SIMULATED EFFECTS OF USE VALUE ASSESSMENT ALTERNATIVES ON LOCAL GOVERNMENT FINANCES IN FIVE TOWNSHIPS ON THE RURAL-URBAN FRINGE IN KENT COUNTY, MICHIGAN

By

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ABSTRACT

SIMULATED EFFECTS OF USE VALUE ASSESSMENT ALTERNATIVES ON LOCAL GOVERNMENT FINANCES IN FIVE TOWNSHIPS ON THE RURAL-URBAN FRINGE IN KENT COUNTY, MICHIGAN

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Property taxes on farmland on the rural-urban fringe have risen dramatically in recent years, resulting in higher fixed costs for farmers. These higher taxes are often caused by the assessment of farmland at the high sales values associated with the sale of isolated tracts of farmland for nonfarm uses. Many agricultural groups believe this situation results in an inequitable assessment of farmland that could be corrected by assessing farmland on its current agricultural use.

The purpose of the study is to simulate the effects two alternative forms of use value assessment, currently being used in other states, would have in five townships on the rural-urban fringe of Grand Rapids, Michigan, if these alternatives had been used in Michigan during the past ten years. Particular attention is devoted to the impact on local government finances and the resulting redistribution of property tax burdens in each township.

Gordon Robert Bachman

A stratified random sample of farmland properties on property tax assessment rolls was used to form sample estimates of farmland assessed valuation and farmland acreage in each township. Simulation models were developed to simulate new township property tax rates resulting from the application of plain use value assessment and deferred taxation to varying proportions of farmland equalized valuation in each township and to simulate changes in the redistribution of the property tax burden in the participating farmland, nonfarmland, and nonparticipating farmland sectors.

Results indicated that there would likely be a redistribution of property tax burdens to those sectors not participating in a use value assessment program. Increases in nonfarmland and nonparticipating farmland property taxes resulting from plain use value assessment would be higher in the more rural townships whose farmland is currently being assessed at higher levels. The largest decrease in property taxes on participating farmland would likely occur in those townships which would have the largest reduction in farmland assessments and which at the same time would have the smallest increase in property tax rates resulting from plain use value assessment. These decreases in participating farmland property taxes would be much larger than corresponding increases in the nonparticipating sectors.

In all townships, the largest decreases in participating farmland taxes would occur in those alternatives in which the least amount of farmland equalized valuation would participate in a plain use value assessment program. However, in all townships the decrease in farmland assessment would have a greater effect on the redistribution of property tax burdens to the nonparticipating sectors than would the amount of farmland equalized valuation that would participate in the program.

Under the deferred taxation alternatives, roll-back revenues resulting from participating farmland changing to a nonfarm use would produce lower property tax rates than would be produced by plain use value assessment. These lower tax rates would result in smaller increases in property taxes in the nonparticipating sectors and larger decreases in taxes in the participating farmland sector than would exist under plain use value assessment.

The study showed that the redistribution of property tax burdens to the nonparticipating sectors under deferred taxation would be affected more by the amount of participating farmland that would change to a nonfarm use than by the length of the roll-back period.

Roll-back penalties for converting participating farmland to nonfarm uses were quite small compared to prices farmland owners have been receiving for sales of farmland.

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CHAPTER I

INTRODUCTION

Since World War II there have been large and often dramatic changes in the landscape of Southern Michigan. Scattered residences and even suburbs now appear where once there was only farmland. Expressways and interchanges now appear where once there was only small, "country" roads. Sprawling shopping centers now stand in places once occupied by only a crossroads store.

The prime moving force behind all these physical manifestations of progress has been the surging population growth in Michigan. Michigan's population has grown from 5,256,106 in 1940, to 6,371,766 in 1950, to 7,823,194 in 1960, to 8,875,083 in 1970.[1] The bulk of this population growth has been concentrated in the southern one-third of the state, particularly around and between the larger urban centers.

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[1] U.S. Department of Commerce, Bureau of the Census, United States Census of Population: 1960, Vol. 1, Characteristics of the Population, pt. 24, Michigan, p. 24-9 and U.S. Department of Commerce, Bureau of the Census, United States Census of Population: 1970, Advance Report, Final Population Counts, Michigan, p. 3.

This large population growth has placed increasing pressure upon the land and its natural resources. Increasing urbanization in Southern Michigan required additional land for new suburbs, recreation areas, and transportation routes. The land needed for these new uses often had to be taken from some of the better agricultural land in the state. The result has brought new problems and conflicts as people have competed for the use of a limited land resource base.

One of these problems has been the increasing competition and conflict between urban and agricultural land uses on some of the better agricultural sites in the state. This problem has been aggravated in many areas by the fact that urbanization has not always developed in tight, concentric rings around the center cities in the manner portrayed by traditional location theory. Instead, residential areas have often developed in "outlying" areas before they did in areas immediately bordering existing urbanized areas. This type of residential development has been prompted by the advent of the automobile and improved highways and by peoples' growing preferences for surburban living. The result has often been a "leapfrogging" approach to the shifting of land from agricultural to urban uses, producing an intermixture of urban and agricultural land uses referred to as urban sprawl or scatteration.

The people who have built residences on these scattered tracts have requested the community services and facilities of their city counterparts such as larger schools, improved roads, water and sewer services, gas, and electricity. To provide the revenue necessary to finance these new services, it has been necessary in most cases to increase the property tax levies of the local residents.

The increase in property taxes applied to both the new owners of the scattered residential tracts who were demanding the new government services and to the owners of the remaining farmland who often neither desired or needed these new services. These farmland owners were unable to pass on the new fixed costs resulting from increased property taxes because they sold their products in a highly competitive market where their ability to influence the market price of their products is negligible.

These higher taxes represented a new cost of production and often led to lower net incomes from farming operations until in some cases farmers claimed they were "forced" to sell their farms because their income from farming operations was not sufficiently high to bear the burden of the additional property taxes. Often these farmers felt that the only way for them to remain in farming was to sell their land to the highest bidder and

attempt to relocate in an area where the pressures from urbanization were not so great.

Often a speculator or land developer, who could more readily absorb the ripening cost of increased property taxes because of the possibility of passing on this additional cost to the purchaser of the land, would pruchase the farmers' land for future, potential development into urban uses. In many cases the local property tax assessor noticed the rising land values resulting from the sale of farmland for urban uses and would begin to assess all farmland in the area on the basis of these sales values even though a current market for urban uses existed for only a fraction of the total farmland in the area. This assessing procedure often resulted again in increased tax levies on the remaining farmland and more "forced" sales or conversions of farmland for urban uses.

Much of the land that was sold to land speculators or developers often lay idle for many years before it was converted to an urban use. This premature conversion resulted because only a small fraction of all the farmland on the rural-urban fringe would be needed for urban expansion in the near future. But land developers often purchased many tracts of land hoping that a few tracts would lie in the path of future urban expansion. This practice usually resulted in large areas of land being taken out of agriculture and placed in largely unproductive uses.

Many farm groups believe that these problems resulting from the high taxation of farmland and the resulting premature or scattered conversion of the land from rural to urban uses could be largely alleviated by the adoption of some form of use value assessment under which farmland would be taxed on the basis of its income producing capacity in an agricultural use rather than on the basis of its future, potential market value for an urban use. These groups believe that such a form of assessment would largely eliminate the influence of the land market on the current assessment of farmland on the rural-urban fringe and would result in a level of property tax assessment that would be more consistent with the present uses of the land. Proponents of use value assessment also believe that the resulting reduced property tax levies would be a sufficient factor in reducing the pressure on farmers to sell their lands prematurely and would permit the retention of that land not needed for urban uses in an agricultural or other open space use rather than an idle use that so often exists today.

Purpose of the Study

The purpose of the study is to simulate some of the alternative forms of use value assessment for farmland that are in current use in other states and to attempt to determine the impact they might have had in five townships on

the rural-urban fringe of Grand Rapids, Michigan, had these particular alternatives been in use in Michigan the past ten years. The study will devote particular attention to the impact of the use value assessment alternatives upon local government finances and the resulting redistribution of the property tax burdens to the sectors of the township that would not participate in a use value assessment program.

CHAPTER II

LAND USE AND PROPERTY TAXATION PROBLEMS OF THE RURAL-URBAN FRINGE

In order to understand the many problems that often result from increasing urbanization pressure, it is necessary to examine the environment or context in which these problems occur. In addition to a brief discussion of the interacting economic forces causing problems in the rural-urban fringe area, specific attention will be directed to problems associated with the taxation of farmland property and their resulting impact on land use patterns and local government finances.

The Rural-Urban Fringe

The rural-urban fringe is a difficult area to precisely define. Conceptually, it can be viewed as a transition area of mixed rural and urban land uses that is constantly shifting outward. It is an area characterized by considerable land use conflicts and competition caused by expected urban development and the disappearance of rural land uses.

Smith defines the area as:

> . . . an ill-defined zone. It is a zone where the interacting influence of urban and rural land uses predominate rather than either one being exclusively dominant. It is a zone of transition, a border area in which the forces from different markets converge.[2]

It is this interaction of forces from different land markets that seems to be the moving force behind many of the land use and taxation problems in the fringe area.

The Land Market in the Rural-Urban Fringe

There does not seem to be a single or even a few major land markets for agricultural land on the rural-urban fringe in the same manner as there is a market for other agricultural commodities such as wheat, hogs, cotton, or cattle. Instead, there are usually many land markets in the fringe area, some of which may consist of only a single buyer and seller. Scofield recognizes this characteristic when he describes the land market as: "Instead of a single market . . . land transactions occur in hundreds, and possibly thousands, of local markets, with no standardization, little exchange of information, and a minimum of competitive bidding."[3] According to Barlowe it is the fixed location

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[2]Steve Smith, "Land Use Problems," Farm Policy Forum, Vol. 14, No. 4 (1961-62), p. 9.

[3]William Scofield, "Prevailing Land Market Forces," Journal of Farm Economics, Vol. 39, No. 5 (Dec., 1957), p. 1500.

factor that tends to make the real estate market a local one.[4]

Within each of these many local land markets it is commonly assumed that land tends to move to the owners who are able to offer the highest bid and to those uses that offer the highest expected future returns. In this manner the land market does perform a useful function in that it allows for the allocation of certain lands to those who demand these and who are willing and able to outbid others for ownership rights to these lands. According to traditional valuation theory, the value of land should then be the discounted present value of these future expected earnings. But in many cases this valuation procedure results in farmland values that are far below the values at which these properties are currently being exchanged in the market. The result is often large discrepancies between current market values and the values of farmland based on its earnings capacity in agricultural uses.

In many cases this phenomenon is being caused by market prices that are reflecting future capital appreciations that are not related to earnings in agricultural uses. According to Scofield, this is the major factor for the bidding-up of farmland values on the rural-urban fringe

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[4]Raleigh Barlowe, Land Resource Economics (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1958), pp.202-203.

above their values based on agricultural earnings.[5] Ruttan substantiates this belief when he states:

> In recent years . . . there has been increased speculation that the continual rise of farm real estate prices in the face of declining or stable values of farm output reflects the effects of nonfarm influences acting directly on the land market rather than through the demand for farm products.[6]

This often leads to a problem in the taxation of farmland when the assessments of the remaining farmland are based on these prospects of nonfarm capital appreciation. But these capital appreciations are not realized by farmers until they sell their land. Meanwhile they must pay for the resulting increased property taxes that are often based on appreciations in land values of nearby farmland that is being sold for nonfarm uses. It is this functioning of the land market that creates an externality in the form of increased assessments that many farm groups claim creates an inequitable tax situation for farmland on the rural-urban fringe.

In addition to the problems this situation creates for individual farm operators who are intent upon entering or remaining in agriculture, the functioning of the land

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[5]William Scofield, "Land Prices and Farm Earnings," in Farm Real Estate Market Developments, Economic Research Service, U.S. Department of Agriculture, (Washington, D.C.: Government Printing Office, Oct., 1964), p. 42.

[6]Vernon Ruttan, "The Impact of Local Population Pressure on Farm Real Estate Values in California," Land Economics, Vol. 37, No. 2 (May, 1961), p. 125.

market on the rural-urban fringe seems to be one of the prime factors in creating discontinuous development or scatteration of urban land uses in the rural-urban fringe.

Knetsch argues that the differential preference for land at varying prices and at varying distances from urban centers is the chief creator of much of the scatteration that so often accompanies suburban development.[7] Land close to urbanized areas is usually preferred by land developers but is often high priced due to its proximity to existing urban development. So land developers or speculators tend to purchase or develop outlying lands first. But purchases and developments also occur all along the "price-location" schedule (the prices of land at varying distances from the center of an urban area). The result is the scatteration and discontinuous development so evident around urbanizing areas.

Schmid describes this pricing mechanism as a sort of "self-fulfilling prophecy" approach to the increasing appreciation in land values on the rural-urban fringe.[8] He argues that the location factor gives certain lands a higher value than others because the fringe area is

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[7]Jack Knetsch, "Land Values and Parks in Urban Fringe Areas," Journal of Farm Economics, Vol. 44, No. 5 (Dec., 1962), p. 1719.

[8]A. Allan Schmid, Rural to Urban Land Conversion: The Economics of Non-Marginal Change, Department of Agricultural Economics Publication No. AE69/3, (Guelph, Ont.: University of Guelph, 1969), p. 3.

constantly shifting. Thus a landowner often expects higher prices for his land in the future because the fringe area is constantly shifting outwards toward him. As more and more landowners share this belief and hold their land off the market, the price of land does indeed increase. The land owners then expect even higher land prices in the future and do not sell their land, and the cycle continues until the price reaches its upper limit based on the prospective uses of the land or until the owner is forced to sell because of increasing holding costs. This price spiral does create an externality for the owners of the remaining farmland because the selling prices of farmland for nonfarm uses are often used as the basis for the assessment of the remaining farmland. The result is that the property taxes on a parcel of farmland may be increased because of the actions of others in selling their land.

Taxing property at its highest and best use has often been used in the past as a technique of encouraging more intensive uses of land. Property taxes were often increased on lands held by speculators in the 1800's in an attempt to force the sale or development of the lands for settlement. Even today the taxing of farmland on the rural-urban fringe at its highest and best use tends to encourage the shifting of the land to nonfarm uses. However, society's goals regarding land use seem to have shifted from land settlement and development to the retention and

maintenance of agricultural and open lands in their present uses along with more public direction or control of the land conversion process for those lands that do shift to higher uses.

The taxing of farmland on the basis of its highest and best use, even though the land may not be currently needed for urban uses, is often considered by many agricultural groups to be unfair in those cases where the landowner is dedicated to retaining his land in an agricultural or open space use. Consequently, a strong rationale often exists for use value assessment alternatives that would encourage the retention of land in agricultural uses until the land is needed for urban expansion. Such alternatives would tend to give a "fair break" to those farmland owners who are intent on retaining their lands in "bona fide" farming operations.

Problems Resulting From Land Appreciation and Scatteration

Aside from its relationship to the scatteration of urban development, high property values on the rural-urban fringe create two other potentially serious problems. First, the competition by landowners and speculators to capture large appreciations in land values often places a great strain on land use planning efforts. Large increases in land values provide a strong economic incentive for

landowners to attempt to influence local planning and zoning efforts so as to provide the landowner with the maximum amount of land appreciation or capital gains. Schmid gives this as one of the major reasons for the large number of unimplemented land use plans.[9]

The second potential problem created by high land values is the possibility that they may increase the cost of home ownership. The subdivision developer who must pay a high price to obtain land on the rural-urban fringe is likely to reflect this cost in the price of the subdivided lots he sells.

In addition to the criticisms that scatteration and urban sprawl is esthetically unpleasing and a wasteful use of land, a major problem of scatteration is that it tends to increase the costs of providing government services to the scattered residential landowners. The costs of providing water, sewer, gas, and transportation services to many scattered locations is greater than if these land uses were more concentrated in compact residential developments.

Problems of Property Taxation on Agricultural Land

Both land appreciation and scatteration contribute jointly to the problem of high property taxes on farmland

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[9] Ibid., p. 6.

in the rural-urban fringe. Local assessors often associate the high prices received from the sale of scattered tracts for nonfarm uses with the value of the remaining agricultural land. The remaining farmland is then assessed on the basis of the few sales for nonfarm purposes even though there may be a current demand for only a fraction of the remaining farmland. Thus it is the farmer who is bypassed by the initial thrusts of urban expansion who receives the most pressure from the resulting high property taxes.

The farmer who receives a major increase in his property taxes usually cannot shift this additional new cost as long as he remains farming because he must sell his products in a large, highly competitive market in which his ability to influence product prices is negligible. Being unable to shift the new tax burden, the farmer must absorb it as a new cost in his production process. In many cases, this new fixed cost is cited as a major factor for "forced" premature conversions of land from farm to urban, or in some cases vacant uses.

There has been much discussion concerning the equity of this process. Hady raises the issue of whether an "ability to pay" criterion for taxing farmland should be based on the annual cash flows from farming operations or on the increase in property values, or whether "benefits received" should be the criterion for adjusting property

tax burdens on farmland.[10] The proponents of use value assessment argue that property taxes should be based on a criterion related more to the current cash flows from the land rather than on increases in property values which are not realized until the property is sold. They argue that under the current system of ad valorem property taxation, assessed valuations are often based upon a market value that is not related to current cash flows in an existing agricultural use.

Brownell sees the problem of taxing farmland on the rural-urban fringes as follows:

> . . . the issue is not that the land is wrongly appraised or a property is wrongly assessed. The issue is that the imposition of a property tax which adheres to the constitutional requirement of uniform appraisal and assessment results necessarily in a tax which exceeds the return on present productive use even though it may be proportional to the actual underlying asset value.[11]

Barlowe views the problem as: "The taxation problem in the areas where agricultural land is shifting to higher uses is primarily one of keeping tax rates at

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[10] Thomas Hady, Taxation Policies in Rural-Urban Fringe Areas, Unpublished manuscript reprinted by permission of the Michigan State University Cooperative Extension Service and Department of Agricultural Economics.

[11] Jonathan Brownell "Tax Manipulation as a Method of Open Space Preservation," in Preserving Open Space in Expanding Urban Areas, Northeast Regional Resource Economics Committee Report No. 2, (Amherst, Mass.: Massachusetts Agricultural Experiment Station, Jan., 1968), p. 34.

reasonable agricultural levels until the land is actually needed for urbanized uses."[12]

Even though high property tax levies are cited by many as a leading contributor of "forced" conversions and the resulting scatteration of land uses, it must be remembered that the prospect of capturing large capital gains is an equally important factor. Probably both of these factors contribute jointly to a farmer's decision to sell his farm or remain in agriculture. However, there is little evidence concerning the effects of either on the farmland tenure situation of the rural-urban fringe as farmers' motives regarding the future use of their lands appear to be quite complex.[13]

Implications for Local Government Finance

The property tax remains as the largest contributor of revenue to local units of government. Total revenues from real and personal property taxes in the United States have increased from $624 million in 1902, to $3,149 million in 1922, to $4,273 million in 1942, to $8,282 million in

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[12] Raleigh Barlowe, "Taxation of Agriculture," in Property Taxation-USA, ed. by Richard W. Lindholm, (Madison, Wis.: University of Wisconsin Press, 1967), p. 97.

[13] Sargent discusses some of the possible motives for acquiring and selling farmland in: Frederic Sargent, The Demand for Land in Texas, Misc. Publication 235, (College Station, Tex.: Texas Agricultural Experiment Station, Oct., 1957).

1952, to $15,798 million in 1960, to $26,835 million in 1968.[14] In a relative sense, property tax revenues have also continued to remain a high proportion of total tax revenues for local units of government.

While property tax revenues at the local level have increased greatly over the past years, many local units of government still are having problems raising the necessary revenue needed to provide the governmental services their citizens demand. Much of this problem of inadequate tax revenue in the face of increasing demands for more or improved government services is created by the heterogenous nature of land uses and conflicts in beliefs and values between farm and nonfarm population segments.

A large influx of urbanization into a predominately rural area brings with it many new urban-oriented land uses which in turn demand new and improved government services and facilities such as schools, streets, and sewers. This can sometimes create a problem in property tax administration because of the time lag that often occurs between the conversion of land to urban uses and the classification, assessment, and payment of taxes on that property. The classification and assessment of the property may be based on bare farmland, but the resulting tax levies

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[14] Barlowe, Land Resource Economics and U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States: 1970, (Washington, D.C.: Government Printing Office, 1970).

must be used to provide transportation or utility services for the new residences constructed since the last assessment. Other problems also arise from the fact that the farmland in the taxing district must also contribute to the financing of the new government services which the owners of the farmland claim they neither desire or need, but which are demanded by the nonfarmland property owners.

This situation often produces differences in beliefs and values within the rural-urban fringe over what level of taxes and government services is considered "adequate." Stocker writes that individual differences in opinion toward public services reflect differences between what a person pays in taxes and what he feels he receives in public services.[15] New suburbanites often demand a higher level of services and are usually more willing to pay taxes to receive them than are the older, more rural-oriented residents who often object to having to pay for services to "newcomers."

In a study of residents of the rural-urban fringe, Maitland also found an almost unanimous belief that property taxes were too high.[16] However, he found that farm residents felt they were paying more than their fair share

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[15]Frederick Stocker, "Tax Problems," Farm Policy Forum, Vol. 14, No. 4 (1961-62), pp. 14-20.

[16]Sheridan T. Maitland, "The New Social Frontier," Farm Policy Forum, Vol. 14, No. 4 (1961-62), pp. 14-20.

of local taxes, while nonfarm residents were critical of the extent and quality of services provided in relation to their tax levies.

Some taxing units face problems because of a lack of diversity in their tax bases. This is particularly true where industry has not yet moved into the area, and the tax revenue needed to supply new community services must come entirely from new residential areas and the old remaining farmland.

In these instances the granting of a property tax exemption or other forms of tax reductions particularly becomes a problem. Groves recognized this problem when he wrote: "Exemptions create a problem because they reduce the tax base and thus necessitate higher tax rates on the remaining taxable property."[17]

Proposals to grant use value assessment (assessment of land on the basis of its value in an agricultural use) to farmland or open space land would constitute such a partial exemption and could create problems arising from a decreased property tax base. Brownell also recognized this problem when he wrote:

> Areas with open lands desired to be saved are generally rural or semi-rural and are those areas with schools requiring substantial expansion to meet rising

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[17]Harold M. Groves, Financing Government (New York, Chicago, San Francisco: Holt, Rinehart and Winston, 1964), p. 97.

> educational standards. These areas are largely those without industrial and commercial tax bases and which must depend on a relatively scattered rural population to meet the rising costs of local government.[18]

If the granting of use value assessment to farmland or open space land results in a decreased tax base, then an important consideration is the redistribution of the property tax burden resulting from increased tax rates. Brownell recognized some of the "social justice" implications of this redistribution of tax burdens when he wrote:

> Those who are being asked, by local preferential tax manipulation law, to bear the burden of increased taxation, are by the large not those for whose long-range benefit such a law is proposed. The public interest designed to be served by such legislation is that of our increasing metropolitan population. . . . The financial burden should be borne not by those in whose local municipality open space happens to be found, but by all those in whose benefit such land uses are to be maintained.[19]

The magnitude of such a shift in property tax burdens would depend upon the amount of reduction in farmland assessed valuation and the amount of farmland in the taxing district that would receive the reduction in assessed valuation. If the land uses of the taxing district were largely urban, there would likely be only a minor shift as only a small proportion of the total assessed valuation would be eligible to receive use value assessments. However, as the amount of urban land uses decreased in

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[18] Brownell, Preserving Open Space, p. 35.

[19] Ibid., p. 36.

relation to farmland uses, the redistribution of the property tax burden to these urban uses would become increasingly larger.

The other alternative to the problem of a decreased property tax base would be to "freeze" property tax revenues at current levels or to decrease them. This would likely result in fewer and lower quality government services than what presently exists. The increasing urban populations on the rural-urban fringe would not likely be happy with this situation and may be more inclined to accept increased property tax levies if they felt the quality of government services and the amount of open space would enhance their living environment.

CHAPTER III

PROBLEM DEFINITION AND ANALYSIS

A problem exists when a difference exists between what a person or group "thinks is" (beliefs) and what he "thinks should be" (values). There are many such beliefs and values held by various groups in the rural-urban fringe and frequently they are conflicting. Some of these beliefs and values concerning taxation of agricultural land, land use, and local government services were discussed in the previous chapter. This chapter will attempt to analyze some of these conflicting beliefs and values by discussing the decision-makers who must resolve these conflicts, the alternatives facing the decision-makers, and the information required by them to make a decision.

The Decision-Makers and Their Objectives

In recent years there have been a number of legislative bills introduced into the Michigan House of Representatives that would alter the present system of assessing agricultural land for property tax purposes. These were House Bills 2168, 3380, 2533, and 4100. Presently only House Bill 4100 remains under consideration for the 1971

Legislative Session. The bill provides that farmland zoned or devoted exclusively to agricultural or horticultural uses for three years and from which the owner derives one-third or more of his normal total income shall become eligible for deferred tax status. The farmland would be assessed on the basis of its productivity and net earnings capacity in agricultural or horticultural uses. If the farmland is sold or used for other than an agricultural or horticultural use, the difference between the taxes paid on the basis of its use value assessment and the taxes that would have been paid in the absence of use value assessment would become due for the current year and the two previous years.

These House Bills have stemmed from the belief of certain agricultural groups that much farmland in Michigan is currently being overtaxed for property tax purposes, even though in many cases this belief may be merely an expression of enlightened self-interest on the part of many farmers. These groups also hold the value that this situation is "bad" and that these farmland taxes should be reduced. To achieve the policy goal of reducing the property tax burden on farmland, these groups propose a procedure of assessing farmland on the basis of its value in agricultural uses.

The Michigan State Legislature, which is the decision-making body, must evaluate and decide upon this

proposal in light of the responsibility conferred upon it to ensure that the property tax is administered in a fair and equitable manner. In particular, they have the objective of ensuring that the property tax system meets the basic requirements of uniformity, universality, proportionality, and ad valorem measurement.

Assessment Alternatives of the Decision-Makers

Numerous alternatives are available to the decision-makers which are designed to assess farmland on the basis of its value in agricultural uses. Aside from recent proposals to institute a local income tax to finance local school operations which would probably reduce some of the need for differential assessment of farmland, there remain five major groups of alternatives for taxing farmland. These are: (1) plain use value assessment; (2) deferred taxation; (3) contractural agreements for easements or development rights; (4) plain use value assessment or deferred taxation combined with planning or zoning powers; and (5) classification of taxable property.

The plain use value assessment alternative usually stipulates that lands devoted to agricultural uses (or other qualifying uses) be assessed on the basis of their value in agricultural uses, and that other potential uses of the land be ignored by the assessor. Thus, the

criterion of value is based upon value in agricultural use rather than current market value of existing or potential uses. This criterion of value is the essential feature of this alternative and is designed to prevent nearby changes in land use from having an effect on the assessed value of the property. Six states have adopted plain use value assessment for use on agricultural or open space lands. These are: Arkansas, Connecticut, Delaware, Indiana, New Mexico, and Colorado.

Deferred taxation represents a type of taxing alternative in which two assessed values are placed upon each parcel of qualifying land. One assessed value is based upon the value in use criterion as under plain use value assessment. The other assessed value represents the value the property would have in the absence of plain use value assessment. As long as the land remains in an agricultural use, property taxes are based on the value in use criterion, and the remaining taxes that would have been due in the absence of use value assessment are deferred or postponed. However, if the land changes to a use not designated in the legislation, all or part of the deferred taxes become due for varying numbers of past years. Eight states currently have deferred taxation. They are: Utah, Texas, Maryland, Minnesota, Alaska, Rhode Island, Kentucky, and New Jersey.

Under the contractural agreement alternative, a qualifying landowner signs a contract agreeing to surrender the nonagricultural development rights of his land for the duration of the contract. In return, his land is assessed only on the basis of its value in the agricultural uses provided in the contract. A related approach would have the landowner sell an easement right to all nonagricultural development of his land for a specified number of years. In return, the assessor would consider the effect of the easement upon the value of the property when assessing for property tax purposes. In most instances, there is a penalty in the form of a fine or deferred taxes due if the landowner breaks the contract by selling or converting the land to a nonagricultural use. Three states have adopted this alternative. They are: California, Washington, and Pennsylvania.

The planning or zoning alternative attempts to combine the features of plain use value assessment or deferred taxation with official planning or zoning efforts. The result is typically a selective form of taxation in which planning or zoning regulations establish agricultural zones or preserves where the provisions of plain use value assessment or deferred taxation apply. Areas outside these zones may not receive all the benefits of the tax relief measures. Three states have adopted this alternative. They are: Florida, Oregon, and Hawaii.

Under the tax classification alternative, all taxable property is classified into a tax classification scheme based on the present use of the property. One of the classes usually applies to agricultural or open space lands. The property in each of the classes is then assessed at a different proportion of full cash value. Four states are currently using some form of tax classification. They are: Minnesota, Arizona, West Virginia, and Ohio.

The Decision-Maker's Problem

Numerous strengths and weaknesses can be advanced for the above tax alternatives. Even though these are relevant to a consideration of these alternative, legislators are also interested in the possible future effects these alternatives could have if they were passed into law in Michigan. Two very general effects that would be of interest are the effects of these alternatives on land use patterns and the effects on local government finances. While the effects of these alternatives on land use patterns are still rather inconclusive even in states such as New Jersey and Maryland which have had some form of use value assessment the longest, the effects on local government finances would be more readily measurable in a state such as Michigan which is just beginning to consider the alternatives.

Even though there likely would be several types of impacts on local government finances, Michigan legislators have expressed particular interest in the possible redistribution of the property tax burdens that could result from the adoption of plain use values assessment or deferred taxation. This would be of particular interest to legislators whose constituency is composed largely of urban residents, many of whom live in urbanizing fringe areas and whose property taxes could be increased by the adoption of one of these tax alternatives.

Summary of Research on Redistribution Effects

Although most of the research on the effects of use value assessment has dealt with changes in prices of land and the rate of conversion of agricultural land on the rural-urban fringe, a few studies have dealt with the question of the redistribution of the property tax burden resulting from use value assessment.

Ishee reports that there is some evidence in Maryland that local taxing units have had to raise tax rates to meet rising revenue needs without a rising tax base.[20] However, he admits that how much of this was

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[20]Sidney Ishee, "Use Value Assessment of Farm Land in Maryland," in Preserving Open Space in Expanding Urban Areas, Northeast Regional Resource Economics Committee Report No. 2, (Amherst, Mass.: Massachusetts Agricultural Experiment Station, Jan., 1968), p. 41.

caused by use value assessment is not clear as the rising cost of government services could have caused some of the rise in tax rates.

House, in a study of the effects of use value assessment on farmland, found that the decrease in tax bases due to use value assessment ranged from 0.7 to 12.8 percent in counties near the Baltimore and Washington, D.C. metropolitan areas.[21] The revenue lost per acre ranged from $1.20 per acre to $15.20 per acre. He also found that property tax rates could have been reduced from $0.02 to $0.27 per $100 assessed valuation in the absence of use value assessment. House concluded that:

> . . . although the more urban counties actually pay more per acre in use value assessment subsidies to their local farmland owners than do the more rural counties, their costs are about the same (or possibly even less) in terms of increased property tax rates or percentages of tax base lost. This suggests that the actual financial burden borne by the owners of nonfarm land is about equal, regardless of where the county lies in a metropolitan area.[22]

Fellows predicted that on the basis of a recent study of the effects of Connecticut's use value assessment law that there would be little shift of the property tax

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[21]Peter House, Differential Assessment of Farmland Near Cities-Experience in Maryland Through 1965, ERS 358, Economic Research Service, U.S. Department of Agriculture, (Washington, D.C.: Government Printing Office, Oct., 1967), pp. 22-23.

[22]Ibid., p. 27.

burden to the urban sector.[23] He concluded this from the fact that the use values resulting from Connecticut's program were very similar to current assessed values and hence would have only a small redistribution effect. Fellows based his findings on the proposed changes in total tax revenue that would originate from the rural, transitional, and urban areas of the state if the provisions of the use value assessment law were applied to all qualifying land in the state.

Dopson and Miller in a study on the effects of urban expansion on farmland, constructed a typical, hypothetical farm near St. Louis, Missouri, to attempt to determine the impact of urbanization on the taxation of farmland in the rural-urban fringe area.[24] The authors estimated that the loss in revenue resulting from plain use value assessment would be 0.056 percent of the total tax revenue, assuming that property tax rates would not be increased to compensate for the decrease in the tax base. The authors concluded that the loss in revenue under deferred taxation would likely be less depending on the

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[23]Based on remarks by Irving Fellows at the Seminar on Taxation of Agricultural and Other Open Space Lands held at Michigan State University, April 1-2, 1971.

[24]Frederick C. Dopson and Frank Miller, Effects of Urban Expansion on Ownership, Use and Taxation of Agricultural Land, (Columbia, Mo.: University of Missouri Agricultural Experiment Station, April, 1966).

rate and time of conversion of the farmland to urban uses. However, in both cases the authors assumed a decrease in tax revenues rather than an increase in tax rates as the likely consequence of use value assessment.

Ching and Frick conducted a simulation study on the hypothetical effects that use value assessment might have on the tax base and tax rate in New Hampshire.[25] The major emphasis of their study concerned the shift in tax incidences among participating and nonparticipating landowners if plain use value assessment were implemented. To do this, the authors developed a series of tax simulation models designed to estimate the percentage of rural valuation for each town (county) in the state, the adjusted town equalized valuation resulting from use value assessment, and the new town tax rates necessary to raise the required level of tax revenue. These estimates were made for each individual town, towns grouped by size of population, and for the entire state.

The authors found that although there would be little change in tax rates resulting from use value assessment at the state level, there could be large increases in small towns relative to large towns. They attributed this

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[25] C. T. K. Ching and G. E. Frick, The Effect of Use Value Assessment on Assessed Valuation and Tax Rates, Research Report No. 13, (Durham, N. H.: New Hampshire Agricultural Experiment Station, April, 1966).

to the fact that smaller towns usually have a higher proportion of rural valuation than do towns with large populations.

The authors also found that participants in use value assessment in small towns would probably have a smaller reduction in tax levies than participants in larger towns, and nonparticipants in smaller towns would probably have their tax bills increased more than nonparticipants in larger towns. From their findings the authors concluded:

> Since participants in all sizes of towns receive about the same proportional reduction in taxes paid, the important consideration is the nonparticipants and his tax load. Due to the rural-urban valuation mix, nonparticipants in the larger towns are required to make only nominal additional tax payments under a use value assessment program. In contrast, nonparticipants in the smaller rural towns are required to make relatively larger additional tax payments. Thus it would be easier to absorb the shift in the tax burden in the more urban towns than in the more rural towns.[26]

Objective of the Study

Most of the past research on the effects of use value assessment has only briefly touched upon the change in the redistribution of property tax burdens resulting from use value assessment. Several of the studies have attempted to estimate the financial impact of use value assessment by assuming that the tax revenues and the tax

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[26] Ibid., p. 13.

base would decrease rather than attempting to estimate the increase in tax rates and the resulting effect this would have on the various sectors of the local economy. Ching and Frick did do this, but most of their analyses were on a state level. Several of the studies have assumed that the provisions of use value assessment would apply to all qualifying farmland rather than only a part of the farmland as would be the likely case in a voluntary program. All of the studies have dealt only with the effects of plain use value assessment. None have considered the impacts of the various tax deferral alternatives.

Therefore, the objective of this study is to simulate the redistribution of property tax burdens that would result from the application of various alternatives of plain use value assessment and deferred taxation to five townships on the rural-urban fringe.

CHAPTER IV

SAMPLE DESIGN AND ESTIMATION OF FARMLAND ASSESSED VALUATION AND FARMLAND ACREAGE

This particular study is one part of a larger, overall Michigan Agricultural Experiment Station project designed to study the economic effects of use value assessment on land use patterns and local government finances. This project includes individual studies in at least three Michigan counties. These counties were selected to include two counties in which rapid urbanization growth has taken place in the last ten years and one county that has remained predominately rural during this period.

Selection of Study Area

The area in Kent County, Michigan, surrounding the city of Grand Rapids was selected as the general study area because it was an area that had undergone considerable change in population and land use during the study period of 1960 to 1969. Grand Rapids in 1960 was the second largest city in Michigan and is located in a major fruit and dairy farming area of Michigan. As a result, there has been a steady encroachment of urbanization into prime

agricultural areas resulting in some of the usual problems and conflicts found on the urban-rural fringe area.[27]

Within the general study area, the townships of Alpine, Byron, Caledonia, Cascade, and Gaines were selected as specific areas of study. On the basis of discussions with the Kent County Agricultural Extension Agent and members of the Kent County Planning Commission and on the basis of U.S. Census and other secondary data, these townships were selected as the most rapidly urbanizing townships surrounding Grand Rapids and which also contained some of the more productive agricultural land in the county. The location of these five townships within Kent County is given on the map in Appendix A.

Description of the Study Area

All five of the townships have had considerable increases in population during the period of 1960 to 1969. The population changes from 1960 to 1970 for each township are given in Table 1.

These percentage increases are considerably larger than the 11.5 percent increase in population for the city of Grand Rapids and 15.0 percent for the city of East Grand Rapids. They are also higher than the average

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[27]This conclusion was based on personal observation and discussions with employees of city and county government agencies.

percentage increase in population of 13.4 percent for the state of Michigan.

Table 1. Population changes in study areas 1960-1970

Township	1960 Population	1970 Population	Percentage Increase
Alpine	4,764	8,163	71.3%
Byron	6,036	7,493	24.1
Caledonia	2,752	3,842	36.6
Cascade	3,333	5,243	57.2
Gaines	6,120	8,794	43.7

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of population: 1970, Advance Report, Final Population Counts, Michigan, p. 3.

The predominate land use in all five townships is agriculture. In 1959, the percentage of the land area in each township that was classified as farmland by the 1959 U.S. Census of Agriculture was 77.0 percent in Alpine, 75.4 percent in Byron, 63.9 percent in Caledonia, 52.7 percent in Cascade, and 79.1 percent in Gaines township.[28] Census data for later years were not available on a township level.

[28]U.S. Department of Commerce, Bureau of the Census, 1959 United States Census of Agriculture, Minor Civil Divisions Reports, Michigan.

The agriculture of the five townships is primarily a mixture of dairy farming and general cash grain farming.[29] Corn, wheat, oats, and alfalfa are the principal crops grown, with corn being the most important in terms of acreage and hay crops the second most important. There is some vegetable farming on muck and peat soils in Byron township, but this industry has been declining in importance in recent years. Fruit farming, particularly apples, is an important industry in Alpine township, occupying approximately one-third of the cropland in the township.

The average size of farms in 1959 was approximately 105 acres in Gaines, Cascade, and Caledonia townships, and approximately 70 acres in Byron and 115 acres in Alpine townships.[30] According to the 1964 U.S. Census of Agriculture, the average value of land and buildings per acre for all farmland in Kent County increased from $210 per acre in 1959 to $260 per acre in 1964.[31]

Transportation routes and facilities have been an important factor in determining the direction and extent of urbanization in the townships during the past ten years.

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[29] Based on discussions with the Kent County Agricultural Extension Agent.

[30] U.S. Department of Commerce, Bureau of the Census, 1964 United States Census of Agriculture, Vol. 1, pt. 13, Michigan, p. 261.

[31] Ibid.

The Kent County Municipal Airport was opened in 1963 in Cascade township. This development along with Interstate Highway 96 which passes through the township have attracted considerable industrial and commercial land uses to the township. The I-96 expressway and the US-131 highway border the south and east sides of Alpine township and have created considerable residential growth in the southern and eastern parts of that township. The US-131 highway also lies along the border between Byron and Gaines townships and has been a factor in the corridor of urbanization that has developed through parts of these two townships.

The Sample Plan

In order to simulate the redistribution effects resulting from various use value assessment alternatives, it was necessary to sample agricultural properties in each township to obtain an estimate of the farmland assessed valuation and acreage in each township. A sample was selected instead of a complete census of agricultural properties in each township because of the cost and time constraints of collecting data on each agricultural property in each township for ten years.

The sample plan selected was a stratified random sampling design using the Neyman allocation to allocate

the sample size to the various strata.[32] Under the Neyman allocation, the sample size is allocated to the strata according to the variance of the sample units in the sample frame that are contained within each strata. This method was selected instead of a proportional allocation method because it reduces the sample size required to attain a specified level of sampling precision, and the variances of the sample units in the sample frame in 1960 could be calculated rather than estimated.

Sample Unit, Sample Frame, and Sample Universe

The sample unit was each property listing in the 1960 property tax assessment rolls for each township which was at least ten acres in size and which was classified as either farm improved or farm vacant on the tax rolls.

The sample frame for each of the five townships was the listing array of sample units contained in the 1960 property tax assessment rolls.

The sample universe was all land in each of the five townships that was devoted to an agricultural use according to the definition of "land in farms" in the 1959 U.S. Census of Agriculture.

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[32]This procedure is discussed in detail in: W. Edward Deming, Sample Design in Business Research (New York: John Wiley & Sons, Inc., 1960), Chapter 15.

The value of the sample unit was measured by the assessed valuation per acre for each observation rather than the total assessed valuation of each observation in order to reduce the variance in the sample frame that is attributable to differences in the acreages of the observations.

Determination of Sample Unit Size

The minimum size limitation of ten acres for the sample unit was selected on the basis of data in the 1959 U.S. Census of Agriculture. In 1959, approximately 95.1 percent of all farms in Kent County were larger than ten acres in size, and 99.4 percent of all farmland acreage and cropland harvested acreage were in parcels of ten acres or larger.[33] All nonfarmland property listings over ten acres were excluded from the sample frame.

Construction of Sample Frame

A sample frame was constructed for each of the five townships by listing all sample units in a township on a section basis from 1 to 36 for the year 1960. Each sample frame was then divided into six strata: (1) Urban Improved; (2) Urban Vacant; (3) Transition Improved; (4) Transition Vacant; (5) Rural Improved; and (6) Rural Vacant.

[33] U.S. Department of Commerce, Bureau of the Census, 1964 United States Census of Agriculture, Vol. 1, pt. 13, Michigan, p. 261.

These strata were formed by classifying each of the 36 legal sections of each township as being predominately urban, predominately rural, or in a state of transition from rural to urban land uses during the period between 1960 and 1969. This classification was based upon six criteria: (1) the percentage change in agricultural land between 1960 and 1966; (2) the amount of farmland in 1960; (3) the amount of urbanized land in 1966; (4) the number of urban residential dwelling units in 1966; (5) population density per square mile in 1965; and (6) major transportation routes and facilities in each township. Data for these six criteria were obtained from land use surveys conducted by the Kent County Planning Commission.

The strata were formed by comparison of each legal section's ranking on a rural-urban continuum based on the first five criteria. The ranks of each section for each of the five criteria were then accumulated to obtain a composite measure of each section's ranking on the basis of all five criteria. In addition, major transportation routes and facilities and land use maps for 1966 were consulted to assist in the classification of each section into an urban, transition, or rural strata. The resulting stratification of the sections of each township are presented in Appendix B.

After all sections in each township were classified into one of the three strata, the sample units within each

strata were divided into Farm Improved or Farm Vacant substrata. This produced two substrata within each of the three original strata. The Farm Improved and Farm Vacant categories were taken from the property tax assessment rolls of each township and divided observations on the basis of whether they contained farm buildings. This second classification was used in conjunction with the first classification to produce the six strata in each township.

Several sections in Cascade township were not included in the sample frame as there was no farmland listed in them in the 1960 property tax assessment rolls. These were sections 1, 4, and 16. Several sample observations in sections 19, 20, 29, and 30 of Cascade township were excluded from the sample frame as they were acquired in 1960 for the construction of the Kent County Airport and were classified as "Exempt" on the 1960 and 1961 tax rolls.

Determination of Sample Unit Size

A separate sample was drawn from the sample frame of each township. The sample size for each township was determined by the following formula:

$$\sigma^2_{\bar{x}} = \frac{(\bar{\sigma}_w)^2}{n} - \frac{\sigma^2_w}{N} \text{ or } n = \frac{(\bar{\sigma}_w)^2 N}{N\sigma^2_{\bar{x}} + \sigma^2_w}$$

where:

N = number of observations in sample frame.

n = number of sample observations.

$\sigma_{\bar{x}}$ = standard error of the sampling plan.

$\bar{\sigma}_w$ = the weighted average standard deviation within the strata = $P_1\sigma_1 + P_2\sigma_2 + \ldots + P_i\sigma_i$ where $i = 1$ to 6.

$P_i = n_i/N$ = proportion of observations in the sample frame that are contained within stratum i.

σ_i = standard deviation of the observations within stratum i.

$\bar{\sigma}_w^2$ = the weighted average variance of the observations within the strata = $P_1\sigma_1^2 + P_2\sigma_2^2 + \ldots + P_i\sigma_i^2$ where $i = 1$ to 6.

The standard deviation of the observations in the sample frame within each stratum was calculated by the following formula:

$$\sigma_i = \sqrt{\frac{\Sigma(x_i - \bar{x}_i)^2}{N_i}} \quad \text{where: } \Sigma(x_i - \bar{x}_i)^2 = \Sigma x_i^2 - \frac{(\Sigma x_i)^2}{N_i}$$

where:

σ_i = the standard deviation of the samples within stratum i.

N_i = the number of observations in the sample frame of stratum i.

x_i = the assessed valuation per acre of each observation in the sample frame of stratum i.

The standard error of the sampling procedure was determined by setting the standard error of estimation at $\leq$ \$10 with a probability of 90 percent based on the t distribution. The standard error of the sampling plan was then calculated by the following:

$$1.64\sigma_{\bar{x}} = \$10$$

$$\sigma_{\bar{x}} = \$6.10$$

$$\sigma^2_{\bar{x}} = \$37.21$$

A rather low standard error of estimation was selected because the estimated mean assessed valuation per acre of the sample observations in a stratum obtained from the sampling plan were multiplied by the mean acreage of the sample observations in that particular stratum. This had the effect of greatly magnifying any sample error present in the estimates of the assessed value per acre of the sample observations in a stratum. To use a larger standard error of estimation would have likely led to a larger sample size and an unacceptable amount of error when calculating the estimates of the farmland assessed valuation for a stratum. Two standard deviations were selected instead of three in order to reduce the sample size as much as possible while still retaining a rather low standard of error estimation.

Allocation of Sample Size to the Strata

After the sample size for each township had been calculated, the sample observations were allocated to the strata in each township by means of the Neyman allocation method. As noted above, this procedure allocated the sample observations to the strata in proportion to the standard deviation of the sample units within each stratum. The sample size of each township was allocated to the six strata in the township by the following formula:

$$n_i = \frac{n\ P_i \sigma_i}{\bar{\sigma}_w}$$

where:

n_i = sample size of stratum i.

n = number of sample observations in the total sample of the township.

P_i = the proportion of observations in the sample frame that are contained within stratum i.

σ_i = the standard deviation of the observations within stratum i.

$\bar{\sigma}_w$ = the weighted average standard deviation of the observations within the strata = $P_1\sigma_1 + P_2\sigma_2 + \ldots + P_i\sigma_i$.

Determination of Zoning Intervals and Number of Subsamples

After the sample size had been allocated to the strata, each stratum was divided into a number of zoning intervals. The purpose of forming the zoning intervals within a stratum was to ensure that the sample drawn would be representative of an entire stratum, to take advantage of any natural stratification that may exist in the sample frame of a stratum, and to enable sample estimates to be made for each zone within a stratum.

A number of subsamples were then drawn from each zone within a stratum. Subsamples, rather than a single sample, were drawn in order to grant degrees of freedom if it were desired to obtain a sample estimate for each zone within a stratum in addition to the sample estimate for the entire stratum.

The zoning intervals and the number of subsamples within each zone were dependent upon the overall sample size and the sample size within each strata. The zones were created by dividing each stratum into zones containing an equal number of sample observations. While the zoning intervals within a certain stratum are equal, the zoning intervals are not necessarily equal for all the strata. A stratum with a greater variance among its sample units, for example, would have a smaller zoning interval in order that it be sampled more heavily.

The zoning interval for each stratum was calculated by the following formula

$$Z_i = \frac{S_k N_i}{n_i}$$

where:

Z_i = the zoning interval for stratum i.

N_i = the number of observations in the sample frame of stratum i.

n_i = sample size for stratum i.

S_k = the number of subsamples within each zone.

The choice of the zoning intervals and the number of subsamples contained within each zone involved a compromise between taking advantage of any natural stratification that may exist among the observations within a stratum and gaining sufficient degrees of freedom for a sample estimate for each zone. A larger number of zones would reflect more of the natural stratification that may exist within a stratum where the sample units are likely to vary from zone to zone. But a larger number of subsamples with a smaller number of zones in each stratum would increase the number of degrees of freedom for a sample estimate for each zone.

Since the sample size was rather small (approximately nine percent of the sample frame) and sample estimates for each zone were not anticipated, a minimum of two

subsamples per zone were used. In five of the strata where the zoning interval equaled the N_i of the stratum, the calculated sample sizes were found to be only one sample observation per stratum. These sample sizes were increased to the minimum of two sample observations per stratum in order to allow for at least one degree of freedom in the sample estimate for that particular stratum. This addition of sample observations resulted in a slight loss in sample efficiency but a possible gain in sample precision. The number of sample observations in the strata for each township are presented in Appendix C.

Selection of the Sample

The two subsamples for each zone within a stratum were selected with the aid of a table of random numbers. Random numbers between 1 and Z_i were used to select one sample observation from every zone in stratum 1. Random numbers between 1 and Z_2 selected one sample observation from every zone in stratum 2. This process was repeated for the remaining strata in the township. This sample constituted subsample one. The same process was repeated to draw the second subsample. The random numbers were drawn without replacement to ensure that a sample unit

would not appear in a subsample for a particular zone more than once.[34]

The random numbers constituting the sample were then translated into serial numbers which corresponded with the identification code of each sample observation in the sample frame. Each sample observation was identified as to the stratum, zone, and subsample it came from.

Collection of Data

Data for each sample unit were collected for the ten year study period. The acreage and assessed valuation of each sample were recorded along with changes in tax classification and ownership. These data were obtained from the property tax rolls of each township. Additional township data were also collected from the Kent County Treasury Department, the Kent County Equalization Department, and the Michigan Department of Treasury. These data included township equalized valuation, township property tax revenue, and township equalization factors.

Ten years was selected as the length of the study period in order to provide a sufficient time span to compare changes in property taxation and to correspond with

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[34]Sampling without replacement did create some bias in the selection of sample observations because the probability of an observation being included in the sample was higher for the second subsample than for the first subsample. However, the probability of selection remained the same within each strata for that particular subsample.

data in the U.S. Census of Population in 1960 and 1970 and the U.S. Census of Agriculture in 1959 and 1969.

Formation of Sample Estimates by Stratum

After data for all sample observations had been collected and compiled, the sample plan was used to produce an estimate of the farmland assessed valuation and farmland acreage for each stratum of each township and for each year in the study period. These estimates were later used as variables in the tax simulation models. Estimates were produced by the following seven steps.

1. The assessed valuation per acre for each sample observation in each stratum was calculated by dividing the assessed valuation of each sample observation by the acreage of that observation.

$$X_{ity} = \frac{av_{ity}}{ac_{ity}}$$

where:

i = stratum.

t = township.

y = year.

X_{ity} = assessed valuation per acre of each sample observation.

av_{ity} = assessed valuation of each sample observation.

ac_{ity} = acreage of each sample observation.

2. The mean assessed valuation per acre of all sample observations in the stratum was calculated by summing the assessed valuations per acre of the observations in the stratum and dividing by the number of sample observations in that stratum.

$$\bar{x}_{ity} = \frac{\Sigma x_{ity}}{n_{ity}}$$

where:

$\bar{x}_{ity}$ = the mean assessed valuation per acre of all sample observations in the stratum.

Σx_{ity} = the sum of the assessed valuations per acre in the stratum.

n_{ity} = the number of sample observations in the stratum.

This operation resulted in the combination of thin zones (the original zoning intervals) into one thick zone for each stratum. The result was that Z_{ity} became N_{ity} for each stratum and an additional degree of freedom was gained for each former thin zone that was combined into the thick zone.

3. The mean acreage of all sample observations in each stratum was calculated by summing the acreages of all sample observations in the stratum and dividing by the number of sample observations in that stratum.

$$\overline{ac}_{ity} = \frac{ac_{ity}}{n_{ity}}$$

where:

$\overline{ac}_{ity}$ = the mean acreage of the sample observations in the stratum.

ac_{ity} = the sum of the acreages of all sample observations in the stratum.

n_{ity} = the number of sample observations in the stratum.

4. The mean assessed valuation of the sample observations in the stratum was calculated by multiplying the mean acreage of the sample observations by the mean assessed valuation per acre of the sample observations in the stratum.

$$\overline{X}_{ity} = (\overline{ac}_{ity})(\overline{av}_{ity})$$

where:

$\overline{X}_{ity}$ = the mean assessed valuation of the sample observations in the stratum.

$\overline{ac}_{ity}$ = the mean acreage of the sample observations in the stratum.

$\overline{av}_{ity}$ = the mean assessed valuation per acre of the sample observations in the stratum = $\overline{x}_{ity}$.

5. The number of observations in the sample frame of each stratum were then estimated for each year. The number of observations in the sample and the sample frame of each stratum were known for the year 1960. However, for the remaining nine years in the study period, only the

number of sample observations in each stratum were known, and from this an estimate had to be made of the number of observations in the sample frame of each stratum for the years 1961 to 1969.

This was necessary because each sample observation had an identification code and property description that was used to identify the sample observation for the years 1960 through 1969. In some cases this identification code changed for some of the sample observations during the study period. These changes resulted from instances where a sample observation had been "broken-up" and the ownership became divided between two or more owners. In these instances, two or more sample observations entered the sample where originally there had been previously only one. This addition of new sample observations to the sample was necessary in order to account for changes in farmland use that had occurred to the original sample observations since 1960.

It was assumed that since the sample was a random one and representative of all the observations in the sample frame, any changes in the number or size of the sample observations would be representative of changes in the observations in the sample frame. Therefore, it was assumed that the ratio of the number of sample observations to the number of observations in the sample frame would maintain the same ratio as they did in 1960. The number

of observations in the sample frame for the years 1961 to 1969 were estimated by the following ratio:

$$\frac{n_{ity(1960)}}{N_{ity(1960)}} = \frac{n_{ity}}{N'_{ity}}$$

where:

$n_{ity(1960)}$ = the number of sample observations in the stratum in 1960.

$N_{ity(1960)}$ = the number of observations in the sample frame in 1960.

n_{ity} = the number of sample observations in the stratum in year y.

N'_{ity} = the estimated number of observations in the sample frame in year y.

These "splits" in ownership would therefore increase the number of sample observations in the stratum and hence would result in an increase in the estimated number of observations in the sample frame. However, this increase in the number of sample observations in a stratum would be partially offset by a decrease in the mean acreage and mean assessed valuation per acre of the sample observations in that particular stratum.

6. The total assessed valuation of farmland in the stratum was calculated by multiplying the mean assessed valuation of the sample observations in the stratum by the estimated number of observations in the sample frame of the stratum.

$$FAV_{ity} = (\overline{X}_{ity})(N'_{ity})$$

where:

FAV_{ity} = total farmland assessed valuation in the stratum.

$\overline{X}_{ity}$ = the mean assessed valuation of the sample observations in the stratum.

N'_{ity} = the estimated number of observations in the sample frame of the stratum.

7. The total farmland acreage in the stratum was calculated by multiplying the mean acreage of the sample observations in the stratum by the estimated number of observations in the sample frame of the stratum.

$$FAC_{ity} = (\overline{ac}_{ity})(N'_{ity})$$

where:

FAC_{ity} = total farmland acreage in the stratum.

$\overline{ac}_{ity}$ = the mean acreage of the sample observations in the stratum.

N'_{ity} = the estimated number of observations in the sample frame of the stratum.

Formation of Sample Estimate for the Entire Township

The sample plan was then used to produce an estimate of the farmland assessed valuation and farmland acreage for the entire sample frame. This was done by summing the

estimates of farmland assessed valuation and the farmland acreage of the six strata in the sample frame.

$$FAV_{ty} = \sum_{i=1}^{6} FAV_{ity}$$

$$FAC_{ty} = \sum_{i=1}^{6} FAC_{ity}$$

These estimates were additive because the weightings created by the unequal N'_{ity} in each stratum were incorporated in the estimates of FAC_{ity} and FAV_{ity} for each stratum. These estimates were then incorporated as variables in the tax simulation models in the next chapter.

CHAPTER V

TAX SIMULATION MODELS

The estimates of farmland assessed valuation and farmland acreage produced by the sampling plan were incorporated into three series of tax models designed to represent the present system of ad valorem property taxation and to simulate the redistribution effects that would result from plain use value assessment and deferred taxation alternatives. The ad valorem models were designed to establish a base of the present system of property taxation against which the results of the plain use value assessment and deferred taxation models may be compared. A simulation approach was selected to do this because it is the most feasible method of estimating effects resulting from alternative taxing systems that have not yet been put into practice.

Ad Valorem Models

The basic ad valorem models were designed to provide estimates of equalized valuations, tax revenues, acreages, and tax rates for the farmland and nonfarmland sectors of each township and for the total township. These were

basically the same ad valorem models Ching and Frick used in their study and are fairly standardized measures of ad valorem taxation.[35]

The data for certain variables in the township ad valorem tax models were obtained from the records of the Kent County Treasury Department, the Kent County Equalization Office, and the Kent County Planning Commission. These data included the township equalized valuation ($TOEV_{ty}$), township property tax revenue ($TORV_{ty}$), the township equalization factor (e_{ty}), and township acreage ($TOAC_{ty}$).

Both the township property tax revenue and township equalized valuation were based on both real and personal taxable property in each township. Personal property was a very small proportion of total taxable property and was included with real property because the two could not be separated in the sampling plan. Individual property listings on the property tax rolls did not make a distinction between real and personal property.

The township property tax rate ($TORT_{ty}$) for each township and each year was calculated by dividing the township property tax revenue ($TORV_{ty}$) by the township equalized valuation ($TOEV_{ty}$).

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[35]Ching and Frick, Effects of Use Value Assessment.

$$TORT_{ty} = \frac{TORV_{ty}}{TOEV_{ty}}$$

where:

t = township.

y = year.

$TORT_{ty}$ = township property tax rate.

$TORV_{ty}$ = township property tax revenue.

$TOEV_{ty}$ = township equalized valuation.

Property tax rates, in actual practice, were determined on a local school district basis in each township. However, during the ten year study period, there was considerable change in the boundaries of local school districts caused by school district reorganization efforts. Thus, using a separate tax rate for each school district would have resulted in considerable effort in determining the school districts for each sample observation for each year. This difficulty, combined with a lack of usable data on the property tax revenues and assessed valuations for each school district for each year, necessitated the use of an overall township property tax rate which represented a composite tax rate based on the tax rates of all school districts in the township.

The township property tax revenues, equalized valuations, and acreages were then calculated for the farm and nonfarm sectors of each township. The estimate of farmland equalized valuation (FEV_{ty}) was obtained by

multiplying the estimate of farmland assessed valuation (FAV_{ty}) obtained from the sampling plan by the township equalization factor (e_{ty}) for each township and year.

$$FEV_{ty} = (FAV_{ty})(e_{ty})$$

where:

FEV_{ty} = township farmland equalized valuation.

FAV_{ty} = township farmland assessed valuation.

e_{ty} = township equalization factor.

All the estimates of farmland assessed valuation were converted to equalized values because in the later years of the study period tax rates and tax revenues were based upon equalized values rather than assessed values as was the case in 1960 when the sample was drawn. Thus, equalization would more readily allow comparisons among years and among the five townships than would assessed values which could vary among townships depending on the local assessor and the assessment methods he used.

The estimate of farmland property tax revenue (FRV_{ty}) for each township and each year was obtained by multiplying the farmland equalized valuation (FEV_{ty}) by the township property tax rate ($TORT_{ty}$).

$$FRV_{ty} = (FEV_{ty})(TORT_{ty})$$

where:

FRV_{ty} = township farmland property tax revenue.

FEV_{ty} = township farmland equalized valuation.

$TORT_{ty}$ = township property tax rate.

The estimates of equalized valuation, property tax revenue, and acreage for the nonfarmland sector of each township were obtained by subtracting the respective farmland estimate from the estimate for the total township.

The estimates of nonfarmland equalized valuation ($NFEV_{ty}$) were obtained by subtracting the farmland equalized valuation (FEV_{ty}) from the total township equalized valuation ($TOEV_{ty}$).

$$NFEV_{ty} = TOEV_{ty} - FEV_{ty}$$

where:

$NFEV_{ty}$ = township nonfarmland equalized valuation.

$TOEV_{ty}$ = township equalized valuation.

FEV_{ty} = township farmland equalized valuation.

The estimates of nonfarmland property tax revenue ($NFRV_{ty}$) were obtained by subtracting farmland property tax revenue (FRV_{ty}) from the total township property tax revenue ($TORV_{ty}$).

$$NFRV_{ty} = TORV_{ty} - FRV_{ty}$$

where:

$NFRV_{ty}$ = township nonfarmland property tax revenue.

$TORV_{ty}$ = township property tax revenue.

FRV_{ty} = township farmland property tax revenue.

The estimates of nonfarmland acreage ($NFAC_{ty}$) were obtained by subtracting farmland acreage (FAC_{ty}) obtained in the sampling plan from the total township acreage ($TOAC_{ty}$).

$$NFAC_{ty} = TOAC_{ty} - FAC_{ty}$$

where:

$NFAC_{ty}$ = township nonfarmland acreage.

$TOAC_{ty}$ = township acreage.

FAC_{ty} = township farmland acreage.

These six formulas constituted the ad valorem property taxation model. The solutions to the six formulas along with the values of the variables in the formulas served as a base against which the solutions and data from the plain use value assessment and deferred taxation models may be compared. The variables in the ad valorem models were later incorporated into the plain use value assessment and deferred taxation models.

Plain Use Value Assessment and Deferred Taxation Simulation Models

The basic township data produced by the ad valorem model were incorporated into a series of tax simulation

models. These tax simulation models were designed to simulate new township property tax rates resulting from the application of various plain use value assessment and deferred taxation alternatives to various proportions of farmland equalized valuation in each township. These new township property tax rates were then incorporated into tax simulation models designed to simulate the changes in the distribution of the property tax burden in three sectors of each township. These three sectors were: (1) participating farmland, (2) nonparticipating farmland, and (3) nonfarmland.

In all models, it was assumed that the property tax revenue for each township and each year was the budget for that township for that particular year that must be obtained from property tax revenues. In other words, it was assumed that any changes in the property tax base caused by the use value assessment alternatives would show their effect through changes in the township property tax rates rather than through changes in the township property tax revenues. It was also assumed in the models that any changes in the township farmland acreage and the township farmland assessed valuation during the study period would be accounted for in the calculations of the sampling plan.

Determination of Farmland Use Values

Almost all of the states having some form of use value assessment specify in their statutes that an assessed value be placed on the farmland or other qualifying land that represents the value of that land in an agricultural or other open space use. Theoretically, this value is supposed to ignore the effects of external forces such as current sales of nearby land for nonfarm uses, potential or future uses of the land, land speculation, and expanding urban growth on the assessment of the land for property tax purposes. As such, use values should be closely related to the concept of land use capacity which represents the ability of land to produce a net return above the production costs in a particular land use. Even though the above mentioned external factors undoubtedly exert some influence on agricultural use values, current writing on the subject seems to indicate that primary emphasis should be given to those factors more directly related to the ability of land to produce a net income in an agricultural use.

Although some states with use value assessment do not specify a means of determining agricultural use value, several states specify that use values shall be determined by the income capitalization approach to the valuation of land. Connecticut, Maryland, and New Jersey are three states in particular which have established definite

procedures for capitalizing net agricultural incomes from the land.

In Connecticut, the land assessor capitalizes average gross rental incomes for particular crops. In Maryland, use values are based upon a capitalization of net income resulting from corn production with adjustments made for soil fertility. New Jersey has perhaps the most elaborate system of use value determination.[36] This procedure uses U.S. Department of Agriculture state data on costs and returns from farming operations along with census data to estimate net farm income on a county basis. These data are then adjusted for soil fertility ratings to arrive at an estimate of net farm income per acre for general categories of land use such as cropland harvested, pastureland, and woodland. These incomes are then capitalized to obtain the final estimate of use values per acre.

An attempt was made to use the New Jersey approach as a basis for determining use values per acre for the sample observations for each year. However, this approach was rejected due to deficiencies and inconsistencies in available data. These problems were caused by the need to combine data on costs and returns from several different

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[36]For details on the New Jersey procedure see: State Farmland Evaluation Advisory Committee, Farmland Assessment Act of 1964, (Trenton, N. J.: State of New Jersey, Oct., 1965).

sources resulting in major inconsistencies in what type of farming operations the data actually represented. It often appeared that the data from these differing sources did not represent the same type of farming operations or even the same areas of the state.

Problems were also encountered in attempting to use cost and return data on a state level to represent the net income situation of agriculture in each of the five townships. Census data on costs and returns were found to be incomplete, and Tele-Farm accounts were judged to be unrepresentative of farming operations in the townships as these data are typically based on the larger, more efficient, and better managed farms.

Difficulties also arose in attempting to relate net returns from the land to differences in soil fertility and topography as the available data on crop yields from varying soil classes did not correspond with data on actual crop yields in the townships. The choice of a capitalization rate also presented problems as small changes in the capitalization rate would have resulted in large changes in the value that was being computed.

In view of these major difficulties, it was decided to utilize a range of values for agricultural use values rather than attempt to calculate a "true" use value for each property listing in the sample. It is doubtful if there even is a "true" use value for land in an agricultural

use. There could conceivably be many use values depending on the particular type of agricultural land use, the intensity of the use, and the possible alternative types of agricultural land uses available.

The values of $100, $200, and $300 per acre were selected as the use values per acre to be used in the tax simulation models. It was felt that these values would not only give reasonable approximations of farmland use values in the townships based on U.S. Census of Agriculture data on the value of farmland per acre, but would also offer a large enough range of values to show the sensitivity of the farmland use value variables in the models to changes in the redistribution of the property tax burdens in the townships.[37]

These use values per acre (UV/AC) were converted to estimates of farmland use values on a township basis (FUV_{ty}) by multiplying them by the estimates of farmland acreage in each township (FAC_{ty}).

$$FUV_{1ty} = (UV_1/AC)(FAC_{ty})$$
$$FUV_{2ty} = (UV_2/AC)(FAC_{ty})$$
$$FUV_{3ty} = (UV_3/AC)(FAC_{ty})$$

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[37]U.S. Department of Commerce, Bureau of the Census, 1964 United States Census of Agriculture, Vol. 1, pt. 13, Michigan, p. 261.

Plain Use Value Assessment
Tax Simulation Models

Four tax simulation models were developed to simulate the redistribution of property tax burdens resulting from the adoption of plain use value assessment. The first model was developed to simulate new property tax rates that would result from the adoption of plain use value assessment. The last three models simulated the changes in property tax levies in the three sectors of each township that would result from the new property tax rates produced under plain use value assessment.

The first model for simulating new property tax rates under plain use value assessment is the following:

Model 1

$$TORT_{ty(uv)} = \frac{TORV_{ty(av)}}{(P_1)(FEV_{ty}) + (P_2)(FUV_{ty}) + (P_3)(NFEV_{ty})}$$

where:

$TORT_{ty(uv)}$ = new township property tax rates resulting from plain use value assessment in township t and year y.

$TORV_{ty(av)}$ = township property tax revenue in township t and year y.

FEV_{ty} = farmland equalized valuation in township t and year y.

FUV_{ty} = farmland use valuation in township t and year y.

$NFEV_{ty}$ = nonfarmland equalized valuation in township t and year y.

P_1 = proportion of township farmland equalized valuation not participating in use value assessment program.

P_2 = proportion of township farmland use valuation participating in use value assessment program.

P_3 = proportion of township nonfarmland equalized valuation not participating in use value assessment program.

Three levels of participation rates (P's) were used for all townships and all years. These participation rates were selected in order to determine the effects of varying rates of participation in use value assessment programs on present property tax rates as it would not be realistic to assume that all farmland in the township would participate in use value assessment programs. The rate of participation would likely have some impact on the resulting new township property tax rates. As more farmland participated in the use value assessment program, there would likely be a greater redistribution of the property tax burden to the nonfarmland and nonparticipating farmland sectors of each township.

The levels of participation and the accompanying values of P_1, P_2, and P_3 that were used in all the models are presented in Table 2.

Table 2. Levels of participation rates in tax simulation models

Participation Levels	Value of P_1	Value of P_2	Value of P_3
1	.75	.25	1.00
2	.50	.50	1.00
3	.25	.75	1.00

The participation rate P_3 remained at 1.00 for all levels of participation. The participation rates P_1 and P_2 were complements of one another in that their totals always equaled 1.00. The particular values of P_1, P_2, and P_3 always remained the same for a particular level of participation.

These three levels of participation were combined with the three values of farmland use valuation (FUV_{ty}) in Model 1 to produce nine new township property tax rates for each township for each year. The combinations of values that these variables assumed for the calculation of the new property tax rates are given in Table 3.

These nine combinations of values for the variables FUV_{ty}, P_1, P_2, and P_3 were used in conjunction with the

Table 3. Combinations of values for participation levels and farmland use value variables in model 1

Farmland Use Values/ Acre	Participation Levels	Value of P_1	Value of P_2	Value of P_3	$TORT_{ty(uv)}$ Id. No.
$100	1	.75	.25	1.00	1
100	2	.50	.50	1.00	2
100	3	.25	.75	1.00	3
200	1	.75	.25	1.00	4
200	2	.50	.50	1.00	5
200	3	.25	.75	1.00	6
300	1	.75	.25	1.00	7
300	2	.50	.50	1.00	8
300	3	.25	.75	1.00	9

single values of the variables $TORV_{ty(av)}$, FEV_{ty}, and $NFEV_{ty}$ to calculate the new township property tax rates resulting from plain use value assessment ($TORT_{ty(uv)}$) for each township and each year. The new property tax rates were given an identification number because they would become inputs into the three remaining plain use value models and would be used in combination with only certain values of the other variables in the models.

The new township property tax rates produced by Model 1 were then incorporated into another model designed to simulate the change in property tax revenues in the non-farmland sector of the township as a result of plain use value assessment. This change was measured by comparing

the property tax revenues produced by the nonfarmland sector of the township under ad valorem assessment with the revenues that would be required to be produced under plain use value assessment in order to obtain the present level of total township property tax revenue. This comparison measured the increase in nonfarmland revenue that would be required to offset the reduction in the total township property tax base as a result of granting plain use value assessment to varying proportions of farmland in the township. This model is:

Model 2

$$NFRV_{ty(uv)} - NFRV_{ty(av)} = (TORT_{ty(uv)})(P_3)(NFEV_{ty}) - (TORT_{ty(av)})(P_3)(NFEV_{ty})$$

where:

$NFRV_{ty(av)}$ = nonfarmland property tax revenue produced under ad valorem assessment in township t and year y.

$NFRV_{ty(uv)}$ = nonfarmland property tax revenue produced under plain use value assessment in township t and year y.

$TORT_{ty(av)}$ = township property tax rate under ad valorem assessment in township t and year y.

$TORT_{ty(uv)}$ = new township property tax rates resulting from plain use value assessment in township t and year y.

$NFEV_{ty}$ = nonfarmland equalized valuation in township t and year y.

P_3 = proportion of township nonfarmland equalized valuation not participating in plain use value assessment program.

The two $(P_3)(NFEV_{ty})$ components in the model had the same values as the corresponding components in Model 1. The nine new township property tax rates that were simulated by Model 1 were used as the values of the $(TORT_{ty(uv)})$ variable. The solutions to the model were the differences between nonfarmland property tax revenues resulting from ad valorem tax assessment and those resulting from plain use value assessment.

The new township property tax rates simulated by Model 1 were then incorporated into a model designed to simulate the change in property tax revenues in the farmland sector of the township that does not participate in the use value assessment program. The rationale behind this model was essentially the same as that of Model 2 in that the nonparticipating farmland tax revenue would be expected to increase as a result of granting plain use value assessment to the participating farmland sector of the township. This model is:

Model 3

$$FRV_{ty(uv)} - FRV_{ty(av)} = (TORT_{ty(uv)})(P_1)(FEV_{ty}) - (TORT_{ty(av)})(P_1)(FEV_{ty})$$

where:

$FRV_{ty(uv)}$ = nonparticipating farmland tax revenue produced under plain use value assessment in township t and year y.

$FRV_{ty(av)}$ = nonparticipating farmland tax revenue produced under ad valorem assessment in township t and year y.

$TORT_{ty(uv)}$ = new township property tax rates resulting from plain use value assessment in township t and year y.

$TORT_{ty(av)}$ = township property tax rates under ad valorem assessment in township t and year y.

FEV_{ty} = township farmland equalized valuation in township t and year y.

P_1 = proportion of township farmland equalized valuation not participating in use value assessment program.

The two components $(P_1)(FEV_{ty})$ had the same value as the corresponding components in Model 1 for each township and each year. There was only one value for the variable $(TORT_{ty(av)})$ for each township and each year. The nine new township property tax rates that were calculated in Model 1 were used as the values of the $(TORT_{ty(uv)})$ variable. Three of these new township property tax rates were used in conjunction with each level of participation

for the variable P_1. These were the same combinations of values for the variables (P_1) and ($TORT_{ty(uv)}$) that were presented in Table 2.

The nine new township property tax rates produced by Model 1 were then incorporated into a model designed to simulate the change in property tax revenue in that part of the farmland sector of the township that participates in a use value assessment program. This model simulated the participating farmland tax revenues that would be produced by using the new township property tax rates in conjunction with the farmland use valuations. This model is:

Model 4

$$FRV_{ty(uv)} - FRV_{ty(av)} = (TORT_{ty(uv)})(P_2)(FUV_{ty}) - (TORT_{ty(av)})(P_2)(FEV_{ty})$$

where:

$FRV_{ty(uv)}$ = participating farmland property tax revenue produced under plain use value assessment in township t and year y.

$FRV_{ty(av)}$ = participating farmland property tax revenue produced under ad valorem assessment in township t and year y.

$TORT_{ty(uv)}$ = township property tax rates resulting from plain use value assessment in township t and year y.

$TORT_{ty(av)}$ = township property tax rates resulting from ad valorem assessment in township t and year y.

FUV_{ty} = farmland use valuation in township t and year y.

FEV_{ty} = farmland equalized valuation in township t and year y.

P_2 = proportion of township farmland equalized valuation participating in plain use value assessment program.

There was only one value for the variables $(TORT_{ty(av)})$ and (FEV_{ty}) for each township and each year. There were nine combinations of values for the variables (P_2), (FUV_{ty}), and $(TORT_{ty(uv)})$ for each township and each year. These combinations of values are given in Table 4.

The solutions to the model were given an identification number because they would become inputs to the deferred taxation models and thus would be needed to permit comparison between the results of the plain use value assessment models and the deferred taxation models.

Deferred Taxation Simulation Models

Data used in the previous models were then incorporated into a second series of models designed to simulate new township property tax rates resulting from the adoption of deferred taxation alternatives and to simulate the

Table 4. Combinations of values for variables in model 4

Participation Level	Value of P_2	Farmland Use Value	$TORT_{ty(uv)}$ Id. No.[a]	$FRV_{ty(uv)} - FRV_{ty(av)}$ Id. No.
1	.25	FUV1	1	1
1	.25	FUV2	4	2
1	.25	FUV3	7	3
2	.50	FUV1	2	4
2	.50	FUV2	5	5
2	.50	FUV3	8	6
3	.75	FUV1	3	7
3	.75	FUV2	6	8
3	.75	FUV3	9	9

[a]Identification number of solutions to Model 1 presented in Table 3.

changes in the redistribution of property tax burdens in each of the three sectors of the township. These models were essentially the same as the plain use value models except that a tax roll-back component was added to the model that simulated new township property tax rates resulting from deferred taxation. The remaining models designed to simulate the redistribution of property tax burdens were essentially the same as the respective plain use value assessment simulation models.

The first deferred taxation simulation model was developed to simulate new township property tax rates that would result from the application of deferred taxation to

varying proportions of farmland in the township. This model is:

Model 5

$$TORT_{ty(df)} = \frac{TORV_{ty(av)} - \sum_{r=3,5} \left[(FRV_{ty(av)}) - (FRV_{ty(uv)}) \right] (w)(s)}{(P_1)(FEV_{ty}) + (P_2)(FUV_{ty}) + (P_3)(NFEV_{ty})}$$

where:

$TORT_{ty(df)}$ = new township property tax rates resulting from deferred taxation in township t and year y.

$TORV_{ty(av)}$ = township property tax revenue under ad valorem assessment in township t and year y.

$FRV_{ty(av)}$ = property tax revenue produced by participating farmland under ad valorem assessment in township t and year y.

$FRV_{ty(uv)}$ = property tax revenue produced by participating farmland under plain use value assessment in township t and year y.

FEV_{ty} = farmland equalized valuation in township t and year y.

FUV_{ty} = farmland use valuation in township t and year y.

$NFEV_{ty}$ = nonfarmland equalized valuation in township t and year y.

r = number of years in roll-back.

w = proportion of the difference in participating farmland property tax revenue that is collectable as roll-back.

s = proportion of farmland participating in deferred taxation program to which the roll-back would apply.

P_1 = proportion of township farmland equalized valuation not participating in deferred taxation program.

P_2 = proportion of township farmland use valuation participating in deferred taxation program.

P_3 = proportion of township nonfarmland equalized valuation not participating in deferred taxation program.

Model 5 was essentially the same as Model 1 except that a roll-back component was subtracted from the township property tax revenue in the numerator of the model. The difference in property tax revenues from participating farmland under ad valorem assessment and under plain use value assessment ($FRV_{ty(av)} - FRV_{ty(uv)}$) were the solutions produced by Model 4 for each township and each year. However,

only the negative solutions produced by Model 4 were used in the roll-back component of Model 5. These negative solutions represented those situations where participating farmland tax revenue under plain use value assessment would have been lower than under ad valorem assessment. The positive solutions from Model 4 were excluded from the roll-back component in Model 5 because they represented situations where participating farmland tax revenue would have been greater under plain use value assessment than under ad valorem assessment. For these situations there would have been no roll-back.

The negative solutions from Model 4 were then converted to positive solutions for inclusion in Model 5 because the ordering of the variables were reversed from $(FRV_{ty(uv)} - FRV_{ty(av)})$ in Model 4 to $(FRV_{ty(av)} - FRV_{ty(uv)})$ in Model 5. Thus, all negative solutions from Model 4 were considered as positive variables in Model 5.

The variable (w) was the proportion of the difference in participating farmland tax revenue that would be collected as roll-back revenue. The value of the (w) variable was 1.00 for all townships and all years. In other words, it was assumed that the roll-back revenue would constitute the full amount of the difference in participating farmland tax revenue under ad valorem assessment and plain use value assessment. This assumption was made because the majority of states with deferred taxation and

the Michigan proposed legislation specified that the roll-back would constitute the full amount of the difference in tax revenues under the two forms of taxation.

The variable (s) represented the proportion of farmland participating in deferred taxation that the roll-back would apply to because of a change to a nonfarm or non-qualifying land use. The values of this variable were set at .10 and .20. The values were set at rather low levels because the values of the (s) variable apply only to the proportion of farmland in each township that participated in a plain use value assessment program, which ranged from .25 to .75. Thus the actual proportion of farmland participating in a deferred taxation program to which the roll-back would apply because of changes in land use would range from (.25)(.10)(100%) = 2.5 percent to (.75)(.20)(100%) = 15.0 percent. It was felt that this represented a wide enough range to cover the more realistic rates of conversion of land from farm to nonfarm uses in each year during the study period.

The (r) variable represented the length of the roll-back period. The values of this variable were set at three years and five years. These two values were selected because they are the most commonly used in deferred taxation programs in other states and have also been incorporated into various Michigan tax deferral proposals.

The roll-back component was subtracted rather than added to the township property tax revenue in the numerator of Model 5 because the roll-back was assumed to be a source of revenue that was not directly derived from the application of a property tax rate to an equalized valuation for the particular year in which the roll-back is collected. Instead, the roll-back was assumed to be a form of penalty revenue that would reduce the amount of property tax revenue required to be raised through property taxation, and hence would result in a lower township property tax rate than would be the case under either ad valorem or plain use value assessment.

If the roll-back were added to the present township property tax revenue produced under ad valorem taxation, the result would have been a new township tax rate necessary to produce a township property tax revenue that would have been equal to the old township tax revenue plus the amount of the roll-back. But since it was assumed that the existing property tax revenue would be the township tax budget, the new property tax rate would only have to be high enough to produce a township property tax revenue equal to the existing property tax revenue minus the amount of the roll-back.

The variables in the model assumed only certain combinations of values. These combinations were based upon the values of these variables in Model 4 which served

Table 5. Values of variables in model 5

Farmland Use Value/Acre	Value of P_1	Value of P_2	Value of P_3	$FRV_{ty(av)}$ / $FRV_{ty(uv)}$ Id. No.[a]	(w)	(r)	(s)
$100	.75	.25	1.00	1	1.00	3	.10
							.20
						5	.10
							.20
	.50	.50	1.00	4	1.00	3	.10
							.20
						5	.10
							.20
	.25	.75	1.00	7	1.00	3	.10
							.20
						5	.10
							.20
$200	.75	.25	1.00	2	1.00	3	.10
							.20
						5	.10
							.20
	.50	.50	1.00	5	1.00	3	.10
							.20
						5	.10
							.20
	.25	.75	1.00	8	1.00	3	.10
							.20
						5	.10
							.20
$300	.75	.25	1.00	3	1.00	3	.10
							.20
						5	.10
							.20
	.50	.50	1.00	6	1.00	3	.10
							.20
						5	.10
							.20
	.25	.75	1.00	9	1.00	3	.10
							.20
						5	.10
							.20

[a]Identification number of solutions to model 4 presented in Table 4.

as the basis for the roll-backs. These combinations of values for the variables in Model 5 are given in Table 5.

Model 5 was not calculated for each of the ten years in the study period. Instead, the model was calculated for eight years with the three year roll-back and for six years with the five year roll-back. This was necessary because the roll-backs could not be calculated for the first three and five years of the study period. Table 6 gives the years that were used for the values of the variables in Model 5.

Table 6. Years used for variables in model 5

Three Year Roll-back		Five Year Roll-back	
Years Used For FRV_{av}-FRV_{uv} Variable	Years Used For FEV,NFEV,FUV, and TORV Variables	Years Used For FRV_{av}-FRV_{uv} Variable	Years Used For FEV,NFEV,FUV, and TORV Variables
1960-62	1962	1960-64	1964
1961-63	1963	1961-65	1965
1962-64	1964	1962-66	1966
1963-65	1965	1963-67	1967
1964-66	1966	1964-68	1968
1965-67	1967	1965-69	1969
1966-68	1968	—	—
1967-69	1969	—	—

The combinations of values for the variables in Table 5 were used for the years in Table 6 to determine the values of the variables in Model 5.

The new township property tax rates resulting from deferred taxation in Model 5 were then incorporated into a model designed to simulate the change in property tax revenues in the nonfarmland sector of the township that would result from the adoption of deferred taxation. This model is the same as Model 2 which simulated the same redistribution of property tax revenues under plain use value assessment. This model is:

Model 6

$$NFRV_{ty(df)} - NFRV_{ty(av)} = (TORT_{ty(df)})(P_3)(NFEV_{ty}) - (TORT_{ty(av)})(P_3)(NFEV_{ty})$$

where:

$NFRV_{ty(df)}$ = nonfarmland property tax revenue produced under deferred taxation in township t and year y.

$NFRV_{ty(av)}$ = nonfarmland property tax revenue produced under ad valorem assessment in township t and year y.

$TORT_{ty(df)}$ = new township property tax rates resulting from deferred taxation in township t and year y.

$TORT_{ty(av)}$ = township property tax rate under ad valorem assessment in township t and year y.

$NFEV_{ty}$ = nonfarmland equalized valuation in township t and year y.

P_3 = proportion of nonfarmland equalized valuation not participating in deferred taxation program.

The $(TORT_{ty(av)})(P_3)(NFEV_{ty})$ component of the model was the same as the corresponding component in Model 2. The values of the $(TORT_{ty(df)})$ variable were the new township property tax rates resulting from deferred taxation produced by Model 5.

The new township property tax rates produced by Model 5 were then incorporated into a model designed to simulate the change in property tax revenues in that part of the farmland sector of the township that does not participate in deferred taxation. This model is essentially the same as Model 3 which simulated the same effect under plain use value assessment. This model is:

Model 7

$$FRV_{ty(df)} - FRV_{ty(av)} = (TORT_{ty(df)})(P_1)(FEV_{ty}) - (TORT_{ty(av)})(P_1)(FEV_{ty})$$

where:

$FRV_{ty(df)}$ = nonparticipating farmland property tax revenue produced under deferred taxation in township t and year y.

$FRV_{ty}(av)$ = nonparticipating farmland property tax revenue produced under ad valorem assessment in township t and year y.

$TORT_{ty(df)}$ = new township property tax rates resulting from deferred taxation in township t and year y.

$TORT_{ty(av)}$ = township property tax rate under ad valorem assessment in township t and year y.

FEV_{ty} = farmland equalized valuation in township t and year y.

P_1 = proportion of township farmland equalized valuation not participating in deferred taxation.

The $(TORT_{ty(av)})(P_1)(FEV_{ty})$ component of the model is the same as the corresponding component in Model 3. The combinations of values for the variables $TORT_{ty(df)}$ and P_1 are the same combinations given in Table 5.

The new township property tax rates resulting from deferred taxation were then incorporated into a model designed to simulate the change in property tax revenues in that part of the farmland sector of the township that participates in deferred taxation. This model is essentially the same as Model 4 which simulated the same effect under plain use value assessment. This model is:

Model 8

$$FRV_{ty(df)} - FRV_{ty(av)} = (TORT_{ty(df)})(P_2)(FUV_{ty}) - (TORT_{ty(av)})(P_2)(FEV_{ty})$$

where:

$FRV_{ty(df)}$ = participating farmland property tax revenue produced under deferred taxation in township t and year y.

$FRV_{ty(av)}$ = participating farmland property tax revenue produced under ad valorem assessment in township t and year y.

$TORT_{ty(df)}$ = new township property tax rates resulting from deferred taxation in township t and year y.

$TORT_{ty(av)}$ = township property tax rate under ad valorem assessment in township t and year y.

FUV_{ty} = farmland use valuation in township t and year y.

FEV_{ty} = farmland equalized valuation in township t and year y.

P_2 = proportion of township farmland equalized valuation that participates in deferred taxation.

The $(TORT_{ty(av)})(P_2)(FEV_{ty})$ component of the model was the same as the corresponding component in Model 4. The combinations of values for the variables $TORT_{ty(df)}$, P_2, and FUV_{ty} were the same combinations presented in Table 5.

CHAPTER VI

DATA PRESENTATION AND ANALYSIS

The data inputs and outputs for the sample plan and the ad valorem, plain use value assessment, and deferred taxation simulation models were analyzed on a CDC 6500 computer. Data inputs on the assessed valuation, acreage, and classification of each sample observation were entered on individual sample observation cards. From the resulting data deck, the estimates of farmland assessed valuation and farmland acreage were made for each township and each year according to the procedures outlined in Chapter IV.

Data inputs for township equalized valuations, township property tax revenues, township equalization factors, and township property tax rates were entered on township data cards. These township data inputs were used in conjunction with the sample estimates as the data inputs for the ad valorem, plain use value assessment, and deferred taxation simulation models presented in Chapter V.

The results of the tax simulation models along with the results produced by the sampling plan are presented in this chapter. The results of each simulation model were analyzed in terms of the effect that each use value

assessment alternative would have on the redistribution of property tax burdens in the township. Comparisons of the alternatives were also made among the five townships in addition to comparisons among alternatives within townships.

Since there were a considerable amount of data generated by the models for all five townships and each of the ten years in the study period, much of the data output has been summarized through the use of means, ranges, and percentage changes. This was done in order to present general trends and effects that otherwise may not have been readily apparent in a large amount of detailed data.

Calculation of Sample Bias and Standard Errors of Estimation

A calculation of sample bias was made for each township for the year 1960. The sample bias represents the difference between the sample estimates of farmland assessed valuation and farmland acreage and the values of these variables based on a census of the sample frame. The sample biases were calculated only for 1960 because this was the only year for which a complete census of the sample frame could be calculated. The values of farmland assessed valuation and farmland acreage for each township based on the sample estimates and a complete census of the sample frame are presented in Table 7.

Table 7. Sample bias for estimates of farmland assessed valuation and farmland acreage in all townships for 1960

	Sample FAV_{ty}	Census FAV_{ty}	Sample[a] Bias	Sample FAC_{ty}	Census FAC_{ty}	Sample[a] Bias
Alpine	$1,478,517	$1,626,900	$-148,383 (-9.12%)	16,283	20,410	-4,127 (-20.22%)
Byron	1,441,056	1,177,300	+263,756 (+22.40%)	20,040	20,561	-521 (-2.53%)
Caledonia	1,410,634	1,001,800	+408,834 (+40.81%)	20,382	19,695	+687 (+3.49%)
Cascade	529,236	515,800	+13,436 (2.60%)	11,835	11,954	-119 (-1.00%)
Gaines	1,380,005	1,192,300	+187,705 (+15.74%)	19,506	20,043	-537 (-2.68%)

[a]Bottom number in parentheses represents percentage of sample bias.

The largest amount of sample bias existed in Caledonia township with appreciable amounts also in Byron and Gaines townships. It is interesting to note that although the sampling plan was based on assessed valuations per acre, the estimates of farmland acreages, with the exception of Alpine township, contained considerably less sample bias than did the estimates of farmland equalized valuation.

In every township except Alpine, the sampling plan overestimated farmland assessed valuation. This overestimation in most instances was caused by individual stratum estimates of farmland assessed valuation per acre that exceeded the standard error of estimation of the sampling plan which had been set at ≤ $10 per acre with a probability of 90 percent. The amounts by which the sample estimates of farmland assessed valuation per acre for each stratum deviated from the census calculation of farmland assessed valuation per acre for each stratum in the sample frame for 1960 are presented in Table 8.

The high standard errors of estimation were responsible for the overestimation of farmland assessed valuation in Caledonia and Byron townships. In Alpine township, the underestimation of farmland acreage seemed to be the factor causing the underestimation of farmland assessed valuation even though the standard errors of estimation of the individual strata were high.

Table 8. Standard errors of estimation of farmland assessed valuation per acre for each stratum in each township in 1960

	Alpine	Byron	Caledonia	Cascade	Gaines
Rural Vacant	$-1.15	$+2.06	$+21.60	$+0.74	$+6.23
Rural Improved	-6.38	+30.17	+27.85	-3.29	+8.02
Transition Vacant	-6.56	+10.40	-4.67	+12.24	+10.03
Transition Improved	+22.24	+11.40	+7.97	+3.26	+14.78
Urban Vacant	+21.31	+27.86	+0.20	-0.88	+37.94
Urban Improved	+30.17	+11.63	+32.95	-1.68	+14.81

The largest standard errors of estimation were generally in the three strata of each township which contained the farmland improved properties. These higher standard errors were likely caused by the higher variability of farmland assessed valuations per acre in these strata due to differences in the values of buildings and structures on the farmland improved properties. These three strata also contained the highest number of observations in the sample frame (N_{ity}) and thus would exert a stronger influence on the township estimates of farmland assessed valuation than would the smaller farm vacant strata. Thus the sample biases seemed to be caused by the larger standard errors of estimation in those strata which contained the higher proportions of total farmland assessed valuation in each township.

Results of the Ad Valorem Models

The results of the ad valorem models are presented to serve as a base for comparison with the results of the plain use value assessment and deferred taxation models, and to present the property tax structure and composition of each township. In order to facilitate comparisons among townships, ten year means were calculated for the key variables in the ad valorem models. These ten year means are presented in Table 9.

Table 9. Ten year means of variables in ad valorem models*

	TOEV	NFEV	FEV	TORV	NFRV
Alpine	$15,288,289 (1)	$11,700,080 (1)	$3,788,209 (2)	$478,798 (1)	$366,815 (2)
Byron	13,035,657 (3)	8,309,806 (4)	4,665,852 (1)	449,620 (2)	289,473 (4)
Caledonia	8,019,616 (5)	4,471,686 (5)	3,547,930 (3)	223,211 (5)	125,694 (5)
Cascade	13,557,163 (2)	11,670,111 (2)	1,987,042 (5)	428,644 (3)	368,087 (1)
Gaines	12,806,348 (4)	9,475,033 (3)	3,331,314 (4)	397,602 (4)	299,933 (3)

*Number in parenthesis refers to a township's ranking for each variable.

FRV	TORT	FAC	FEC/FAC	NFEV/TOEV	FEV/TOEV
$111,983	31.18	15,949	$224.46	76.5%	23.5%
(2)	(2)	(4)	(1)	(2)	(4)
160,147	33.67	20,342	230.56	63.8	36.2
(1)	(1)	(1)	(2)	(4)	(2)
96,517	27.11	19,121	186.41	55.8	44.2
(4)	(5)	(3)	(3)	(5)	(1)
60,557	30.23	11,423	173.08	84.3	15.7
(5)	(4)	(5)	(4)	(1)	(5)
98,069	30.36	19,701	169.06	74.0	26.0
(3)	(3)	(2)	(5)	(3)	(3)

Alpine and Cascade townships contained the highest amounts of total township equalized valuation and nonfarmland equalized valuation, and Caledonia township contained the least amount. Byron township had the highest amount of farmland equalized valuation and Cascade township the lowest amount with Alpine, Caledonia, and Gaines townships containing quite similar amounts. Alpine township ranked quite high for both farmland and nonfarmland equalized valuation because of the high amount of total township equalized valuation in the township.

The percentage that nonfarmland equalized valuation was of total equalized valuation corresponded quite closely to the rankings of the townships for nonfarmland equalized valuation with Cascade and Alpine townships having the highest percentages and Caledonia township the lowest.

The rankings of the townships for total township property tax revenues, nonfarmland property tax revenues, and farmland property tax revenues were very similar to the corresponding rankings for equalized valuations. Some minor changes in the rankings were due to differences in the rankings of the townships based on township property tax rates.

The estimates of farmland acreages generally corresponded with the rankings of farmland equalized valuation per acre for all townships except Alpine and Gaines.

Here the rankings differed because the farmland equalized valuation per acre was higher in Alpine than in Gaines township.

It is interesting to note that the farmland equalized valuations per acre were not always highest in the most urbanized townships (using the ratio of nonfarmland equalized valuation to total township equalized valuation as a measure of urbanization). Byron township had a low ratio of nonfarmland to total township equalized valuation but had the second highest level of farmland equalized valuation per acre. Cascade township ranked the highest in terms of urbanization but had the second lowest level of farmland equalized valuation per acre. This condition could have been caused by deficiencies in the assessment practices of certain townships which resulted in infrequent and/or under assessment of farmland properties.

The values of many of the variables in the ad valorem models increased dramatically during the study period. Table 10 gives the percentage increases for selected variables in the ad valorem models between 1960 and 1969 along with the ranges of values these variables had in 1960 and 1969.

Major changes occurred in the values of farmland equalized valuation and farmland property tax revenue in Gaines township in 1968 and 1969 as a result of property tax equalization efforts in that township. Between 1967

Table 10. Ranges and percentage changes in selected variables in ad valorem models from 1960 to 1969[a]

		Alpine	Byron	Caledonia	Cascade	Gaines
NFRV	1960	$176,736	$188,950	$67,817	$212,984	$149,909
	1969	654,810	479,964	234,943	842,351	599,963
		270.5%	154.0%	246.4%	295.5%	300.2%
TORV	1960	271,505	295,458	140,986	266,569	232,931
	1969	807,381	722,443	395,724	946,634	672,361
		197.4%	144.5%	180.7%	255.1%	188.7%
FRV	1960	94,769	106,508	73,169	53,585	83,022
	1969	152,571	242,479	161,781	104,283	72,398
		61.0%	127.7%	121.1%	94.6%	-12.8%
NFEV	1960	7,149,103	6,868,005	3,362,289	8,564,122	6,620,044
	1969	16,542,904	11,699,815	6,190,363	20,922,460	15,311,092
		131.4%	70.4%	84.1%	144.3%	131.3%

TOEV	1960	10,982,602	10,739,402	6,989,876	10,718,801	10,286,304
	1969	20,397,400	17,610,600	10,453,024	23,512,650	17,018,005
		85.7%	64.0%	49.6%	119.4%	65.4%
FEV	1960	3,833,499	3,871,397	3,627,587	2,154,679	3,666,260
	1969	3,854,496	5,910,785	4,262,661	2,590,190	1,706,913
		0.6%	52.7%	17.5%	20.2%	-53.4%
TORT	1960	24.72	27.51	20.17	24.87	22.64
	1969	39.58	41.02	37.95	40.26	42.41
		60.1%	49.1%	88.2%	61.9%	87.3%
FAC	1960	16,283	20,040	20,382	11,835	19,506
	1969	15,376	19,778	17,996	11,511	19,655
		-5.6%	-1.3%	-11.7%	-2.7%	0.8%
NFAC	1960	6,757	3,064	2,658	11,141	3,278
	1969	7,664	3,326	5,044	11,465	3,129
		13.4%	8.6%	89.8%	2.9%	-4.6%

[a]Bottom number in each cell represents percentage change between 1960 and 1969.

and 1968, the township equalization factor dropped from approximately 2.5 to 1.0 without a corresponding increase in the amount of farmland assessed valuation. The result was a sharp decrease in the value of farmland equalized valuation and farmland property tax revenues during 1968 and 1969 even though the amount of total township equalized valuation had increased. The result was that nonfarmland equalized valuation had to be increased substantially to make-up the decrease in farmland equalized valuation. This instance is mentioned because it represents a sort of "de facto" form of use value assessment for the owners of farmland that resulted in a major redistribution of the property tax burden to the nonfarmland sector. The same type of situation resulting from equalization efforts also occurred in Alpine township in 1968 although by 1969 the situation had corrected itself as farmland equalized valuation again increased.

In all townships the percentage increases in nonfarmland property tax revenues exceeded the percentage increases in total township property tax revenue which exceeded the percentage increases in farmland property tax revenues. Likewise, the percentage increases in nonfarmland equalized valuation exceeded the percentage increases in total township equalized valuation which exceeded the percentage increases in farmland equalized valuations. These relative rankings indicate that the nonfarmland

sectors of each township have been growing at a much faster rate than the farmland sectors. The increases in total township property tax revenues and equalized valuations have been coming largely from the nonfarmland rather than from the farmland sectors of the township.

In all townships, the percentage increases in property tax revenues exceeded the respective percentage increases in equalized valuations. This was caused by the increases in township property tax rates which when applied to the increases in equalized valuations produced an even greater increase in property tax revenues.

The absolute and percentage changes in farmland and nonfarmland acreages were relatively small compared to changes in tax revenue and equalized valuations. This suggests that possible changes in farmland and nonfarmland equalized valuations may be a more relevant measure of urbanization and land use changes than are changes in acreages. However, the validity of this conclusion would depend on whether the assessor's assessment methods do indeed result in a valid measure of the cash value of the properties being assessed. The changes in equalized valuations reflect not only changes in acreage between farm and nonfarm land uses, but also changes in the particular types of nonfarmland uses. For example, changes from a residential to a commercial or industrial land use would be reflected in the changes in equalized valuation but not in

the changes in acreages between farm and nonfarm land uses. Even though a change from a farm to a nonfarm land use would be reflected in a very small change in acreage, the particular type of development that occurred on the parcel would be reflected by a change in nonfarmland equalized valuation.

The changes in property tax revenues could be viewed as a measure of the increase in the quantity and quality of local government services and facilities that have occurred in a township. Changes in property tax revenues could be used as a measure of the supply of local government services. However, the cost of these increased services per taxpayer could remain the same or even possibly decrease because of an increase in the population of the taxing unit which could result in greater economies of scale in supplying these services.

The changes in township property tax rates could be viewed as a measure of the rate of increase in local government services and facilities relative to the increase in the value of the properties that are being supplied with these services and facilities. This measure would depend on the assumption that the equalized valuations are a valid measure of the cash value of the properties being assessed. Thus, the changes in township property tax rates could be viewed as a measure of how rapid the supply of government and community services are being increased relative to the

increase in the value of the property that is being supplied with these services.

Based on these measurements, Alpine and Cascade townships experienced the greatest increase in urbanization during the study period as they both had the greatest increase in total township and nonfarmland equalized valuation. Caledonia township had the least amount of increase in urbanization.

Almost all of the increase in total township equalized valuation in Alpine township was caused by the increase in the nonfarmland sector. In Byron township, the increases in equalized valuations for the farmland and nonfarmland sectors were more equal, indicating a more balanced growth between the farm and nonfarm sectors of the township.

Using changes in property tax revenues as a measure of the increases in the quantity and quality of local government services, Cascade township had the largest increase followed by Alpine and Caledonia townships. It is interesting to note that Caledonia township which had the smallest increase in township equalized valuation had a relatively high increase in township property tax revenue. This was caused by the high increase in the township property tax rate in the township. Such a relationship indicates that the increase in the supply of local

government services has been increasing faster than the value of the property being supplied by these services.

In Alpine township, almost all of the increase in farmland property tax revenue was caused by the increase in the township property tax rate as farmland equalized valuation remained almost the same during the study period.

Results of Plain Use Value Assessment Models

Results of Model 1

Model 1 simulated the changes in the township property tax rates that would result from granting plain use value assessment to varying proportions of farmland equalized valuation in each township. In order to compare the resulting new township property tax rates with the tax rates under ad valorem assessment, the mean percentage change between the two tax rates were calculated for the ten year study period. These mean percentage changes are presented in Table 11.

The new township property tax rates increased in all townships for those plain use value assessment alternatives where farmland use valuation per acre had been set at $100 and in Alpine and Byron townships where farmland use valuations per acre had been set at $200. These alternatives represented situations where the farmland use valuations would be lower than the present level of

Table 11. Mean percentage changes in township property tax rates resulting from plain use value assessment

Alternative	FUV/AC	P_2	Alpine	Byron	Caledonia	Cascade	Gaines
1	100	.25	3.18%	5.24%	5.33%	1.63%	3.86%[b]
2	100	.50	6.95	11.06	11.26	3.23	8.04[b]
3	100	.75	11.03	17.58	17.92	5.07	12.57[b]
4	200	.25	0.34	2.21[a]	-1.00	-0.65	-1.71
5	200	.50	1.01	4.52[a]	-1.95	-1.29	-2.69
6	200	.75	1.69	6.74[a]	-2.85	-1.92	-3.63
7	300	.25	-2.35	-2.96	-6.60	-2.83	-5.44
8	300	.50	-4.29	-5.68	-12.32	-5.49	-9.74
9	300	.75	-6.14	-8.19	-17.33	-8.01	-13.65

[a]Based on last five years which had a positive percentage increase.

[b]Based on first eight years which had a positive percentage increase.

assessment on farmland. In these instances the granting of plain use value assessment to farmland would lower the overall township property tax base and necessitate a higher township property tax rate in order to produce the present level to township property tax revenue.

Those plain use value assessment alternatives in Caledonia, Cascade, and Gaines townships where farmland use valuation per acre had been set at $200 and those alternatives where it had been set at $300 for all townships represented situations in which the level of farmland use valuation would have been higher than the current level of assessment of farmland under ad valorem assessment. These situations would result in a lower township property tax rate because the township property tax base would have been increased. However, these situations would not likely exist as farmland owners would not likely volunteer for a program that would increase their present level of property tax assessments. However, in most cases farmers would not know the changes in their tax levies until after reassessment of their properties after which it would be too late to withdraw from the program.

The greatest increase in township property tax rates occurred in those townships with the highest ratio of farmland equalized to total township equalized valuation and in those townships with the highest level of farmland equalized valuation per acre. As the proportion of farmland

equalized valuation increased relative to the total township equalized valuation, the resulting new township property tax rates would increase because a larger proportion of the township equalized valuation would receive a reduction in equalized valuations. Likewise, the higher the level of farmland equalized valuation per acre, the greater would be the difference between farmland equalized valuation and farmland use valuation. The greater the difference between these two variables, the greater would be the decrease in the township property tax base as a result of granting use value assessment to farmland. A higher township property tax rate would then be needed to produce the current level of township property tax revenue from the decreased township property tax base.

Within townships, the new township property tax rates increased as the participation percentages in a plain use value assessment program increased and as the levels of farmland use valuation per acre decreased. However, the changes in tax rates were influenced more by the level of farmland use valuation per acre than by the level of participation in a plain use value assessment program. This relationship was determined by a simple sensitivity analysis of the effects of farmland use valuation and participation rates upon changes in township property tax rates. This sensitivity of new township property tax rates to farmland use valuations per acre increased as the

proportion of farmland equalized valuation to total township equalized valuation decreased. Thus changes in property tax rates tended to be more sensitive to changes in farmland use valuations in the more rural townships than in the more urban townships.

Results of Model 2

The mean percentage changes in nonfarmland property tax revenues as a result of plain use value assessment had the same values as the mean percentage changes in property tax rates in Table 11. The reason is that in Model 2 the participation percentages and nonfarm equalizations had the same values under both ad valorem assessment and plain use value assessment with the only difference being in the township property tax rates. Consequently, the mean percentage changes in nonfarmland property tax revenues were the same as the mean percentage changes in township property tax rates. Thus the same relationships discussed under Model 1 also apply to the percentage changes in nonfarmland property tax revenues in Model 2.

Model 2 also simulated the changes in millage rates in the nonfarmland sector of the township as a result of granting plain use value assessment to varying proportions of the farmland sector. The changes in the nonfarmland millage rates were calculated by the following formula:

$$\frac{NFRV_{ty\,(uv)} - NFRV_{ty\,(av)}}{NFEV_{ty}} \times 1000$$

The millage rates calculated by this formula would represent the additional millage rate created by plain use value assessment that would be added to the present township millage rate under ad valorem assessment. This additional millage rate would reflect the increased property tax revenue necessary from the nonfarmland sector of the township in order to compensate for the decrease in the township property tax base caused by plain use value assessment.

The mean dollar changes in millage rates in the nonfarmland sector are presented in Table 12.

The positive increases in nonfarmland millage rates represent those situations in which additional property tax revenues would be required from the nonfarmland sector of the township in order to compensate for the decrease in the township property tax base caused by plain use value assessment. These increases occurred in the same alternatives for the same townships as did the percentage increases in township property tax rates. These increases also followed a similar pattern as did the mean percentage increases in tax rates in that they increased as the participation percentages increased and as farmland use valuations decreased.

Table 12. Mean change in nonfarmland and nonparticipating farmland millage rates resulting from plain use value assessment

Alternative	FUV/AC	P_2	Alpine	Byron	Caledonia	Cascade	Gaines
1	100	.25	$0.94	$1.78	$1.46	$0.48	$1.07[b]
2	100	.50	2.08	3.77	3.09	0.98	2.23[b]
3	100	.75	3.31	5.99	4.92	1.49	3.49[b]
4	200	.25	0.08	0.84[a]	-0.20	-0.19	-0.65
5	200	.50	0.29	1.71[a]	-0.40	-0.42	-0.98
6	200	.75	0.50	2.63[a]	-0.57	-0.54	-1.30
7	300	.25	-0.73	-0.92	-1.68	-0.82	-1.73
8	300	.50	-1.31	-1.76	-3.15	-1.59	-3.04
9	300	.75	-1.87	-2.54	-4.44	-2.32	-4.23

[a]Based on last five years which had a positive increase in millage rates.

[b]Based on first eight years which had a positive increase in millage rates.

The mean increases in millage rates were highest in those townships with the highest proportion of farmland equalized valuation to total township equalized valuation and in those townships with the highest level of farmland equalized valuation per acre. As the amount of farmland equalized valuation in a township that received plain use value assessment increased, the greater would be the amount of property tax revenue that would have to be made up by the nonparticipating sectors of the township that did not receive the use value assessment, and the greater the difference between farmland equalized valuation and farmland use valuation, the larger would be the millage rate increase in the nonfarmland sector to make up the decrease in the township property tax base.

Results of Model 3

Model 3 simulated the changes in the redistribution of property tax revenues in the farmland sector of the township that does not participate in plain use value assessment. No results of Model 3 are presented in this chapter as the results of the model are the same as the results of Model 2 which simulated effects in the nonfarmland sector of the township.

Originally it had been planned to analyze Model 3 in terms of the changes in property taxes per acre in the nonparticipating farmland sector as a result of granting

plain use value assessment to the participating farmland sector. But to do this would have required the assumption that the participation percentages of the nonparticipating farmland (P_1) would apply equally to both farmland equalized valuations and farmland acreages. In other words, it would have had to been assumed that fifty percent of the farmland equalized valuation would have been contained on fifty percent of the farmland acreage in the township, for example. But this assumption could not be made as there was no basis for assuming that the distributions of farmland equalized valuations and farmland acreages were the same. The invalidity of this assumption was discovered when the changes in nonparticipating farmland tax revenue per acre were found to be inconsistent with the increases in the millage rates for the nonparticipating farmland.

Results of Model 4

Model 4 simulated the redistribution of property tax burdens in the farmland sector of the township that participates in plain use value assessment. Model 4 simulated both the mean percentage changes and the mean changes in millage rates in the participating farmland sector. Table 13 presents the mean percentage changes in property tax revenues in the participating farmland sector under the various plain use value assessment alternatives.

Table 13. Mean percentage changes in participating farmland property tax revenues under plain use value assessment alternatives

Alternative	FUV/AC	P_2	Alpine	Byron	Caledonia	Cascade	Gaines
1	100	.25	-54.05%	-53.13%	-42.75%	-40.66%	-45.00%[b]
2	100	.50	-52.37	-50.58	-39.55	-39.68	-42.80[b]
3	100	.75	-50.55	-47.74	-35.98	-38.67	-40.40[b]
4	200	.25	-10.64	-22.97[a]	7.52	15.99	27.05
5	200	.50	-10.05	-21.25[a]	6.33	15.20	16.43
6	200	.75	-9.45	-19.46[a]	5.20	14.42	23.83
7	300	.25	30.45	29.38	52.03	70.13	84.09
8	300	.50	27.83	25.39	42.42	65.38	75.27
9	300	.75	25.33	21.70	34.03	60.89	67.39

[a]Based on last five years which had negative percentage changes.

[b]Based on first eight years which had percentage decreases.

These percentage changes in the participating farmland sector were considerably higher than the corresponding changes in the nonfarmland and nonparticipating farmland sector presented in Table 11. The reason for the higher mean percentage decreases was because farmland equalized valuation represented a smaller proportion of total township equalized valuation than did nonfarmland equalized valuation. Thus a large decrease in a small sector of a township could be offset by a relatively smaller increase in a large sector of a township. Under this type of relationship, the participating farmland sector would receive a large decrease in property tax revenues which could be recaptured by a small increase in property tax revenues in the nonparticipating farmland and nonfarmland sectors of the township.

The largest mean percentage decreases occurred in Alpine and Byron townships which had the highest levels of farmland equalized valuation per acre. The greater the difference between the levels of farmland equalized valuation and farmland use valuation, the larger would be the percentage decrease in participating farmland property tax revenues.

The largest percentage decreases in participating farmland property tax revenues were also in those townships with the smaller increases in the new township property tax rates resulting from plain use value assessment. However,

this relationship was true for only Alpine, Caledonia, and Cascade townships. In Byron township, the largest difference of any townships between farmland equalized valuation and farmland use valuation apparently cancelled out the rather high increase in new township property tax rates. Thus the greatest decrease in participating farmland property tax revenues would be expected in those townships with the greatest difference between farmland equalized valuation and farmland use valuation and in those townships with the smallest increase in new township property tax rates resulting from plain use value assessment. Within these townships, the largest decreases would occur in those plain use value assessment alternatives with the lowest level of farmland use valuation per acre and in those alternatives with the lowest participation in a plain use value assessment program. The percentage decreases in participating farmland property tax revenues were largest for those alternatives with the lowest participation percentage in a plain use value assessment program because these alternatives resulted in lower increases in new township property tax rates resulting from plain use value assessment. These lower township property tax rates would then result in larger decreases in participating farmland property tax revenues when applied to the farmland use valuations than would the higher township property tax

rates produced under those alternatives with higher participation rates.

The changes in the millage rates for the participating farmland sector were also calculated using the same formula as was used for calculating the changes in millage rates for the nonfarmland sector. These changes in millage rates are presented in Table 14.

The changes in millage rates followed the same general pattern as did the mean percentage changes in participating farmland revenues in Table 13. The greatest decrease in millage rates occurred in those townships with the highest level of farmland equalized valuation and which had the smaller increases in new township property rates. The data indicated that the level of participation of farmland equalized valuation in plain use value assessment would have a smaller effect on the decrease in millage rates than would the level of farmland use valuation per acre. The changes in participating farmland millage rates among levels of participation percentages were smaller than was the case in the nonfarmland and nonparticipating farmland sectors indicating that changes in the level of farmland use valuation per acre were affecting the changes in millage rates much more than were changes in participation levels. However, in all cases, the decreases in participating farmland millage rates were greater in those alternatives with low participation percentages.

Table 14. Mean changes in participating farmland millage rates under plain use value alternatives

Alternative	FUV/AC	P_2	Alpine	Byron	Caledonia	Cascade	Gaines
1	100	.25	$-16.91	$-18.19	$-11.90	$-12.42	$-12.64[b]
2	100	.50	-16.42	-17.34	-11.04	-12.12	-12.03[b]
3	100	.75	-15.86	-16.39	-10.08	-11.84	-11.36[b]
4	200	.25	-3.43	-8.75[a]	1.50	4.60	10.34
5	200	.50	-3.25	-8.10[a]	1.25	4.38	9.68
6	200	.75	-3.06	-7.38[a]	1.01	4.16	9.06
7	300	.25	9.36	9.12	13.39	20.91	28.56
8	300	.50	8.58	7.88	10.95	19.51	25.71
9	300	.75	7.83	6.74	8.84	18.23	23.12

[a]Based on last five years that had negative decreases.

[b]Based on first eight years that had negative decreases.

If the increases in nonfarmland and nonparticipating farmland millage rates and the decreases in participating farmland millage rates were applied to hypothetical properties with a cash value of $40,000, the differences between the impact of plain use value assessment on the three sectors of the township become quite apparent. The equalized value of such a property would be $20,000 (assuming equalized value to be fifty percent of cash value). The resulting changes in property tax millages (changes in property taxes paid) are presented in Table 15.

It is apparent from Table 15 that there could be substantial shifts in property tax revenues resulting from plain use value assessment. The difference in property tax millages between a participating and a nonparticipating property could range from over $300 in Alpine and Byron townships under alternative 1 to approximately $70 in Alpine township under alternatives 4, 5, and 6. These differences in property taxes could provide a rather strong financial incentive for a property owner to participate in a plain use value assessment program. There could also be large differences in the impacts between townships as the difference in revenues could be almost $150 higher in Alpine than in Caledonia township. The greatest differences between participating properties and nonparticipating properties would be in the more rural townships with high levels of farmland equalized valuation per acre and where

Table 15. Mean changes in property tax millages on participating and nonparticipating property with a cash value of $40,000*

Alternative	FUV/AC	P_2	Alpine	Byron	Caledonia	Cascade	Gaines
1	100	.25	$+18.80 -338.20	$+35.60 -363.80	$+29.20 -238.00	$+9.60 -248.40	$+21.40 -252.80
2	100	.50	+41.60 -328.40	+75.40 -346.80	+61.80 -220.80	+19.60 -242.40	+44.60 -240.60
3	100	.75	+66.20 -317.20	+119.80 -327.80	+98.40 -201.60	+29.80 -236.80	+69.80 -227.20
4	200	.25	+1.60 -68.60	+16.80 -175.00			
5	200	.50	+5.80 -64.50	+34.20 -162.00			
6	200	.75	+10.00 -61.20	+52.60 -147.60			

*Top number in each cell is the increase in property tax millages for nonparticipating property, and the bottom number is the decrease in property tax millages for participating property.

a small proportion of farmland equalized valuation would participate in a plain use value assessment program which authorized a low level of farmland use valuation per acre.

The decrease in participating farmland millage rates were compared against the increases in nonfarmland and nonparticipating farmland millage rates by comparing the decrease in the participating farmland millage rates for a dollar increase in the nonparticipating rates. This gave a measure of the benefit to the participating farmland sector in comparison to the cost of that benefit to the nonparticipating sectors. These decreases are presented in Table 16.

The largest decreases represent those alternatives in which the decreases in participating farmland millage rates would be the largest for a dollar increase in the millage rates of the nonparticipating sectors. In four townships, the largest per unit decrease occurred in alternative 1 which had the lowest level of participation percentages and farmland use values. However, in Alpine and Byron townships, corresponding large decreases also occurred in alternative 4 where the farmland use valuation per acre had risen to $200.

The data in the last two tables indicate that the participating farmland sector would receive the largest decrease in property taxes and the nonfarmland and nonparticipating farmland sectors would receive the smallest

Table 16. Mean decrease in participating farmland millage rates for each dollar increase in nonparticipating millage rates

Alternative	FUV/AC	P_2	Alpine	Byron	Caledonia	Cascade	Gaines
1	100	.25	$-17.99	$-10.22	$-8.15	$-25.88	$-11.81[b]
2	100	.50	-7.89	-4.62	-3.57	-12.37	-5.39[b]
3	100	.75	-4.79	-2.74	-2.05	-7.95	-3.26[b]
4	200	.25	-42.88	-10.42[a]			
5	200	.50	-11.21	-4.74[a]			
6	200	.75	-6.12	-2.81[a]			

[a]Based on last five years of study period.

[b]Based on first eight years of study period.

increase in property taxes under those alternatives in which the participation levels of farmland equalized valuation would remain low.

The nonfarmland and nonparticipating farmland millage rates would increase the least in the more urban townships with the least proportion of farmland equalized valuation. Thus as both the proportion of farmland equalized valuation to total township equalized valuation and the rate of participation in a plain use value assessment program decrease, the amount of farmland equalized valuation that could receive plain use value assessment would decrease. This would result in a smaller increase in township property tax rates resulting from plain use value assessment. These increases in property tax rates would be the lowest under those alternatives which had the highest level of farmland use valuation per acre because these alternatives would decrease the township property tax base the least.

The participating farmland sector would prefer both a low participation percentage in a use value program and a low level of farmland use valuation per acre. The decrease in participating farmland property taxes would be the greatest in those townships with the highest level of farmland equalized valuation per acre. Thus, under a low level of farmland use valuation per acre, participating farmland would receive the largest decrease in assessment.

Under a low participation percentage, participating farmland would receive the smallest increase in township property tax rates as the township property tax base would be decreased the least.

Thus a situation would likely develop where all nonfarmland property owners in a township would favor the least amount of farmland participation in a plain use value assessment program with a high level of farmland use valuation per acre. The participating farmland owners would prefer a program with a low level of farmland use valuation per acre and that would restrict the largest amount of other farmland from entering the program. The nonparticipating farmland owners would likely prefer a change in the entrance requirements of the plain use value program that would enable them to enter the program and receive a reduction in property taxes.

Results of the Deferred Taxation Models

The deferred taxation simulation models were similar to the plain use value assessment models except that a roll-back component was included in the first deferred model that simulated new township property tax rates resulting from the application of deferred taxation to varying proportions of farmland equalized valuation in each township. This roll-back component would cause

township property tax rates to increase less than under plain use value assessment depending on the value of r (length of roll-back), w (amount of difference in participating farmland tax revenues in the roll-back), and s (proportion of participating farmland equalized valuation the roll-back applies to).

Results of Model 5

The mean percentage change in the township property tax rates and nonfarmland and nonparticipating farmland property tax revenues resulting from deferred taxation are presented in Table 17.

The mean percentage changes in Table 17 were based on the last six years of the study period. Six year means were selected because the solutions to the five year roll-backs existed only for the last six years of the study period. The same time period was used to calculate the mean percentage changes for the three year roll-back alternatives and the plain use value assessment alternatives in order to allow comparison among all three taxing alternatives. The means for Gaines township were based on the period of 1964 to 1967 because the solutions to the deferred models in 1968 and 1969 were negative due to tax equalization efforts. Negative solutions would represent situations in which participating farmland tax revenues would be higher under deferred taxation than under

Table 17. Mean percentage changes in township property tax rates and nonfarmland and nonparticipating farmland property tax revenues resulting from deferred taxation

Alternative	FUV/AC	P_2	s	Alpine			Byron		
				PUV	r=3	r=5	PUV	r=3	r=5
1	100	.25	.10	3.10%	2.25%	1.74%	5.61%	4.21%	3.56%
2	100	.25	.20		1.39	0.39		2.82	1.51
3	100	.50	.10	6.40	4.69	3.69	11.88	8.90	7.76
4	100	.50	.20		2.99	0.98		6.25	3.63
5	100	.75	.10	8.32	7.36	5.87	18.96	14.71	12.76
6	100	.75	.20		4.80	1.81		10.46	6.56
7	200	.25	.10	0.62	0.47	0.39			
8	200	.25	.20		0.33	0.16			
9	200	.50	.10	1.26	0.97	0.82			
10	200	.50	.20		0.69	0.39			
11	200	.75	.10	1.90	1.49	1.29			
12	200	.75	.20		1.09	0.67			

Caledonia			Cascade			Gaines		
PUV	r=3	r=5	PUV	r=3	r=5	PUV	r=3	r=5
5.59%	4.26%	3.62%	1.33%	0.97%	0.76%	3.75%	2.80%	2.30%
	2.93	1.65		0.61	0.18		1.85	0.86
11.84	9.22	7.98	2.70	1.99	1.56	7.78	5.91	4.93
	6.60	4.13		1.27	0.42		4.04	2.08
18.87	15.06	13.29	4.11	3.05	2.42	12.15	9.38	7.95
	11.25	7.71		1.99	0.73		6.61	3.74

ad valorem assessment. For such situations there would be no roll-back. The solutions in 1968 in Alpine township were also excluded for this reason.

The values in the PUV column of Table 17 represent the percentage changes for the alternatives under plain use value assessment. The values under the r=3 and r=5 columns represent the percentage changes under deferred taxation alternatives with three and five year roll-backs. The first and second values under the r=3 and r=5 columns represent the percentage changes for deferred taxation alternatives where the roll-back would be applied to ten and twenty percent respectively of the difference in participating farmland property tax revenue produced under ad valorem assessment and plain use value assessment.

In all townships the mean percentage changes were less than under plain use value assessment. This was because the amount of the roll-back component was subtracted from the total township property tax revenue before the new township property tax rates were calculated. This had the effect of reducing the amount of total township property tax revenue that would be required to be produced by the new township property tax rates. Thus the new township property tax rates under deferred taxation would be less than those produced as a result of plain use value assessment but still greater than those tax rates existing under ad valorem assessment.

The percentage change in new township property tax rates were less for the five year roll-back than for the three year roll-back because the amount of the roll-back had increased because the difference between participating farmland tax revenues between ad valorem and deferred taxation was summed over five years rather than three years.

The percentage increase in new township property tax rates were largest in those townships with the highest proportion of farmland equalized valuation to total township equalized valuation. This was the same relationship as existed under plain use value assessment.

The new township property tax rates under both the three and five year roll-backs increased as the participation percentage of farmland equalized valuation in deferred taxation increased. The percentage change between the three year and the five year roll-back alternatives also increased as the participation percentage increased. Thus not only did the difference between township tax rates under deferred taxation and plain use value assessment increase as participation percentages increased but also the difference between the new township tax rates under the three and five year roll-backs also increased.

The new township property tax rates under those roll-back alternatives where the value of s (percent of the difference in participating farmland tax revenue between ad valorem and plain use value assessment that

the roll-back applies to because of a shift in land use) was .10, were higher than for those alternatives where the value of s was .20. This was because the amount of the roll-back where s=.10 was less than where s=.20 and hence the amount of total township property tax revenue that would have to be raised by the new township property tax rates would be higher where s=.10.

Results of Model 6

Model 6 simulated the changes in millage rates in the nonfarmland sector of the township that would result from deferred taxation. Model 6 was basically similar to Model 2 except that it used the new township property tax rates resulting from deferred taxation that were produced by Model 5.

The dollar changes in the nonfarmland millage rates resulting from deferred taxation are presented in Table 18.

The changes in nonfarmland millage rates followed the same basic pattern as did the percentage changes in new township property tax rates and nonfarmland property tax revenues in Table 17. The increases in the nonfarmland millage rates were highest in those townships with the highest ratio of farmland to total township equalized valuation and in those townships with the highest levels of farmland equalization per acre. In all townships the millage rates increased as the participation percentages

Table 18. Mean changes in nonfarmland and nonparticipating farmland millage rates resulting from deferred taxation

Alternative	FUV/AV	P_2	s	Alpine			Byron		
				PUV	r=3	r=5	PUV	r=3	r=5
1	100	.25	.10	$1.02	$0.74	$0.57	$2.04	$1.54	$1.30
2	100	.25	.20		0.46	0.13		1.03	0.56
3	100	.50	.10	2.10	1.54	1.22	4.33	3.30	2.83
4	100	.50	.20		0.98	0.33		2.28	1.33
5	100	.75	.10	3.25	2.42	1.93	6.90	5.37	4.66
6	100	.75	.20		1.56	0.61		3.81	2.40
7	200	.25	.10	0.21	0.16	0.14			
8	200	.25	.20		0.11	0.07			
9	200	.50	.10	0.42	0.33	0.28			
10	200	.50	.20		0.23	0.13			
11	200	.75	.10	0.64	0.50	0.44			
12	200	.75	.20		0.37	0.23			

Caledonia			Cascade			Gaines		
PUV	r=3	r=5	PUV	r=3	r=5	PUV	r=3	r=5
$1.71	$1.31	$1.12	$0.45	$0.33	$0.26	$1.16	$0.87	$0.71
	0.90	0.52		0.21	0.07		0.58	0.27
3.63	2.83	2.46	0.90	0.67	0.53	2.41	1.84	1.53
	2.03	1.29		0.44	0.16		1.26	0.65
5.80	4.63	4.09	1.37	1.27	0.82	3.76	2.91	2.47
	3.46	2.39		0.68	0.28		2.05	1.17

of farmland equalized valuation in deferred taxation increased. The millage rates also increased as the percentage of participating farmland equalized valuation to which the roll-back applied to (s) decreased. Decreases in this variable had the effect of reducing the amount of the roll-back revenue and hence increasing the amount of the township property tax revenue that would have to be raised by the township property tax rate.

The millage rate changes for all townships followed a same general pattern in that the millage rate increases were highest for the three year roll-backs with a .10 roll-back participation, followed by the five year roll-backs with a .10 roll-back participation percentage, followed by the three year roll-backs with a .20 roll-back participation percentage, followed by the five year roll-backs with a .20 participation percentage. These relationships suggest that the percentage of farmland equalized valuation that participates in the roll-back because of a change in land use is a more dominant factor in determining the changes in nonfarmland millage rates than is the length of the roll-back period. This relationship is supported by the fact that the differences in the millage rates were greater for changes in the s variable than for changes in the r variable. Thus the amount of the difference in the participating farmland property tax revenues that would be recaptured in a roll-back would be larger because of a

ten percent increase in the roll-back participation than for a two year increase in the length of the roll-back period.

Results of Model 8

Model 8 simulated the changes in the millage rates in that part of the farmland sector that would participate in a deferred taxation program. These changes in millage rates are presented in Table 19.

In all townships and for all deferred taxation alternatives, deferred taxation resulted in lower millage rates than under plain use value assessment. These decreases were greatest in those townships with the highest levels of farmland equalized valuation per acre along with low increases in new township property tax rates resulting from deferred taxation.

The deferred taxation alternatives resulted in larger millage decreases than did plain use value assessment because the amount of the recovered roll-back decreased the amount of the total township property tax revenue that would be needed to be raised by the township property tax rate, thus resulting in lower township property tax rates. Meanwhile, the difference in assessment between farmland equalized valuation and farmland use valuation remained the same under deferred taxation as under plain use value

Table 19. Mean changes in participating farmland millage rates resulting from deferred taxation

Alternative	FUV/AC	P_2	s	Alpine			Byron		
				PUV	r=3	r=5	PUV	r=3	r=5
1	100	.25	.10	$-18.07	$-18.22	$-18.29	$-21.21	$-21.50	$-21.40
2	100	.25	.20		-18.39	-18.49		-21.79	-21.59
3	100	.50	.10	-17.62	-17.87	-18.05	-20.31	-20.89	-20.70
4	100	.50	.20		-18.09	-18.40		-21.49	-21.12
5	100	.75	.10	-17.09	-17.46	-17.80	-19.31	-20.18	-19.92
6	100	.75	.20		-17.79	-18.31		-21.06	-20.52
7	200	.25	.10	-3.80	-3.84	-3.86			
8	200	.25	.20		-3.88	-3.93			
9	200	.50	.10	-3.61	-3.70	-3.74			
10	200	.50	.20		-3.76	-3.86			
11	200	.75	.10	-3.42	-3.54	-3.60			
12	200	.75	.20		-3.66	-3.78			

	Caledonia			Cascade			Gaines		
5	PUV	r=3	r=5	PUV	r=3	r=5	PUV	r=3	r=5
.40	$-14.43	$-14.63	$-14.72	$-13.73	$-13.80	$-13.83	$-14.62	$-14.77	$-14.84
.59		-14.81	-15.02		-13.86	-13.95		-14.91	-15.07
.70	-13.46	-13.88	-13.98	-13.45	-13.59	-13.69	-13.99	-14.28	-14.43
.12		-14.26	-14.65		-13.75	-13.91		-14.57	-14.88
.92	-12.39	-12.99	-13.25	-13.20	-13.57	-13.49	-13.83	-13.57	-13.96
.52		-13.57	-14.10		-13.50	-13.83		-14.17	-14.62

assessment. The resulting interaction between these two variables was a reduction in the participating farmland millage rates.

The decrease in participating farmland millage rates became less as the participation of farmland equalized valuation in a deferred taxation program increased. As the participation in deferred taxation increased, the amount of farmland equalized valuation that would receive farmland use valuation would increase. The township property tax rate would then need to be increased to make-up this decrease in the total township property tax base. This increased township property tax rate would then be applied to the same level of farmland use valuation under the higher participation percentages as under the lower participation percentages resulting in a smaller decrease in participating farmland millage rates.

The decrease in millage rates were greater under a five year roll-back than under a three year roll-back period. The decreases were also greater under a .20 roll-back participation than under a .10 roll-back participation. The reason was that both the five year roll-back period and the .20 participation in the roll-back would increase the amount of the roll-back revenue that could be collected.

The decrease in participating farmland millage rates would be less under deferred taxation than under plain use value assessment for a farmland owner who does

not sell or convert his land to a nonfarm or nonqualifying use. However the decrease in millage rates for an owner of participating farmland who does convert his land to a nonfarm use would be greater under plain use value assessment because the penalty payment in the form of the roll-back would cancel out much of the advantage of the lower millage rates under deferred taxation.

Deferred taxation number 6 in Table 19 for Caledonia township involving a five year roll-back resulted in the largest difference between millage rates under plain use value assessment and deferred taxation of any of the alternatives in the five townships. The greater the difference in millage rates, the sooner would the lower millage rate under deferred taxation be expected to cancel out the roll-back penalty payment to produce the same yearly mean reduction in millage rates as existed under plain use value assessment. In this instance in Caledonia township where the differences in millage rates were the largest, a participating farmland owner would have had to remain in deferred taxation for at least 42 years before converting to a nonfarm use before his yearly mean reduction in millage rates under deferred taxation would have became equal to the yearly mean reduction in millage rates under plain use value assessment. This relationship assumes that the selling price of the land would have been equal to the purchase price and that the differences in millage rates

would remain the same over time, but it does point out the benefit of plain use value assessment to a landowner intending to convert his land to a nonfarm use.

In the remaining alternatives where the differences in millage rates under the two forms of taxation were less, the length of time the landowner would have to hold his land in a farm use before converting to a nonfarm use and still achieve the same reduction in millage as existed under plain use value assessment would be even greater.

The impacts of deferred taxation and plain use value assessment on participating farmland can be determined by illustrating their effects on a hypothetical forty acre property that converts to a nonfarm use at varying times in the future. Data from the Federal Land Bank Office in Kent County were used to determine the mean selling price of farmland in each of the five townships during the study period. This data, along with the mean farmland equalized valuations per acre and assessment sales ratios, are presented in Table 20.

In all townships the mean market values per acre are considerably higher than the equalized values per acre. The assessment sales ratios indicate that farmland may be being assessed at considerably below fifty percent of market value. The differences between townships may be seen by comparing Cascade with Gaines townships where the equalized values per acre are similar but the market values

Table 20. Mean market values, equalized values and assessment sales ratios of hypothetical forty acre property in each township

Township	Market Value*	Equalized Value*	Assessment Sales Ratio
Alpine	$737/acre $29,480	$224/acre $8,960	34.34%
Byron	596 23,840	231 9,240	38.76
Caledonia	639 31,950	186 7,440	23.29
Cascade	970 38,800	173 6,920	17.84
Gaines	428 17,120	169 6,760	39.49

*Top value is value per acre and bottom value is total value for a 40 acre property.

per acre and the resulting assessment sales ratios in Cascade township are over twice as large as those in Gaines.

The amounts of property tax roll-backs that would become due on these properties if they changed to a nonfarm use are presented in Table 21. These values are based on deferred taxation alternative number 1 where P_2=.25, FUV/AC=$100, and s=.10.

The relationship that is immediately evident is that the roll-backs in Gaines and Cascade townships are approximately similar even though the market values are over twice as great in Cascade as in Gaines township.

Table 21. Amount of property tax roll-backs that would be applied to the forty acre hypothetical properties*

Township	r=3*	r=5*
Alpine	$489.75 1.66%	$819.39 2.78%
Byron	595.98 2.50	988.68 4.15
Caledonia	326.54 1.02	547.58 1.71
Cascade	286.49 0.74	478.52 1.23
Gaines	299.54 1.75	501.59 2.93

*Top value is the amount of roll-back on a 40 acre property and bottom value is the amount of the roll-back as a percent of market value.

The result is that the roll-back penalty as a percent of market value is only half as large in Cascade as in Gaines township. Thus a landowner in Cascade township who decides to convert his land to a nonfarm use could likely sell his land at twice the price as could a landowner in Gaines township and yet pay only approximately the same amount of roll-back penalty as would the landowner in Gaines township.

A landowner in Byron township would pay the largest roll-back penalty and yet would receive the second lowest price for his land of all the five townships. Thus there could be a large difference in the financial gain among the

five townships that could accrue to a landowner who converts his land to a nonfarm use under deferred taxation. This difference is created both by the market value of farmland in a particular township and by the current level of assessment of farmland in that township.

A comparison may also be made on the amount of reduction in property taxes a landowner would receive over time under deferred taxation and plain use value assessment if he converted his land to a nonfarm use at some time in the future. This comparison was made only for deferred taxation alternative 1 in Alpine township. The same basic relationships would also hold for the other four townships.

Table 22 gives the amount of the reduction in property taxes a participating farmland owner would receive under deferred taxation and plain use value assessment if he were to convert his land to a nonfarm use at some time in the future. The table presents both the cumulative reduction in property taxes under plain use value assessment and the net cumulative reduction in property taxes under deferred taxation which was determined by subtracting the amount of the roll-back penalty from the gross reduction in property taxes under deferred taxation.

A landowner who converted his land to a nonfarm use during the first three years under a three year roll-back and during the first five years under a five year roll-back would receive no reduction in property taxes as the amount

Table 22. Reduction in property taxes on a forty acre property that converts to a nonfarm use under deferred taxation and plain use value assessment

Three Year Roll-Back					
Year	1	2	3	4	5
Deferred Taxation	$163.25	$326.50	$489.75	$653.00	$816.25
Amt. of Roll-Back	163.25	326.50	489.75	489.75	489.75
Net Reduction	0	0	0	163.25	326.50
Plain Use Value	161.90	323.80	485.70	647.60	809.50
Year	6	7	8	9	10
Deferred Taxation	$979.50	$1,142.75	$1,306.00	$1,469.25	$1,632.50
Amt. of Roll-Back	489.75	489.75	489.75	489.75	489.75
Net Reduction	489.75	653.00	816.25	979.50	1,142.75
Plain Use Value	971.40	1,133.30	1,295.20	1,457.10	1,619.00

Table 22. Continued

Five Year Roll-Back							
Year	1	2	3	4	5	6	7
Deferred Taxation	$163.87	$327.75	$491.62	$655.49	$819.39	$983.23	$1,147.10
Amt. of Roll-Back	163.87	327.75	491.62	655.49	819.39	819.39	819.39
Net Reduction	0	0	0	0	0	163.84	327.71
Plain Use Value	161.90	323.80	485.70	647.60	809.50	971.40	1,133.30
Year	8	9	10	11	12	13	14
Deferred Taxation	$1,310.97	$1,474.84	$1,638.71	$1,802.58	$1,966.45	$2,130.32	$2,294.19
Amt. of Roll-Back	819.39	819.39	819.39	819.39	819.39	819.39	819.39
Net Reduction	491.58	855.45	819.32	1,083.19	1,147.06	1,320.93	1,874.80
Plain Use Value	1,295.20	1,457.10	1,619.00	1,780.90	1,942.80	2,104.70	2,266.60

of the roll-back would cancel out the decrease in his property taxes during this period. It would only be after these initial periods that a landowner who converted to a nonfarm use would begin to receive a net reduction in property taxes. The amount of the net reduction would increase the longer the land remained in a farm use.

The net reduction in property taxes for corresponding years would be greater under the three year roll-back than under the five year roll-back because the amount of the roll-back penalty would be less for the three year roll-back. Equivalent net decreases would occur two years later in the five year roll-back resulting in a yearly mean reduction in property taxes that would be lower than that for the three year roll-back.

Under all three taxing alternatives, it is apparent that the longer a participating landowner retains his land in a farm use before converting it to a nonfarm use, the greater would be the net cumulative reduction in his property taxes. In addition to this incentive of reduced property taxes, there would likely be an even greater financial incentive due to the increases in the market value of farmland.

Table 23 presents the mean selling prices for farmland for the periods 1960 to 1962 and 1967 to 1969. These mean market values of farmland for these time periods were calculated to give an indication of the appreciations in

the market values of farmland that took place during the study period. The mean market values do not necessarily represent the changes in market value of the same properties but they do indicate the increase in market values based on the sales of farmland during the first and last years of the study period.

Table 23. Mean sales values per acre of farmland between the years of 1960-62 and 1967-69 in each township

Township	Mean Selling Price Per Acre 1960-62	Mean Selling Price Per Acre 1967-69	Increase In Market Value
Alpine	$423/acre	$1,677/acre	$1,254/acre
Byron	438	759	321
Caledonia	253	1,025	722
Cascade	294	1,685	1,391
Gaines	420	619	199

The appreciations in farmland market values would offer an even greater financial incentive for retaining ownership of farmland for longer periods of time than would the reductions in property taxes under deferred taxation and plain use value assessment. In Alpine township, the appreciation in market value for the hypothetical property could have been approximately $100,000 during the ten year study period while the reduction in property taxes during

the same time period would have ranged from $819 under deferred taxation with a five year roll-back to $1,619 under plain use value assessment. In view of the large appreciations in market values of farmland, the roll-back penalty under deferred taxation may play a rather minor role in a landowner's decision to sell or convert his farmland to a nonfarm use if the selling price offered him would enable him to capture these large appreciations in farmland values.

CHAPTER VII

SUMMARY AND CONCLUSIONS

This chapter will present a summary of the major findings and conclusions that may be derived from the findings, some policy implications of the findings regarding use value assessment, and recommendations for future research efforts on the economic effects of use value assessment.

Summary and Conclusions

The purpose of the study was to simulate two alternative forms of use value assessment that are in current use in other states and attempt to determine their impact in five townships of the rural-urban fringe of Grand Rapids, Michigan, if use value assessment had been used in Michigan the past ten years. The study devoted particular attention to the impacts on local government finance and the resulting redistribution of property tax burdens to the nonfarmland and nonparticipating farmland sectors of the township.

A stratified random sample design was used to sample farmland properties from property tax rolls and to form estimates of farmland assessed valuation and farmland acreage in each township. Simulation models were developed

to simulate new township property tax rates resulting from use value assessment alternatives and the resulting redistribution these tax rates would cause in the participating farmland, nonfarmland, and nonparticipating farmland sectors of each township.

Each of the five townships experienced large increases in property tax revenues and equalizations between 1960 and 1969. In all townships the mean percentage increases in property tax revenues and equalized valuations for the ten year period were larger for the nonfarmland sector than for the farmland sector of the township. The increases in nonfarmland equalized valuation and property tax revenue were responsible for the major proportion of the increase in total township equalized valuation and property tax revenue. Thus the nonfarmland sectors of each township appeared to have grown at a much faster rate than the farmland sectors. However, this trend could have also been caused by more frequent and/or valid assessments in the nonfarmland sector.

In all townships, the mean percentage increases during the ten year period were higher for property tax revenues than for equalized valuations. This was caused by the increases in township property tax rates which when applied to the increases in equalized valuations resulted in even greater increases in property tax revenues. However, there were quite small changes in farmland and

nonfarmland acreages in the townships. These relationships indicate that changes in equalized valuations may be a more relevant measure of urbanization and land use changes than changes in acreages because they reflect not only changes in acreages but also changes in the types of nonfarm land uses. As such, changes in equalized valuations, being measures of changes in the values of property, may give a better measure of changes in the value or intensity of urban land uses which would not be reflected by changes in acreages between rural and urban land uses. However, in some townships the quality of assessment may be too variable to permit equalized values to be used as a universal indicator of urbanization.

The changes in property tax revenues could be used as measures of changes in the quantity and quality of local government services and facilities being supplied to the townships. However, there could be differences among townships in the supply of services per taxpayer because of increases in population which may result in economies of scale. The fact that the percentage changes in property tax revenues exceeded those of equalized valuations indicates that the quantity and quality of local government and community services have been increasing at a faster rate than the value of property being supplied with these services (assuming that the equalized valuations were a valid measure of the cash value of property in the township).

The highest levels of farmland equalized valuation per acre were not necessarily in the most urbanized townships. The lowest level of farmland equalized valuation per acre occurred in one of the more urban townships.

The plain use value assessment alternatives resulted in an increase in the township property tax rates in all townships where farmland use valuation per acre had been set at $100 and in Alpine and Byron townships where it had been set at $200. The largest increases occurred in the more rural townships (highest ratio of farmland equalized valuation to total township equalized valuation) with the highest level of farmland equalized valuation per acre. The increases in the township property rates were more sensitive to the level of farmland use value per acre than to the amount of farmland equalized valuation that would participate in a plain use value assessment program. The new property tax rates were most sensitive to changes in farmland use values in the more rural townships.

The increases in the millage rates in the nonfarmland and nonparticipating farmland sectors as a result of plain use value assessment were much smaller than the corresponding decreases in the millage rates in the participating farmland sectors. This resulted because farmland equalized valuation represented a small proportion of total township equalized valuation and hence a large decrease in the small farmland sector of the township could

be offset by a small increase in the large nonfarmland and nonparticipating farmland sectors of the township.

The increases in nonfarmland and nonparticipating farmland millage rates were highest in those townships with the highest ratio of farmland equalized valuation to total township equalized valuation and in those townships with the highest level of farmland equalized valuation per acre. The largest decrease in participating farmland millage rates occurred in those townships with the largest difference between farmland equalized valuation and farmland use valuation and which at the same time had relatively small increases in new township property tax rates resulting from plain use value assessment.

In all townships, the largest decrease in participating farmland millage rates and the smallest increase in nonfarmland and nonparticipating farmland millage rates occurred in those alternatives with a low level of participation in a plain use value assessment program. This was because a low level of participation would result in the smallest increase in new township property tax rates for all sectors of the township, but would not have an effect on the difference between farmland equalized valuation and farmland use valuation in the participating farmland sector. The greatest difference between participating and nonparticipating property tax revenues were in the more rural townships with high levels of farmland equalized valuation

per acre and where a small proportion of the farmland equalized valuation would participate in a plain use value assessment program which contained a low level of farmland use valuation per acre. Thus all sectors of the township would likely opt for a program with the smallest level of participation, but the nonparticipating sectors would prefer a high level of farmland use valuation per acre whereas the participating sector would prefer a low level of farmland use valuation.

The increases in the township property tax rates under deferred taxation were less than those under plain use value assessment because the roll-back under deferred taxation constituted a source of property tax revenue that did not have to be produced by the township property tax rate. The largest increases in nonfarmland and nonparticipating farmland millage rates and the largest decrease in participating farmland millage rates occurred in those alternatives with the lowest level of participation in deferred taxation and the lowest level of farmland use valuation per acre.

The increases in the nonfarmland and nonparticipating farmland millage rates were smallest for those deferred taxation alternatives with a five year roll-back applied to twenty percent of the participating farmland equalized valuation because these alternatives resulted in a larger amount of roll-back revenue which reduced the

amount of total township property tax revenue that had to be raised by the township property tax rate. The differences in millage rates in the nonfarmland and nonparticipating farmland sectors were greater for changes in the roll-back participation variable (s) than for the length of the roll-back variable (r) indicating that the shift of property tax burdens to the nonparticipating sectors would be affected more by the amount of farmland equalized valuation the roll-back applied to than by the length of the roll-back.

The decreases in participating farmland millage rates were also lower for those deferred taxation alternatives with a five year roll-back applied to twenty percent of the participating farmland equalized valuation, and where the levels of farmland use valuation per acre and participation percentage in a deferred taxation program were the lowest. Under these circumstances, the difference between farmland use valuation and farmland equalized valuation would be the greatest while at the same time the low level of participation in a deferred taxation program combined with the largest amount of roll-back revenue would produce the smallest increase in township property tax rates. The result of the interaction between these variables produced the largest reduction in participating farmland millage rates. This reduction was largest in those townships with the highest level of farmland equalized valuation per acre.

However, there was little difference in the decreases in the millage rates among all four roll-back alternatives or even between the corresponding plain use value and deferred taxation alternatives. Apparently the difference among the township property tax rates caused by the various roll-back alternatives were less important than the difference between farmland equalized valuation and farmland use valuation in determining the reduction in participating farmland millage rates.

Because the reduction in millage rates for the participating farmland sector were slightly greater than the reduction under plain use value assessment, a landowner of participating farmland who does not anticipate converting to a nonfarm use may prefer the deferred taxation program over the plain use value program. However, a landowner who anticipates converting to a nonfarm use in the near future would likely opt for the plain use value program which does not contain the penalty payment for conversion to a nonfarm use. The advantage of slightly lower millage rates under deferred taxation for the landowner of participating farmland who anticipates converting his land to a nonfarm use would be cancelled out by the roll-back penalty with the result that the yearly mean decrease in millage rates under deferred taxation would not equal the yearly mean decrease under plain use value assessment until after a considerable number of years.

There were large differences in the mean selling price of farmland among townships that could create large differences in the financial gain that could accrue to the owner of participating farmland who would sell his land for a nonfarm use under deferred taxation. In certain townships there were large differences in the market values of farmland with small differences in the amount of the roll-back penalty for converting to a nonfarm use.

Even if the owner of participating farmland anticipated converting his land to a nonfarm use, the reduction in his property taxes under deferred taxation and plain use value assessment would increase the longer the land remained in a farm use.

There may be an even larger financial incentive, in addition to the reduction in property taxes, for retaining ownership of participating farmland because of the large appreciation in the market value of farmland over time. In certain townships, this appreciation in the market value of farmland was as high as $1250 to $1391 per acre during the study period. This large appreciation in the market value of farmland indicates that the amount of the roll-back penalty may be rather insignificant in a landowner's decision of whether to sell or convert his farmland for a nonfarm use.

Policy Implications of Findings

The amount of farmland equalized valuation that participates in a use value assessment program can have an effect on the redistribution of property tax burdens to the nonparticipating sectors of the township. The less the participation, the greater would be the decrease in property taxes in the participating sectors and the less would be the increase in the nonparticipating sectors. Thus both groups would likely opt for a program with the least amount of participation.

There are a number of entrance requirements in existing use value assessment alternatives in other states that could have an effect on the amount of farmland that participates in a use value assessment program. Among these are productivity requirements of the land, prior agricultural use requirements, acreage limitations, and zoning requirements.

High acreage, prior use, and productivity requirements could possibly eliminate the smaller, less productive farmlands that have recently converted to agricultural land uses. How much farmland these requirements would exclude would depend on the size distribution of farmland tracts in the township and whether the legislation would permit the consolidation of multiple, scattered tracts. High entrance requirements could eliminate the smaller,

less efficient, less productive farmland from receiving the benefits of the program and result in the larger, more efficient farmer receiving the greater reductions in property than would be the case if the smaller farmers participated and increased the level of participation.

Zoning requirements have been used in some states to establish rather restrictive agricultural zones or preserves on the better agricultural land in the state, particularly lands close to expanding metropolitan areas on which are grown high value per acre crops. The application of use value assessment on these lands to the exclusion of other farmland could result in an even greater tax benefit accruing to the owners of these farmlands as participation in the program would be at a rather low level.

Situations could possibly develop where the participating farmland owners would push for more stringent entrance requirements to use value assessment programs in order to achieve the largest decrease in their property taxes and possibly gain a slight competitive advantage over the nonparticipating farmers. They may be supported by the nonfarmland sector in this direction because the property taxes of the nonfarmland sector would be increased the least under the lower levels of participation in the program.

How large a competitive advantage such an arrangement would grant to the participating farmland sector would depend largely on the current level of farmland equalized

valuation per acre and the new farmland use valuation per acre. With a wide range in farmland equalized valuation per acre among townships, the use of a standard, fixed level of farmland use value per acre could result in larger reductions in farmland property taxes for certain townships as was the case in this study. However, determining separate farmland use values for each township based on the productivity or income-generating capacity in an agricultural use would likely reduce some of the differences in the reduction of property taxes among townships. Thus the procedure that would be used to establish farmland use values would likely have the largest impact on the redistribution of property taxes within a township.

The largest shift in property tax burdens to the nonparticipating sectors occurred in the more rural townships. This relationship has interesting implications in the cases where various forms of use value assessment are proposed to maintain open space for expanding metropolitan areas. In these instances it would likely be the nonparticipating property owners in the more rural townships surrounding the metropolitan areas rather than the property owners in the metropolitan areas who would bear the burden of increased property taxes resulting from the use of use value assessment to maintain open space in these townships. Yet in many cases it is the people in the metropolitan areas who are demanding more open space on

the periphery of their cities and yet who may not have to pay for any additional open space that may be provided by the use value assessment alternatives.

This situation is further complicated by the fragmentation of taxing districts that often exist in townships. Increasing the size of the taxing districts to a county basis could eliminate some of the unequal redistribution of property tax burdens among townships that could result from use value assessment. But inequalities still could exist among counties where a city would be located on the boundary between counties. One possible alternative to reduce these inequalities would be to place the collection and distribution of property tax revenues on a state level as was recommended in the recent decision of the California State Supreme Court.

Those nonparticipating landowners who would have their property taxes increased as a result of use value assessment could be involved in a sort of compulsary "option demand" arrangement in that they would be paying for the opportunity to enjoy the benefits of any open space provided by use value assessment around cities either now or at some time in the future. But they may actually be receiving no option either now or in the future to enjoy or use in that there is no assurance under either plain use value assessment or deferred taxation that the participating farmland will remain in an agricultural or other open space

use. Under either alternative, the landowner may sell or convert the land to a nonfarm use at any time he desires.

Likewise, a similar type of "option demand" relationship exists in the participating farmland sector in that the landowner would be paying slightly higher property taxes under plain use value assessment than under deferred taxation for the option of selling or converting his land to a nonfarm use without paying a penalty payment. He would have to retain his land in an agricultural use for a very long period of time before conversion under deferred taxation in order to achieve the same reduction in property taxes that he would receive under plain use value assessment. Under this situation, the landowner may be willing to pay the higher property taxes under plain use value assessment for the option of converting his land to a nonfarm use with no penalty payment. His preference for the ability to do this would likely be greatly strengthened in light of the large appreciations in farmland values in the rural-urban fringe that have taken place during past years.

Because of these large appreciations in farmland property values, there may be a problem of how to handle the land speculators who are interested only in making the largest possible profit and who are not responsive to land use planning efforts or maintaining land in open space uses. Possibly stringent entrance requirements to use value assessment programs or some form of capital gains

tax on unearned increments in property values could be utilized to promote more desirable patterns in land use.

Finally, the simulation models suggest a means-ends relationship that may be used in policy formation. Under this type of relationship, the policy-making body could specify the desired end results, and the models could be used to delineate and compare the alternative means that could be used to achieve these ends. The simulation models could thus be used in reverse order of how they were used in this study. In doing this, the policy maker could decide how much change in property tax revenues he deems desirable in the three sectors of the township, and the models could be used to give the various combinations of values for the farmland use valuation and participation percentage variables that would produce the desired changes in property tax revenues.

The models could also be used to determine the relationship between the rules for determining farmland use valuation or participation requirements and the effects such rules would have on the redistribution of property tax burdens in the township. In this manner, specific methods for determining farmland use values currently being used in other states and rules governing participation such as acreage limitations, prior use requirements, zoning and productivity requirements could be transformed into values for the participation and farmland use value

variables in the models and their effects determined in specific townships.

Recommendations for Future Research

The most pressing need for further research in the area of use value assessment seems to be in determining the relationship between property taxation and land use changes. In particular, there has been little research in determining the effectiveness of the various use value alternatives as tools in land use planning efforts. Research is needed to determine the reasons underlying a property owner's decision to sell or convert his land to another use or retain it in its existing use and the role of property taxes in these decisions. These types of answers are needed in order to devise and evaluate the ability of various land use controls to achieve the types of land use patterns that decision-makers feel are desirable.

In addition to the effects of property taxation on land use changes, data are also needed on the effects of land use changes on local government finance. Little is known on how much additional property tax revenue is generated by the conversion of farmland into a subdivision in comparison to the costs of supplying local government services and facilities to that subdivision and what

redistribution of property tax burdens this conversion creates for the other property owners in the taxing district.

Research at this time would be very timely on the effects of various proposals of property tax reform that are currently being considered in the Michigan State Legislature. A simulation approach could be used to determine the impact of the proposal to finance local school operations with a local income tax and what impact this would have on the rural and urban sectors of the township in comparison with the impacts that would result from use value assessment alternatives. A similar study could also be developed to determine the effects of a current proposal to grant a $5,000 exemption in equalized valuation to homeowners and the resulting impact this would have on the rural and urban sectors of the township. A study may be needed to determine the effects of the California Supreme Court ruling that the use of local property taxes to finance local school operations is unconstitutional, which will be ruled upon by the Michigan State Attorney General in the near future. Such studies are needed to answer the questions of who would benefit and who would pay under these proposed property tax reforms.

The sample plan and simulation models developed for this study could also be used to determine the economic effects of other use value assessment alternatives such

as local planning or zoning powers combined with plain use value assessment or deferred taxation, and the purchase of easements or development rights on participating farmland. The strata in the sample frame could be used to delineate agricultural zones in each township or those properties from which easements or development rights would be purchased and that would be eligible for use value assessment.

By varying the values of the three participation percentages in the tax simulation models, one could artificially simulate increases or decreases in the amount of urbanization that exists in each township and study the effects these changes would have on the redistribution of the property tax burdens resulting from use value assessment alternatives. The models could simulate the effects of changes in land uses on local government finances and the resulting redistribution of property tax burdens within townships.

The strata and zoning intervals within these strata could be used to study the changes in equalized valuations over time on a section basis within a township to determine in which parts of the township land use changes are taking place and which parts of the township are experiencing the largest increases in urbanization. A rather detailed land use study could be developed by using the strata to separate the farm, suburban, commercial, industrial, and recreation equalized valuations on the property tax rolls,

and the zoning intervals within each strata could be used to form small geographic regions within each township. In this manner, changes in land uses could be made for each class of property within a specific location over time by forming yearly sample estimates for the zoning intervals. Such an approach would offer several advantages over the commonly used methods of land use studies consisting of mapping land uses at one point in time.

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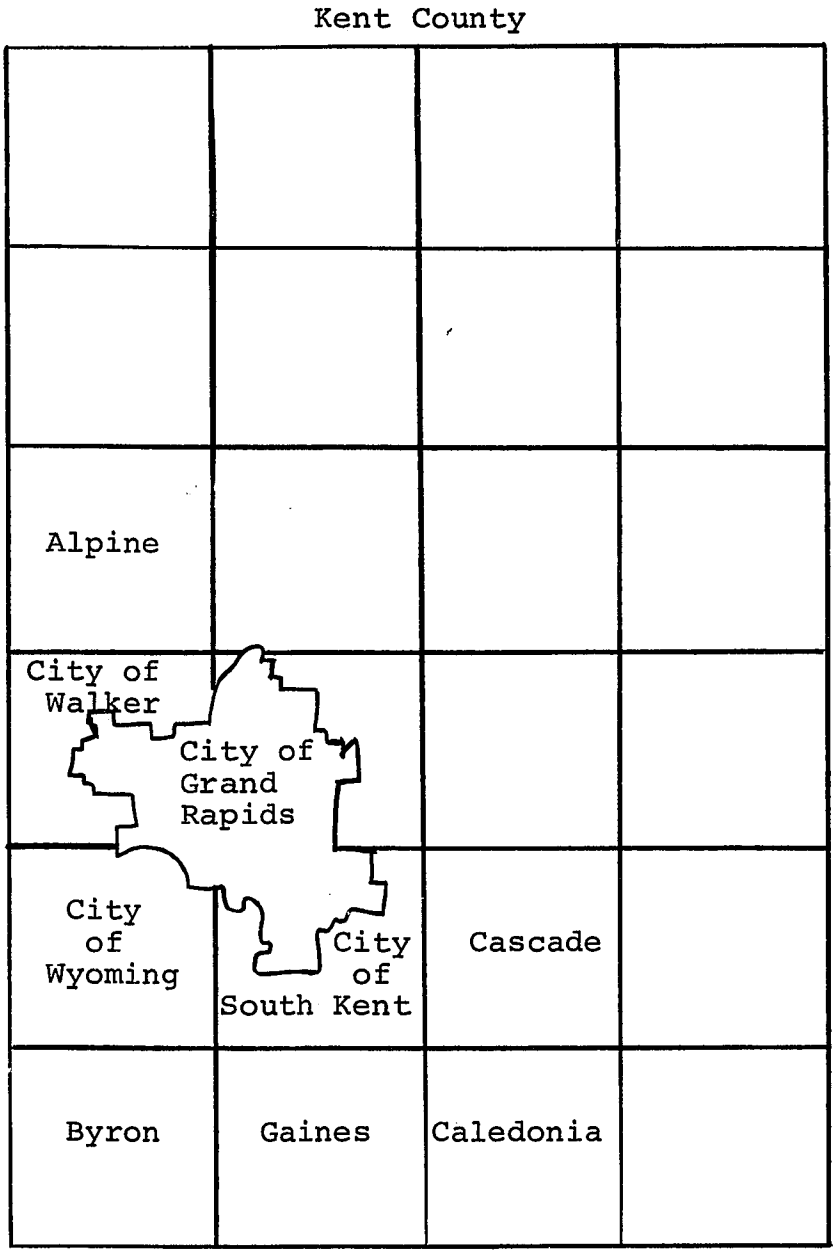
APPENDICES

APPENDIX A

LOCATION OF STUDY AREA



APPENDIX B

STRATIFICATION OF LEGAL SECTIONS OF EACH TOWNSHIP INTO URBAN, TRANSITION, AND RURAL STRATA*

	Urban	Transition	Rural
Alpine	1,11,12,13,24, 25,26,32,33 35,36.	2,3,14,19,21,22, 23,27,28,29,30, 34.	4,5,6,7,8,9, 10,15,16,17, 18,20,31.
Byron	1,6,10,12,13, 16,21,24,25, 27.	2,4,5,7,11,14 15,22,23,26, 36.	3,8,9,17,18, 19,20,28,29, 30,31,32,33, 34,35.
Caledonia	1,3,4,6,9,11, 12.	2,7,8,10,14,15, 16,17,18,21,22 24,25.	5,13,19,20,23, 26,27,28,30, 31,32,33,34, 35,36.
Cascade	3,6,8,9,10,15, 19,20,27,29,30.	2,5,7,11,12,17, 18,22,26,34,35, 36.	13,14,21,23,24, 25,28,31,32,33.
Gaines	2,5,6,7,8,11, 18,19,30.	1,3,4,9,10,17, 20,29,31,32,33.	12,13,14,15,16, 21,22,23,24,25, 26,27,28,34,35, 36.

*Numbers in each cell represent legal section numbers.

APPENDIX C

NUMBER OF OBSERVATIONS IN SAMPLE AND SAMPLE FRAME FOR EACH STRATA IN EACH TOWNSHIP IN 1960*

	Alpine	Byron	Caledonia	Cascade	Gaines
Urban Improved	8 (74)	11 (96)	4 (47)	8 (41)	11 (55)
Urban Vacant	2 (37)	2 (32)	2 (24)	2 (18)	3 (31)
Transition Improved	11 (105)	8 (96)	6 (90)	3 (48)	13 (75)
Transition Vacant	2 (29)	2 (37)	2 (34)	3 (40)	2 (30)
Rural Improved	5 (92)	19 (165)	6 (102)	4 (66)	6 (107)
Rural Vacant	2 (41)	4 (55)	2 (39)	3 (32)	6 (51)

*The top number refers to the number of observations in the sample in 1960, and the botton number in parenthesis represents the size of the sample frame in 1960.