a rise in the amount of capital with which the average person engaged in farming will work.

Whether changes in the relative importance of types of agriculture will cause a further rise in capital per worker is indeed difficult to say. If we assume an increasing importance of livestock products, there is reason to believe that the investment per worker would increase. The addition to capital would probably be less if the main development of livestock enterprises was in southern rather than northern states. Fruits and vegetables also promise to occupy an increasingly important place in agricultural production. Hitherto, an increase in production of these labor-intensive crops has gone hand in hand with a decline in capital per worker. But can we be sure that

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the production of these crops will indefinitely resist mechanization and so demand a higher than average proportion of hand labor?

PROSPECTIVE TREND OF CAPITAL PER FARM

The factors just presented that favor a rise in the amount of capital per person engaged support also, in the main, our expectation of larger amounts of capital per farm. Fuller and, especially, more widespread mechanization, however induced, will be a powerful force in enlarging the area of the individual operation, and the investment in machines will probably in itself contribute to higher investment per farm. As farmers strive for lower costs and higher net incomes, they are likely to increase the size of their operations and the amount of capital involved.

PROSPERITY AS A PREREQUISITE TO CAPITAL GROWTH

The expectation of an expansion of farm capital presupposes a reasonable degree of farm prosperity. If, on the other hand, farmers generally should face a period of seriously depressed income, stagnation in capital formation would almost certainly follow. Whether the curtailment would be as sharp or prolonged as that which occurred in the 1920's and 1930's would depend partly on the extent and duration of the reduction of farm income, partly also on the financial condition of farmers and their financiers at the time of the decline. For it seems certain that the serious and prolonged curtailment of capital formation following 1920 stemmed in large part from the difficult financial situation in which many farmers and local lenders found themselves after the war boom subsided. The inordinately high prices to which farm products and farm assets rose during and immediately after World War I, and the excesses in general spending, in land speculation, and in the use of credit that accompanied the general inflation, contributed much to the straitened financial condition of many farmers and local lenders. The trend in farm income in the postwar period cannot alone explain the severity and persistence of the curtailment in capital formation that followed 1920; the latter makes sense only as the weight of fixed charges on farmers and the weakened condition of rural banks are fully recognized.

We can therefore expect capital formation sufficient to provide growth in the agricultural sector only when farming is relatively prosperous. If we assume a degree of balanced prosperity sufficient to provide incentives for investment in farm capital, what factors support an expectation of a rate of growth substantially less than 1 per cent per annum?

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As already shown, the rate of capital growth had decelerated sharply for at least half a century when the prolonged depression in agriculture during the 1920's and 1930's halted growth completely. In the 1910's and again in the 1940's the rate of increase was 10 per cent per decade, or 1 per cent per annum. But both of these decades witnessed inflationary expansion of farm earnings, exceptionally tight labor conditions, and other abnormalities associated with war which caused capital formation to proceed under forced draft. What is more, capital formation during the 1940's reflected a backlog of need for capital built up by an expanding population during years in which difficult financial conditions among farmers and poor prospects prevented both the replacement and the increase of farm capital which ordinarily would have accompanied population growth. Hence the rate of 1 per cent per annum during the 1940's has every indication of being quite abnormal and far higher than should be expected over the years ahead.

That the rate of increase will be well below that of the 1940's seems clear also when the prospects for growth are considered. Since the end of World War II numerous studies have been made of the demand for farm products that is likely to develop in the years ahead, the projections usually being made to 1975.⁷ In these projections the Bureau of the Census medium estimates of population in 1975 (190-193 million) have been basic data,⁸ and major assumptions have generally included a decline in tension of world affairs, substantial stability in prices, declining exports, and full employment with a fairly high level of per capita income.

Under these conditions the growth in demand for products from the farm foreseen by these investigators ranged generally from 30 to 40 per cent, and in one case, where a 15 per cent per capita increase to

⁷ Reference is made specifically to the following studies: (1) "A Water Policy for the American People," *Report of the President's Water Resources Policy Commission*, 1950, Vol. I, Chap. 11. (2) "Resources for Freedom," *Report of the President's Materials Policy Commission*, June 1952, Vol. I, Chap. 9, and Vol. V, Report 7. (3) Byron T. Shaw, "Land Resources for Increased Agricultural Output," *Journal of Farm Economics*, December 1952. (4) Byron T. Shaw, *Statement at Hearings before the Subcommittee on Appropriations*, H. R., 82nd Cong., on Department of Agriculture Appropriations for 1953, Part I, pp. 228-236. (5) Sherman E. Johnson, "Prospects and Requirements for Increased Output," *Journal of Farm Economics*, December 1952. (6) H. H. Wooten, *Major Uses of Land in the United States*, Dept. of Agriculture, Tech. Bull. 1082, 1953.

⁸ A later estimate of 207 million has been published by the Bureau of the Census (*Current Population Reports*, Series P-25, No. 78, August 21, 1953). The use of this slightly higher estimate would, of course, raise the estimates of demand for farm products a little.

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provide improved diet was included, the increase was estimated at 47 per cent.

With increases in demand within these limits the need for additional amounts of land was estimated within a range of no net increase in cropland or its equivalent to an increase of many millions of acres, with no one believing that, in view of the reclamation projects that were likely to be carried out, the net increase would exceed 30 million acres. How much farm land would really have to be increased to provide the prospective requirements incidental to population growth and possible increase in per capita consumption depends, of course, on how much the yield per acre can be raised through wider use of available technology and by advances in technology that are yet to come. But in any case the consensus is that net increase in farm land acreage, if any occurs by 1975, will at most be so small that the annual rate will be substantially less than 1 per cent. The extent to which the quality of existing farm land will be built up through irrigation, drainage, clearing, and other methods by which land is improved, thereby adding to the quality of our land resources, can hardly be foretold. Unfortunately, depletion on land that is carelessly farmed will also affect the net results. In any case, net accretions to the land base from improvement are likely to be very moderate when considered in relation to the total land now under farm use.

Expenditures for farm buildings are likely to be sufficient to offset depreciation and to provide for a modest expansion between 1950 and 1975. Were expenditure on farm buildings to be maintained throughout the period at the rate which has prevailed since 1946, the expansion in the inventory of farm buildings would be large. But expenditures in recent years reflect a backlog of need growing out of years of stagnation in building caused first by depression in the 1920's and 1930's and later by wartime restrictions and shortages in construction materials. This backlog should be fully liquidated long before 1975. Once this influence is removed, there is reason to believe that further expansion will be small.

In support of this conclusion several considerations may be advanced. To begin with, if expansion of farm land is to be severely limited, it follows that expansion of farm buildings through construction of entire new sets on the new farm land will likewise be severely limited. Moreover, the tendency toward larger farms will make some existing sets of buildings unnecessary, and they will not be replaced when they wear out. There is, of course, a concurrent tendency to divide farms that are located near industrial centers to provide small part-time farms for industrial workers, and this gives rise to some

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new construction. However, this development has not prevented a substantial decline in the number of farms in recent years, even of part-time farms, many of which have disappeared in suburban developments. This suggests that consolidation of farms has been considerably more influential in determining the number of farm buildings required than partition. Finally, as will be shown in Chapter 7, the substitution of mechanical for animal power has reduced the volume of service buildings required to house the power units, a development offset to some extent by the rise in other livestock, especially in dairy herds, that has increased the need for shelter for these animals. Moreover, the trend in buildings to service cattle is toward less costly units both in the matter of construction and in maintenance (see Chapter 7).

The investment in machinery is likely to rise. As already pointed out, mechanization in much of the Cotton Belt was not far advanced in 1950 and there is a strong probability, based in part on the likelihood of improvements that will increase the adaptability of machines and in part on developing competition for farm labor, that much machinery will be added to farms in the southern regions.

Whether or not the investment in machinery will grow much, or any, in the regions which are already well-mechanized will depend largely upon the intensity of competition of other sectors of the national economy for the farm labor supply. Should this remain as intense as it has generally been since the start of World War II, the expectation of some further growth of investment in labor-saving machinery does not seem unreasonable even in highly mechanized regions like the Corn Belt and Great Plains. Moreover, the increasing availability of electricity on farms and further progress in making tractors adaptable to uses heretofore limited to hand or animal power should contribute to higher investments in machinery in all regions.

The forces that would make productive livestock a larger or smaller element of farm capital are conflicting. It seems likely that demand for livestock products will increase relative to demand for other farm products, and this fact, coupled with the prospective increase in population, suggests a steady and marked growth in the size of the livestock inventory from which the products will be derived. But perhaps in no other branch of farming have innovations of the past two or three decades been so capital-saving, and if this trend continues, the larger requirements of animal products will be secured in part by improvement in breeds, feeds, and management. Even so, the investment in productive livestock on farms is likely to grow substantially over the years.

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The cash working balances used in farming are likely to continue their steady growth in relative importance in the total capital mix. Belief that our growing population can be adequately supplied with little or no expansion of land and buildings rests to no small extent on the assumption that we shall increasingly substitute other resources for land—that we shall look more and more to commercial fertilizers, lime, insecticides, and commercial feeds for the increase in output that we need. This means a further growth in specialization and reliance on nonfarm sectors for intermediate products—developments which underlie the rise in importance of working balances which has already occurred.

In this connection it seems safe to assume that stored crops may become somewhat less important. The bulk of such holdings are home-grown feeds, and to the extent that commercial feeds supplant those grown on the farm, a smaller volume naturally will be stored.

CHANGING COMPOSITION OF CAPITAL

The foregoing analysis indicates that a distinct though moderate change in the composition of farm capital is under way. The indicated creeping growth of farm land (far less than 1 per cent per annum) suggests that this major component will decline in relative importance along with buildings and stored crops, while the importance of machinery and cash balances will rise. As we have seen, technological changes that are fairly compelling because they are economical tend to bring about these relative changes in the components of farm capital. Meanwhile, productive livestock seems assured of rising importance because of prospective trends in food consumption.

PROSPECTIVE SOURCES OF FINANCING

If the above-mentioned changes materialize, they are likely to have certain effects on agricultural financing. First, the historical data support the expectation that by far the larger part of new capital formation will continue to be financed by farmers without assistance from creditors. But there is good reason to believe that the proportion financed by creditors in the years ahead will be somewhat larger than in the 1920's and the 1930's. The marked increase for 1950 (and since) in creditor participation in capital formation is probably more than a temporary upsurge following the war. More likely it is the beginning of a trend that may carry the proportion of agricultural capital financed by creditors considerably higher. The factors which support this view are impressive.

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A price level that is high in comparison with most earlier years receives substantial support from important economic policies embraced by both major parties. This will contribute much to the need for borrowed funds of those who wish to begin farming, as well as of those who wish to expand present facilities.

The marked tendency since 1940 for farms to increase in area and in total capital employed is likely to continue in the foreseeable future. The increasing mechanization of farms and the increasing availability of mechanical devices for accomplishing all sorts of farm work will strongly support the movement toward larger and more costly units of operation. As farms grow in size and cost, so does the problem of financing them. Increasing amounts of help from creditors will probably be needed to assemble and develop the fields, the herds, and the equipment which will make efficient operation possible. Some of this credit will, of course, contribute nothing to capital formation, as it will be utilized in transferring ownership of existing resources. But loans used for development of land and construction of buildings or for improvement and enlargement of inventories of livestock and machinery will result in capital formation.

A factor that will encourage capital formation and that may raise the proportion that is financed by creditors is the growing awareness of the benefits to be derived from heavier capital investments per farm and per worker. As already indicated, this awareness is not limited to farmers and their technical advisors but is shared increasingly by both public and private lenders. The practice of employing agricultural experts on the staffs of private lenders is a relatively new development. One of the purposes of such experts is to make farmers more aware of opportunities to use additional capital in their operations, which the lending agencies are prepared to help finance.

The Farmers Home Administration and its predecessors have in a sense gone much farther than other lending agencies in that they have assisted farmers who were unable to obtain loans through ordinary channels to establish profitable farm operations. These agencies provided plans and supervision as well as complete financing in many instances. Although these programs have been very limited in aggregate effect, the loans which were made have financed improvements and expansion in every major type of farm capital. Under careful supervision they were instrumental in raising the output per farm and per person to a point where income was sufficient not only to repay the loans but materially to improve the level of living of the farm family. Since studies in many parts of the country indicate that much additional capital can be invested advantageously in agriculture,

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there is little doubt that some capital expansion financed by loans will result as lending agencies and farmers study these possibilities.

CHANGING IMPORTANCE OF MAJOR TYPES OF CREDIT

The changes in farm capital that are indicated by this study will tend to make non-real-estate credit relatively more important in the decades that lie ahead than it has been so far in this century. "Production credit," necessary to acquire adequate amounts of the resources that are increasingly used in farm production as substitutes for land, is certain to grow in relative importance, unless there is a marked inflation in farm land values, or a depressed agricultural situation requiring a funding of short-term debts. In fact, the ability of farmers to attain the level of production indicated for 1975 depends in large measure on their obtaining adequate loans to finance their requirements for fertilizer, machinery, and other productive items. Thus the changing importance of components of capital tends to raise the importance of non-real-estate credit.

The proportion of long-term mortgage credit used to transfer existing farm real estate to new owners will probably increase, and a smaller proportion will be used for establishing farms or improving real estate. This is not to say that lenders will have few occasions to finance land improvement projects and new buildings, but such uses are likely to be less prominent than when farming was spreading out over new land requiring new sets of buildings, and when drainage and clearing projects undertaken by farmers themselves were on a vaster scale than those foreseen in the next few decades. On the other hand, the level of prices that we assume will prevail and the increasing size of farms will make the use of mortgage credit in assembling a farm of proper size more important than in the past.