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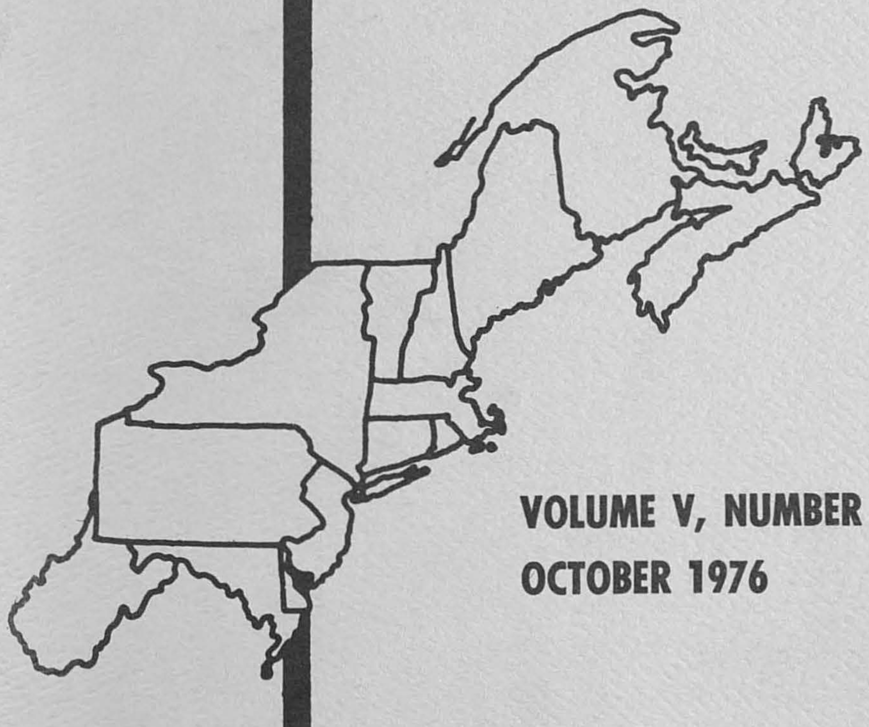

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ASSESSING THE RELATIVE IMPORTANCE OF ECONOMIC AND TECHNICAL INFORMATION IN ESTIMATING AGRICULTURAL VALUES OF FARMLAND: A CASE STUDY

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Introduction

Economists play two rather distinct roles in the area of public policy. These roles might be characterized as analytical and operational. In their analytical role, economists develop models designed to evaluate alternative policy measures which either might be or have been adopted by a public agency. In their operational role, economists help develop the specific techniques and estimates necessary to make a chosen policy operational.

In this second role, economists are faced with the problem that a strict application of economic theory often would necessitate utilizing data which could be obtained only at a high cost. Reconciling the requirements of theory with the costs of obtaining data is in essence an economic problem. Given the limited resources available to make a specific policy operational, the economist should attempt to allocate these resources in such a way as to minimize the difference between the situation resulting from the actual operation of the policy and the situation which would have resulted if the operation of the policy had been based on a rigorous application of economic theory.

In attempting to optimize in this fashion, the economist needs to know two things regarding each of the estimates or data items which he must use. First, he needs to know its reliability in terms of the magnitude of the likely difference between the estimates and the true situation. In statistical terms this could be expressed as the length of a confidence interval (at some specified level of confidence) centered on the estimate. Second, the economist needs to know the impact of a given change in the estimate on the situation resulting from the operation of the policy.

For those estimates and data items which are basically economic in nature, economists should be able to exercise professional judgment in evaluating their reliability. Economists should also be able to utilize sensitivity analysis techniques to estimate the impact of reasonable changes in the data. But in their operational role, economists frequently must rely on estimates and data which are basically technical in nature. Often, they have little basis for judging the reliability of this technical information.

This creates a dilemma. If the impact of reasonable changes in the technical items is overwhelming in comparison to the impact of changes in the economic items, there is little value in expending resources to refine the latter. On the other hand, the potential impact of changes in technical estimates may be relatively unimportant as contrasted with the impact of reasonable changes in economic estimates. If this were the case, resources would best be applied to the refinement of the economic rather than the technical data. In this paper, I examine the relative importance of technical and economic data in the development of procedures associated with the implementation of New Jersey's farmland assessment program. The procedures considered are those used in the estimation of average agricultural values of farmland in each county of the state.

Estimating Agricultural Values of Land Under the New Jersey Farmland Assessment Program

In 1964 New Jersey became one of the first states to enact legislation formally permitting the taxation of agricultural land based on assessments of its use value rather than its market value [1,6]. One issue of concern was the basis on which local tax assessors would determine the agricultural value of the qualified farmland.[1] The legislation thus required that a State Farmland Evaluation Advisory Committee be established to "annually determine and publish a range of values for each of the several classifications of land in agricultural or horticultural use in the various areas of the State" [1, Section 20]. The legislation specifies that these values are to be based upon the productive capabilities of the land in agricultural or horticultural use as evidenced from soil survey data and other pertinent data/[1, Section 20]. These values, which have been published annually in accordance with the requirements of the legislation [2], provide guidance to the local tax assessors in assessing land at its agricultural value.

The procedures used in estimating these agricultural values were developed by economists and soil scientists at Rutgers University. The approach is based on the concept that the appropriate measure of the agricultural value of land is the capitalized value of the net

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1/ To qualify under the act, the tract must consist of at least 5 acres, and must generate at least a specified minimum income per acre. Land occupied by farm buildings does not qualify for use-value assessment.

agricultural income generated by the land. Income generated from the land is assumed to depend on (1) the type of land use and (2) the productivity of the soil.

Several estimates which are basically economic in nature are needed to make this concept operational. First, net farm income must be estimated for each county. Net farm income is calculated by subtracting estimated production expenses from the estimated gross farm income. Data for these calculations come from the Census of Agriculture and from USDA estimates of farm income by states. Second, the appropriate rate at which to capitalize net farm income is estimated to be 10 percent. Third, trends in census data are used to estimate the county acreages in each of four land-use categories: cropland harvested; cropland pastured; permanent pasture; and woodland. Finally, the average relative productivities of the four categories of land use must be estimated.2/

From the above predominately economic information it is possible to estimate, by county, the average value of land in each of the four land use categories.3/ But to incorporate, as the law requires, information on soil productivity necessitates some technical soils information.

To provide this information, soil scientists at Rutgers University defined six soil productivity groups, ranging from very productive farmland (group A) to land unsuitable for agriculture (group F). Each of the soils found in the state were categorized into one of the productivity groups [4].4/ Given the county estimates of the average agricultural value of land in each of the four land use categories (developed from the economic information discussed above), county estimates of average agricultural values of land for each of the five productivity groups within a land use category are given by the following equation:5/

$$\sum_{j=A}^{E} V_{ij} P_{ij} = \overline{V}_i$$

2/ The figures used are as follows: cropland harvested is estimated to be twice as productive as cropland pastured; 5 times as productive as permanent pasture; and 20 times as productive as woodland.

3/ For a more complete discussion of the procedures used, see [2].

4/ Between 1911 and 1927 soil maps were published for the entire state. A total of 215 soils were identified and mapped. Each of these soils is described briefly in [4].

5/ Productivity group F is omitted because soils in this group are not suitable for agriculture.

where: V_{ij} is the average per acre value of land in land use category i and soil productivity group j;

P_{ij} is the percentage of the land in category i which falls in soil productivity group j; and

$\overline{V}_i$ is the average value of land in land use category i.

For each of the four land use categories, the soil scientists estimated the relative productivity (and thus the relative value) of each of the five groups of soils. It is thus possible to solve for the V_{ij} once the P_{ij} are known. But the data necessary for estimating the P_{ij} generally have not been available. In the absence of this information, the simplifying assumption was made that in each land use category, the distribution of farmland centered on group B soils, i.e., that $V_{iB} = \overline{V}_i$. With this assumption (hereafter referred to as the distribution assumption), the desired estimates of agricultural values can be made. For illustrative purposes, the 1972 published estimates for Somerset County are presented in Table 1.

Table 1
Published Estimates of Agricultural Values for Farmland, Somerset County, New Jersey, 1972
($ per acre)

Soil Productivity Group	Land Use Category			
	Cropland Harvested	Cropland Pastured	Permanent Pasture	Woodland
A	432	216	79	20
B	360	180	72	18
C	252	126	58	16
D	144	72	50	14
E	36	18	43	13

Source: [2, p. 7]

Recent technical and administrative developments permit an investigation of both the reliability of the technical estimates and assumptions used, and the impact of reasonable changes in these estimates on the resulting agricultural assessments. The technical development of interest is that a new and more detailed soil survey has been undertaken in New Jersey by the USDA Soil Conservation

Service (SCS).[6/] Although the number of soils into which the state has been mapped is much larger than previously, each of the new soils has been rated according to the same productivity groupings developed for use with the farmland assessment program.[7/] This soil survey is mapped on aerial photo base maps at a scale permitting the identification of the boundaries of individual farms.

Tax assessors in some parts of the state are taking advantage of this expanded technical capability by requiring each farmer to obtain from the SCS a map segment showing the boundaries of his farm, and showing the soil productivity rating of each soil type present on the farm. The assessor then measures acreages from the map and multiplies by the appropriate published estimates of agricultural values. Summing the results gives the total agricultural assessment for the farm.

Where this procedure for assessing farmland has been used, data on the actual distribution of agricultural land in each land use category by soil productivity groups have been generated. It thus becomes possible to investigate the impact on agricultural assessments of the distribution assumption. Furthermore, the existence of two different soil surveys which have been categorized into the same soil productivity groups permits at least a limited investigation of the reliability of the productivity ratings. This investigation is based on the assumption that the two resulting distributions of soil productivity ratings are both reasonable estimates of the true distribution of soil productivity. Thus the difference between the two distributions is a measure of the degree of reliability of the data on soil productivity.

Impact of the Distribution Assumption

To investigate the impact of the distribution assumption on the resulting assessments of agricultural land, it was necessary to obtain data on the actual distribution of farmland in an entire county. Somerset County was chosen because in all but one municipality in the county, the SCS air photo soil maps had been used in making the assessments for the 1973 tax year. It was therefore possible to

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6/ Reports for several counties have been published. The mapping of soil in several other counties is complete, with information available from the state SCS office.

7/ These ratings do not appear in the published reports, but are available from the state SCS office.

obtain from the various assessors' offices, data on the actual distribution of farmland.[8/] From these data the average agricultural value of each of the twenty land use/soil productivity cells was calculated. These are the values which would have been published if the actual soil productivity distribution of farmland (under the new survey) had been known and used. These values, presented in Table 2, can be compared with the actual published values presented in Table 1. It can be seen from this comparison that the effect of the distribution assumption was to bias the per acre values downward as compared to what they would have been had the actual distribution of land been used.

Table 2
Adjusted Estimates of Agricultural Values of Farmland, Somerset County, 1972*

Soil Productivity Group	Land Use Category			
	Cropland Harvested	Cropland Pastured	Permanent Pasture	Woodland
A	500	259	95	22
B	417	216	86	20
C	292	151	69	18
D	167	86	60	16
E	42	22	52	14
Average	360	180	72	18

* Based on the actual distribution of land in each land use category among the productivity groups and on the published estimates of average value for each land use category (line 2 of Table 1).

The impact of the distribution assumption on total agricultural assessments is readily determined by multiplying the actual acreages in each land use/soil productivity combination by the two sets of land values. Using the published per acre values would result in a

8/ The missing municipality (Bridgewater) accounted for only 2.4 percent of the total qualified farmland in the county [3], making its omission inconsequential in the resulting data on the distribution of farmland among the productivity ratings.

total assessed value of qualified agricultural land in Somerset County of $12,711,000.[9] The comparable figure based on the values which reflect the actual productivity distribution of farmland in Somerset County is $14,632,000. Thus the potential impact of the distribution assumption in Somerset County is to reduce assessments of qualified agricultural land by $1,921,000, which is equal to 15 percent of the value that would result from using the published figure.[10]

Reliability of Soil Productivity Estimates

The existence of two soil surveys permits some examination of the reliability of the estimates of soil productivity. But investigating the consistency of the soil productivity ratings between the two soil surveys is made difficult by the fact that data to permit this comparison are not in a readily available form. Soils are mapped by soil type, and not by productivity grouping. To make a comparison for any given geographic area, it is therefore necessary to develop two overlay maps (one for each survey) showing the location of the soil productivity groups. Visual comparison of the resulting maps is made difficult by the differences in scale. A more systematic comparison requires the tedious job of measuring, from each map, the acreages in each productivity group.

For these reasons, the comparison of the two soil surveys was limited to one municipality of Somerset County. Montgomery Township, an important agricultural municipality in the county, was selected. Of the 16 municipalities of the county which report farmland, Montgomery ranks third in total acres of farmland (10,600) and second in the proportion of total area in farms (51 percent). The results, presented in the first two columns of Table 3, demonstrate that for Montgomery Township there are very large differences in the soil productivity ratings stemming from the two soil surveys.

9/ The value of agricultural assessments in Bridgewater Township is excluded.

10/ This represents, however, only 2.5 percent of all agricultural assessments (qualified and non-qualified farmland) in the county, and only 0.09 percent of the total assessed value of all classes of land in Somerset County ($2,132,311,000) for the 1973 tax year [3].

Table 3
Distribution of Land by Soil Productivity Group,
Montgomery Township, Somerset County
(percent)

Soil Productivity Group	Total Land in Township: Old Soil Survey (1)	Total Land in Township: New Soil Survey (2)	Total Farmland, New Soil Survey (3)
A	3.2	11.7	12.3
B	72.3	31.9	30.2
C	11.8	29.2	26.6
D	5.9	26.7	28.8
E	6.8	0.5	2.0
Total	100.0	100.0	100.0

Source: Calculated from soil productivity overlays developed from soil maps.

But to examine the potential impact of this large difference in soil productivity ratings on agricultural assessments, it is necessary to compare the two surveys with respect to the distribution of soil productivity ratings for farmland in each of the four land use categories. For the new survey, these data had been generated by the local tax assessor in the process of assessing qualified farmland. It was necessary, however, to estimate the distribution of farmland under the old survey. In making these estimates, it was assumed that the productivity distribution of farmland was the same as that of all land in the township. The justification for this assumption is that under the new survey, there is little difference between the distribution of total land and the distribution of farmland (columns 2 and 3 of Table 3).

Figures showing the potential impact on agricultural assessments of the change in soil productivity estimates are presented in Table 4.[11/] The figures in the first column show data on the actual assessments for the township. These figures resulted from the use of the published estimates of agricultural value (with its assumption that distribution of soil productivity groups centers on group B) with soil productivity data generated from the new survey. The figures in column 2 are the

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11/ This is termed the "potential impact" because local tax assessors never actually used the old soil survey in the way that they now use the new survey in making assessments of agricultural value.

estimated values that would have resulted if the same procedures had been followed using the old soil survey. These figures indicate that the differences in the estimates of soil productivity result in a difference in total assessments of $277,000. Thus under the old survey, agricultural assessments potentially would have been about 13 percent higher than they actually were under the new survey. On a per acre basis, average assessments for cropland harvested also would have been about 13 percent higher under the old survey. For cropland pastured the figure is about 15 percent, while for permanent pasture and woodland the figures are 9 and 7 percent, respectively.

Table 4
Alternative Agricultural Assessments of Qualified Agricultural Land, Montgomery Township, Somerset County, 1973 Tax Year (dollars)

Item	Basis for Assessment		
	Published Values With New Soil Survey* (1)	Published Values With Old Soil Survey (2)	Adjusted Values With New Soil Survey** (3)
Cropland Harvested (per acre)	294	331	340
Cropland Pastured (per acre)	155	178	186
Permanent Pasture (per acre)	57	62	68
Woodland (per acre)	15	16	17
All Farmland (per acre)	207	234	241
All Farmland (total)	2,215,000	2,492,000	2,570,000

* Figures in this column represent the actual assessments for Montgomery Township.

** The adjusted values used are those for Somerset County presented in Table 2.

For purposes of comparison column 3 has been developed, showing the figures that would have resulted if the agricultural values for Somerset County shown in Table 2 had been used with soil productivity data generated from the new survey.[12] These are the figures that would have resulted under the new survey if the bias resulting from the distribution assumption had been eliminated.

A comparison of columns 1 and 3 shows the effect of the distribution assumption on the assessments of qualified agricultural land in Montgomery Township. The reduction in assessed value of $355,000 is 16 percent of the actual assessed value, which is very close to the figure of 15 percent estimated above for Somerset County as a whole.[13] But a comparison of columns 2 and 3 of Table 4 indicates that most of the impact of the distribution assumption can be attributed to the change in the soil survey. Under the old survey, the distribution assumption used was fairly valid for Montgomery Township resulting in an underassessment of only $78,000. Most of the actual underassessment resulted from the fact that the actual productivity distribution under the new survey was quite different, and the original assumption was no longer appropriate.

Conclusions

The procedure developed by economists for the estimation of agricultural values for farmland in New Jersey requires technical data on soil productivity. Use of such data is, in fact, mandated by legislation. This study has shown that very large aggregate differences between alternative reasonable estimates of soil productivity exist (Table 3). It has also shown that lack of data on the soils of farmland may affect the resulting agricultural assessments even more than changing from one set of estimates of soil productivity to another (Table 4). The analysis suggests that existing assessments might be about 15 percent higher with more complete and accurate soils data.

But considering the likely magnitude of error in the economic data used in calculating agricultural values for land, the potential impact of improving the technical data appears modest. For example, a decrease in the estimated farm production expenses of merely 1.4

12/ The average assessments per acre shown in column 3 in Table 4 are not the same as the average in Table 2 because the distribution of soil productivity groups in Montgomery Township is not identical to the distribution for the entire county.

13/ Because Montgomery Township is largely rural, the importance of this reduction in assessments is greater than for the entire county. But it still represents only 0.4 percent of total assessments in the township (see footnote 9).

percent would raise the estimate of net farm income, and thus of the average assessments per acre by 15 percent. Or a change of one percentage point in the rate at which net farm income is capitalized into land values would have an impact on agricultural assessments of the same order of magnitude. This suggests that the most productive use of resources devoted to improving the estimates of the agricultural value of farmland lies not in improving data on soil productivity, but rather in refining the economic data and estimates used.

References

1. New Jersey. Farmland Assessment Act of 1964, Chapter 48, P.L. 1964.

2. New Jersey. "Report of the State Farmland Evaluation Advisory Committee." Trenton, New Jersey, Ninth Report, 1972.

3. New Jersey, Division of Taxation, "Fifth Report of Data from FA-1 Forms for 1973 Tax Year." Trenton, September 1973.

4. Tedrow, J.C.F. "Productive Capacity of New Jersey Soils: A Soils Guide for Use in Connection with the Valuation, Assessment, and Taxation of Land Under the Farmland Assessment Act of 1964". Rutgers University, New Jersey Agricultural Experiment Station Bulletin No. 811.

5. U.S.D.A. Bureau of Soils. "Soil Survey of Trenton Area, New Jersey." Washington, D.C., U.S. Government Printing Office, 1926.

6. U.S.D.A. Economic Research Service. "State Programs for the Differential Assessment of Farm and Open Space Land." Agricultural Economic Report No. 256, 1974.