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Appendix A

Methods of Computing Constant-Price Values of Farm Real Estate

The physical inventory of farm real estate is affected by changes in the area and condition of land in farms and in the number, character, and condition of farm buildings. Physical measures of at least some of these changes are available. Acreage of land in farms and of improved land in farms, as well as the number of farms, has been reported by the Bureau of the Census or estimated by the Bureau of Agricultural Economics.[1] But none of the physical measures is really comprehensive; none is expressed in terms that can be combined with the measures of other elements in real estate growth, or of other classes of farm capital. Hence a series of constant-price values that reflects the movement of the more prominent indicators of physical change was calculated (Chart A-1).[2] Different procedures were used for the eleven western states where irrigation is widely practiced (those of the Mountain and Pacific regions) and for the remaining thirty-seven states. These are described below.

Procedure in the Thirty-Seven Humid States

Constant-Price Value of Land, 1870–1950

As the method applied to these states treats land and buildings separately, the first step was to obtain the average value of land alone for the base years 1910–1914. This was done in two operations. First BAE's 1910–1914 average value per acre of land and buildings was multiplied by the ratio of the value of land to the value of land and buildings as reported by the 1910 census.

[1] Improved land was defined in the 1920 census as "all land regularly tilled and mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards and nurseries, and land occupied by farm buildings." Unimproved land, according to the census definition, included woodland, brushland, rough or stony land, swamp land, and any other land not improved.

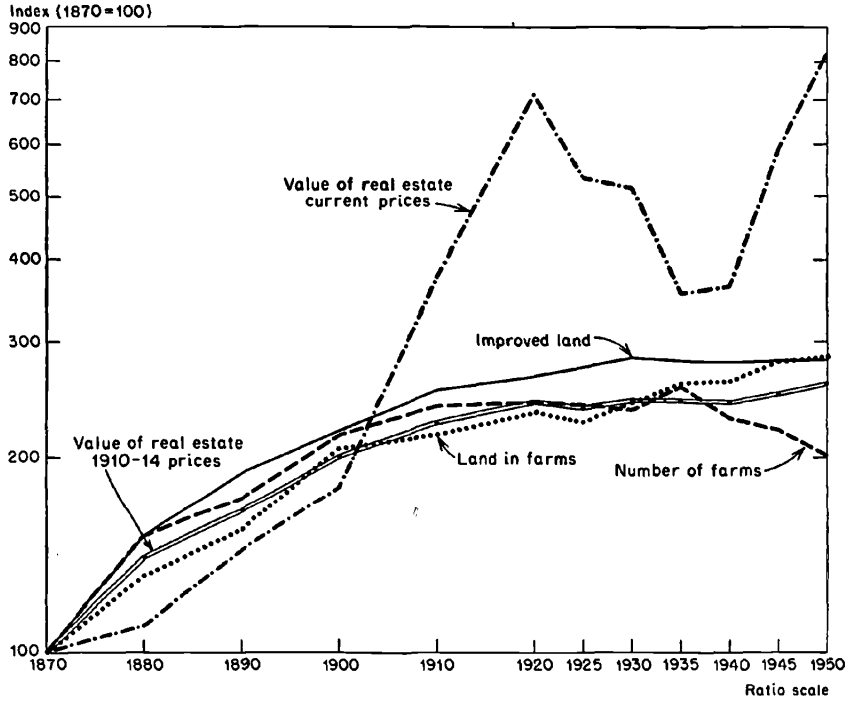
Substantially the same classification was used at each census from 1880 to 1920. In 1870 improved land "meant cleared land used for grazing, grass or tillage, or lying fallow." After 1920 the census did not classify land in farms as "improved" or "unimproved." However, beginning with 1925 BAE has estimated the acreage of "improved" land for census years by combining, and in some cases adjusting, the following classes: cropland harvested, land on which crops failed, fallow or idle cropland, plowable pasture, farmsteads, gardens, orchards, roads, and ditches.

[2] For a table of the state estimates and some tests of their reliability, see Alvin S. Tostlebe, "Estimated Value of Farm Real Estate 1870–1950 in 1910–1914 Prices," *Agricultural Finance Review,* Bureau of Agricultural Economics, November 1952.

The resulting value per acre of land was then multiplied by the acreage in farms reported by the 1910 census. For example, the BAE estimate of the 1910–1914 average value per acre of land and buildings in Ohio is $71.06. Multiplying this amount by the ratio of the value of land in Ohio in 1910 to the value of land and buildings (.777) gives a per acre value of $55.21 for land alone. When this amount is multiplied by the census acreage for 1910, the product is the value of Ohio farm land in 1910 at 1910–1914 prices, or $1,331 million.

CHART A–1

VALUE OF FARM REAL ESTATE IN CURRENT AND IN 1910–1914 PRICES, LAND IN FARMS AND IMPROVED LAND IN FARMS (ACREAGE), NUMBER OF FARMS, UNITED STATES, CENSUS YEARS, 1870–1950



The second step was to calculate a per acre value for "improved" and "unimproved" farm land in each state. In addition to the value of all land in farms in 1910 at the 1910–1914 level of prices and the acreages of improved and unimproved land, this step required a ratio of the value per acre of improved and unimproved land in the 1910–1914 period.

Unfortunately, data with which to establish such a ratio are limited. How-

ever, those that were found pertain to, or are particularly applicable to, the South and the Lake States, where recognition of the difference in rate of increase in improved and unimproved farm acreage is especially necessary for a trustworthy estimate of constant-price values.[3] These data indicate that during 1910–1914, in areas in which unimproved land in farms was mainly woodland or cut-over forest, the per acre value of improved land was about three times that of unimproved land. As the data indicate a surprising similarity in the ratio of the value of improved to unimproved land in widely separated regions, and in soils of very different quality, a 3 to 1 ratio was applied in all of the humid states except those of the Great Plains region, Iowa, and Illinois. In these six states unimproved farm land was typically prairie. The cost of converting unbroken prairie into cropland usually was much less than the cost of clearing woodland or stumpland. Hence a lower ratio, 1½ to 1, was considered appropriate for these states.

With these estimates of the relation between the value per acre of improved and unimproved land in 1910–1914, together with the number of acres in each class in 1910, and the value of all land in farms in 1910 at the 1910–1914 price level, it was possible to calculate the respective values per acre of the two categories for each state.[4] These per acre values became the constant prices that were applied respectively to the number of acres of improved and of unimproved land reported by the census or estimated by BAE for the census years 1870–1950.

Constant-Price Value of Buildings, 1870–1900

Before 1900, the value of farm buildings was not reported separately in the census. To estimate constant-price values of farm buildings for 1870, 1880, and 1890, it was assumed that the physical inventory of buildings *per farm* in each state was the same in each of the three preceding census years as it was in 1900. The value of buildings per farm in each state as reported in the 1900 census

[3] See Supplementary Note, page 76.

[4] Thus for Ohio, where in 1910 the unimproved and the improved land in farms amounted to 4,877,739 and 19,227,969 acres respectively, and the calculated value of all farm land at the 1910–1914 level of prices was $1,330,876,139, the per acre values at the 1910–1914 level for unimproved and improved farm land were calculated as follows:

Let

X = the value per acre of unimproved land in 1910–1914 prices,

and

$3X$ = the value per acre of improved land in 1910–1914 prices.

Then

$4{,}877{,}739X$ = the value of all unimproved land in farms,

and

$19{,}227{,}969\ (3X)$ = the value of all improved land in farms.

So that

$4{,}877{,}739X + 19{,}227{,}969\ (3X)$ = the value of all farm land, or $1,330,876,139.

$X = \$21.27$

$3X = \$63.81.$

was multiplied by the number of farms in the state in 1870, 1880, and 1890.[5] These values, together with those reported in the 1900 census, were then raised 26 per cent, an adjustment indicated by the rise in cost of construction on farms from 1900 to 1910–1914.[6]

Constant-Price Value of Land and Buildings, Census Year 1910 and After

For the census year 1910 and later, at least two methods of estimating constant-price values of farm real estate by states are possible. The simplest procedure is to divide the value of farm real estate reported in the census by the index of value per acre of land and buildings (1912–1914 = 100) constructed by BAE from crop-reporter estimates. Both the current values of land and buildings and the index are available by states. However, this operation produces results which, in numerous instances, are clearly biased—probably because the data in the dividend are not fully comparable with the data used in calculating the divisor. Moreover, the base of the divisor (1912–1914) differs slightly from the constant-price base used in the present study. Hence the results obtained by this method were used only as a rough check on those obtained by application of the method described below. For land, the same procedure as used after 1910 as before. The constant-price values of buildings for the census years 1910–1950, were estimated, by states, as follows.

The values of farm buildings in the United States for the census years 1910–1950, calculated in 1910 prices by BAE, were raised 1 per cent to place them on the 1910–1914 price level.[7] This slight increase was suggested by the

[5] This may result in some overstatement of the physical inventory of buildings for the earlier years, especially in regions that were relatively newly settled in 1870. In these areas it is likely that some service buildings were added on established farms, or that some smaller temporary buildings gave way to larger, more substantial ones. On the other hand, such additions and improvements were probably somewhat restricted before 1900 because of the persistent and general decline in the prices of farm products that characterized most of the period. Depreciation of farm buildings usually exceeds expenditure on construction and repair during periods of agricultural depression. If an overstatement of the physical inventory has resulted from the method used, it is believed to be small.

[6] Estimate based on a 19 per cent rise in the Warren and Pearson index of wholesale prices of building materials, a 47 per cent rise in the composite farm-wage-rates index, and a 45 per cent rise in hourly earnings in building trades. The percentage increases in wages were averaged and combined with the percentage increase in building materials. Weights of one and three were used in averaging wages and costs of material.

[7] In calculating these values, BAE started with the value of buildings reported in the 1910 census and extended the series by adding each year expenditures on buildings, wells, windmills, and fences, and subtracting depreciation, each in terms of 1910 prices. The inclusion of expenditures and depreciation on wells, windmills, and fences affects somewhat the comparability of the estimates for 1920 and later with those of 1910 and earlier. The effect must, however, be small in view of the fact that such expenditures are estimated at only 14 per cent of the total and that depreciation largely offsets the expenditures.

For greater detail of the method by which the value of farm buildings in 1910

BAE's farm-construction cost indexes. These adjusted constant-price values, which reflect changes in the number and condition of farm buildings, were then prorated to the states on the basis of each state's proportion of the current value of farm buildings in the United States. These current values were reported in the census by states except for 1935, 1945, and 1950; for these three years the current values were estimated.

The usefulness of this method may be questioned on the ground that depreciation and new construction, especially the latter, are likely to proceed at somewhat different rates in the several states and regions. Three considerations, however, support the belief that error from this source is small. First, by 1910 settlement was fairly complete, even in the most westerly states to which this method was applied. Hence the establishment of new farms that required construction of entire sets of new buildings would not vary greatly from region to region. Second, the changes in economic conditions that were important enough to influence farm construction from one census year to another were generally nationwide rather than regional. Finally, any variation in rate of new construction and depreciation that may nevertheless have occurred influences the percentage of the total current values of buildings for the United States, represented by the current values of buildings in each state at census years, and hence is reflected in the final estimates.

Procedure in the Eleven Western States

In estimating constant-price valuations of farm real estate in the eleven western states, it seemed necessary to distinguish between three classes of farm land —irrigated, dry-farming, and grazing land.[8] The procedure was to calculate per acre values of land and buildings at 1910–1914 prices for each of the three classes in each state, and to multiply these by the number of acres of the corresponding class at census years.[9]

Values per acre for the three classes of farm real estate in each of the western states are available in the annual estimates made since 1926 by crop reporters of BAE. Relationships among the values of these three classes at about the time of the 1930 census were assumed to apply also in the base period 1910–1914. Accordingly, three-year averages centering on 1930 were compiled for each class of real estate from crop reporters' estimates. These averages were adjusted so that when they were multiplied by the respective number of acres reported in the 1930 census, the sum of the products equaled the census-re-

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prices are calculated see *Expenditures for and Depreciation of Permanent Improvements on Farms, 1910–40.* This is Section 5 of Part II of *Income Parity for Agriculture,* Dept. of Agriculture, 1941. A more condensed description may be found in *The Agricultural Estimating and Reporting Services of the USDA,* Dept. of Agriculture Misc. Pub. 703, pp. 153–154.

[8] In the Pacific states dry-farming land includes cultivated land that is not irrigated but is well watered by rain.

[9] I am indebted to William H. Scofield of BAE for suggestions and data useful in developing the method described below.

ported value of all farm land and buildings in 1930. Adjusted three-year averages were used to reduce distortion that might result from the limited number of farms covered by the estimates of crop reporters in any one year.

By assuming that the values per acre of irrigated, dry-farming, and grazing land in 1910 bore the same relation to each other as the adjusted averages just described, it was possible to calculate the value per acre for each class in 1910. The data utilized for this purpose were the census-reported acreages for the three classes, the value of all land and buildings in 1910, and the adjusted averages described above. The calculations were similar to those described in footnote 4 for land alone. The final step was to raise the values so computed for each western state to the 1910–1914 level by dividing them by an index for each state based on the value per acre of all farm land and buildings in 1910–1914. This gave constant prices for irrigated, dry-farming, and grazing land, which were then multiplied by the respective acreages in each census year.

Acreages of the three classes were partly estimated. Acreage of irrigated land has been reported in the census beginning with 1890, but it was necessary to estimate the acreage under irrigation in 1870 and 1880.[10] Acreage of dry-farming land was estimated by subtracting irrigated acreage from improved acreage in farms. Grazing land was estimated as the difference between all land in farms and improved land.

Supplementary Note

Clues to the relative value of improved and unimproved land more or less applicable to the period 1910–1914 are as follows:

1. Lake States, 1914: In *Costs and Methods of Clearing Land in the Lake States,* Dept. of Agriculture Bull. 91, 1914, Thompson and Strait provide a comparison of value per acre of improved and logged-off land in twenty counties of Minnesota, in thirty counties of Wisconsin, and in forty-four counties of Michigan. The value per acre of improved land does not include the value of farm buildings. In Minnesota the value of improved land was $26.71 per acre and that of logged-off land $9.95 per acre, indicating a ratio of 2.7 to 1. In Wisconsin the values of the two types were $43.35 and $13.62 respectively, indicating a ratio of 3.2 to 1; in Michigan they were $56.78 and $11.85, making a ratio of 4.8 to 1. The authors summarized their findings as follows:

> At the present time [1914] very little logged-off land that would make desirable farm land can be bought for less than $15 to $25 an acre. As the cost of clearing varies from $20 to $90 per acre the cost of farm

[10] Mainly by extrapolating ratios of irrigated to improved land. However, in Utah irrigated acreage was reported for both years in C. H. Brough, *Irrigation in Utah* (Johns Hopkins Press, 1898). An estimate of irrigated acreage in Colorado in 1884 published in Elwood Mead's *Irrigation Institutions* (Macmillan, 1910), influenced our estimate for 1880.

land cleared of stumps will run from $35 to $115 per acre, the average being about $65.

This indicates a ratio of about 3.3 to 1 for the region.

2. Mississippi, 1915, 1917: In 1915 the assessed value of cultivated land in Mississippi averaged $7.26 per acre; wild and uncultivated land averaged $3.07 per acre exclusive of standing timber; the value of the timber averaged $1.82 per acre of wild and uncultivated land. In 1917 the Mississippi Tax Commission improved the assessment procedure of the state, thereby raising the 1917 assessment, made by the old method, by 18.1 per cent for cultivated land, 7.7 per cent for wild and uncultivated land, and 9.7 per cent for timber standing on the latter. Application of these correction factors to the per acre assessed values of 1915 raises them to $8.57, $3.31, and $1.99 respectively. In 1917, after prices of cotton not only had recovered from the sharp drop of 1914 but also had advanced quickly to levels that had not been reached for more than forty years, the average assessed values per acre for the two classes of land and for standing timber were $17.47, $4.48, and $2.79 respectively. It is probably correct to assume that valuable standing timber was mainly on large tracts not in farms. If, then, the value of standing timber is ignored, the value per acre of improved land in 1915 was 2.6 times the value of unimproved land. In 1917, the value per acre of improved land was 3.9 times that of unimproved land. In view of the possible influence on land prices of the severe depression of cotton prices following the outbreak of war in Europe in 1914, and the high prices of cotton in 1917, a ratio of 3 to 1 for the per acre value of improved to unimproved land in Mississippi seems defensible.

3. Missouri, 1910–1915 and 1910–1931: [11] Data from the sales records of forty-six farms sold during 1910–1915 in Mississippi County, Missouri, are contained in an unpublished report by BAE entitled "Farm Appraising in the Birds Point New Madrid, Missouri, Floodway." Acreage in these farms totaled 8,655, of which 4,073 were cleared and 4,582 were woodland. The average price per acre, including buildings, was $38; of cleared land with buildings, $61; and of woodland, $18.

Values of the buildings on the forty-six farms are not reported separately, but if it is assumed that the average value of these buildings equaled the average for the county in which they were located in 1910 (adjusted for the difference in census values and appraised values suggested by the difference in the value per acre of land and buildings, and for moderately rising real estate prices throughout the period), a value of buildings per acre of cleared land of about $5 appears likely. This indicates that the average value per acre of cleared land without buildings was about $56, or 3.1 times the value per acre of woodland.

[11] I am indebted to Hugh H. Wooten of BAE for calling attention to the studies of land values in Missouri, Tennessee, Louisiana, and Arkansas referred to in this Appendix.

The same report presents data from the sales records of 186 farms (including the above 46) sold during 1910–1931, as follows:

	Acres	*Average Price per Acre*
Total	29,663	$56
Cleared	19,858	73 (including buildings)
Woodland in farms	9,805	22

Values of buildings per farm in Mississippi County, Missouri, as reported in the 1910, 1920, and 1930 censuses, were adjusted to the level of the values in the report, averaged, and applied to the 186 farms. These calculations indicate a value of buildings of about $6 per acre of improved land. On this basis, the value per acre of cleared land without buildings averaged $67, or three times the value of the woodland in farms.

4. Louisiana and Arkansas, 1930: A "Report Submitted by the Department of Agriculture to the Secretary of War on the Valuation of Property between the Proposed Protective Levees of the Boeuf and Atchafalaya Basins, and in the Red River Backwaters" deals with a total of 3,696,695 acres in twenty-two counties in Louisiana and four counties in Arkansas, of which 705,426 acres were cleared and the remainder were woodland.[12] The average value per acre of the cleared land without buildings in 1930 is given as $33.45, or 4.2 times that of woodland, which was appraised at $8.01 per acre.

5. Tennessee, 1937: An unpublished BAE report entitled "Real Property Appraisals of the Norris Reservoir Purchase Area" covers 133,999 acres of farm land in five counties of northeastern Tennessee. The 72,388 acres of cleared land are valued, without buildings, at $43.70 per acre; the woodland and timber are valued at $18.80 per acre. The value per acre of the cleared land (without buildings) is 2.3 times that of the woodland.

6. South Carolina, 1934: In 1934 the first purchases of the United States Forest Service in South Carolina included fifty-seven tracts in the Enoree Purchase unit, each of which contained some plowland. The total acreage involved was 36,000, of which 13 per cent was plowland. Prices paid for plowland averaged $8.81 per acre, or 3.3 times the $2.67 average paid for uncultivated land.

7. North Carolina, 1934: At the same time that the 57 tracts were purchased in South Carolina, the Forest Service bought five tracts in the Uwharrie unit in North Carolina, comprising 3,808 acres. The price per acre paid for plowland was $9.10; for uncultivated land, $2.90. The ratio here was 3.1 to 1.

[12] Much of this was published in *Control of Floods in the Alluvial Valley of the Lower Mississippi River*, H. Doc. 798, 71st Cong., 3d Sess., 1931, Vol. 2, Annex 20, pp. 1519–1558.