# AN ECONOMIC ANALYSIS OF THE PROPERTY WEALTH AND PROPERTY TAX EFFECTS OF ALTERNATIVE LAND USE CONTROL POLICIES

By

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Bachelor of Science

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Stillwater, Oklahoma

1975

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
December, 1977

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WEALTH AND PROPERTY TAX EFFECTS OF
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# Preface

Development of a research project and completion of that project has been the most important part of the author's education. A great deal more has been learned in this endeavor than ever could have been learned in the classroom.

I would like to express my appreciation to Dr. Evan Drummond for his guidance in my research activities as well as in all other areas of my graduate program. His willingness to answer all questions, some more than once, helped minimize the frustrations involved in this project.

I would also like to thank Dr. Wayne Purcell and Dr. Darrell Kletke for their suggestions.

Special thanks goes to Marilyn Wheeler for correcting the format errors and typing the final draft of the paper.

Finally, thanks to Beth. Her love and encouragement has been a tremendous help to me in completing this paper and in all my other endeavors for the past year.

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## CHAPTER I

## INTRODUCTION

The United States is currently in a period in which public awareness of a need for wise use and conservation of natural resources is at an all time high. One of the resources, the scarcity of which has become apparent in the last two decades, is land. The result of this public awareness of the scarcity of land has been a questioning of the ability of the traditional free market system of allocation and unregulated private ownerships and control of land to achieve the goal of making the wisest and best use of available land resources. The trend toward regulation of land use has, however, been extremely slow because private ownerships and control of property is an institution which has been recognized and protected by the United States constitution.

The concept of private property rights is not unique to the American system; in fact, most of the precedents were drawn from England where it was first expressed in the Magna Charta of 1215 (1). Chapter 39 of this document states that "no freeman shall be arrested or detained in prison or <u>deprived of his free hold</u>, or in any way molested; and we will not set forth against him, nor send against him, unless by the lawful judgement of his peers and by the law of the land."[1] A primary reason for the inclusion of this statement was that the crown had made a practice of routinely seizing property for failure of the landholder to pay debts or obey royal summonses. It was thus designed to protect the private property rights of landowners against government seizure.

Interest in protection of private property rights continued to grow in England and, in fact, was experiencing a revival in the early 1600's during the colonization of America. Consequently, the colonists brought with them a high regard for private property rights and the institution became ingrained in the American system of government.

Despite a commitment to the sanctity of private property rights it is clear that the early settlers were aware of a need for some regulation of land use. This fact is evidenced by an act passed by the Virginia House of Burgusses in 1631 which required each white male to grow two acres of corn or forfeit his entire tobacco crop. This act, designed to insure a sufficient supply of food, retained some land in food production regardless of the strength of the economic forces which made other uses more profitable.

Although this and other early precedents were set for land use control in the United States almost no comprehensive land use regulation existed, especially in rural areas, until recently. Now, however, there is an obvious trend toward more comprehensive land use planning and control. Evidence of this trend can be gained by looking at one of the many proposals concerning land use which has come before Congress in recent years. This proposal is Senate Bill 984, the Land Use and Policy and Planning Assistance Act, which came before the 93rd Congress in 1975.

The basic objective of Senate Bill 984 was to encourage land use planning at the state level. In doing this the bill provided for grants-in-aid to the states for purposes of developing and implementing a State Land Resources Program. Certain minimum standards of compliance were required in order for a state to receive these funds (2):

1. A Land Planning Agency;
2. A Land Resources Planning Process;
3. A Study of Existing Land Resource Planning and Management Authority;
4. Methods of Implementation;
5. An Energy Facility Planning Program; and
6. Participation of the Public.

The critical element of this bill which is germaine to this discussion is that all land, not just that located within cities, would be made subject to the planning process.

It is noteworthy that Senate Bill 984 was passed by the Senate but died in the Interior Committee of the House of Representatives. A similar fate has been met by most other comprehensive land use planning proposals at the national level. However, the fact that such proposals are being made and are receiving consideration is evidence that concern with the matter of land use is becoming more serious with the passing of time.

## Need for Land Use Control

Although it is obvious that the public is realizing an increasing need for land use control the specific reasons for this need are numerous and less obvious. Most of the reasons can be classified as evolving from one of three major areas of concern:

1. Inefficiency of the present sprawl-type urban development;

2. The loss of prime agricultural land to urbanized uses; and

3. The degradation of the environment caused by development of land which possesses particular esthetic or scenic qualities.

A look at the reasons for concern in each of these areas should be helpful in understanding the present trend in land use regulation.

## Inefficiency of Urban Sprawl

Unregulated urban sprawl is of concern to policy makers and the public for two reasons. First, because it results in increased cost of providing public services, and second, because it requires more land to support a given level of population than does a continuous pattern of urban development. The increased cost of providing public services places an extra burden on the local government and also on all residents of the jurisdiction unless user charges and taxation policies shift the burden to those businesses and residences which are located in discontiguous developed areas. Thus, sprawl-type development may be efficient for the individual but not for society due to externalities for which the individual does not pay the full cost. The loss of land caused by urban sprawl is of concern because it has been estimated that for every acre of land developed in the disjoint manner typical of urban sprawl two acres are removed from agricultural production or other non-urban uses. Thus, discontiguous development requires approximately twice as much land as contiguous development. Furthermore, land which is removed from other uses because of urban sprawl typically does not go into some other productive use but simply remains idle for a number of years awaiting development.

## Loss of Prime Agricultural Land

The issue of conversion of prime agricultural land to urban uses has attracted much attention since some observers have been warning of an impending world food crisis. Whether or not such a crisis is imminent the argument does bring up a question of whether the free market is allocating land between urban and agricultural uses in such a way as to maximize societial welfare. Since the best cropland is typically also the easiest and least costly to develop, private investors tend to concentrate development on this land leaving less productive land in agricultural uses. This effort to minimize the private cost of development may result in a less than optimal pattern of land use from a societal point of view.

## Degradation of the Environment

The problem of environmental degradation associated with unregulated urban growth, like that of loss of prime agricultural land, is caused by the failure of the market system to allocate resources optimally considering all externalities. Since scenic or recreational land has a low private value in those uses it is particularly susceptible to developmental pressures. The preservation of land that possesses the greatest amenities for these purposes might result in a gain to society.

## Considerations for Planners

Two primary types of considerations must be remembered by planners in the land use planning process. These two types of considerations are legal and economic. A look at the current status of the legal aspect of land use control and the specific economic consideration which planners should take into account should be helpful in understanding the problems which planners face.

### Current Legal Status of Land Use Control

The basic constitutional issue in most cases concerned with the regulation of land use stems from the provision in the fifth amendment that "private property" shall not "be taken for public use without just compensation." Three methods or judicial theories are currently being used by the courts to determine when a "taking" without just compensation has occured (3). These methods are the physical invasion theory, the nuisance abatement theory, and the diminution of value theory.

The physical invasion theory indicates that a "taking" occurs when private property is confiscated or intruded upon by the public. According to the nusiance abatement theory the public has the right to restrict noxious or harmful uses of property without compensation. The diminution of value method for determing the occurance of a "taking" centers its analysis on the magnitude of losses suffered by the land owner as a result of public land use restriction. Final determination under this method is usually based on whether or not the land owner is left with a reasonable use of his property. Court decisions in land use cases are usually based on one or more of the above factors along with other factors relevant to the specific case.

Economic Considerations in Land Use Control

The economic considerations of concern to planners involve the gains and losses resulting from implementation of any given land use policy. The distribution of these gains and losses between the public sector and individuals in the private sector is the primary determinant of effectiveness of a policy in achieving land use goals. This is especially true since political acceptability, a necessary characteristic of an effective land use policy, is dependent upon an equitable distribution of these gains and losses.

It is reasonable to assume that any viable land use policy alternative will result in a gain to the public sector since this is the primary reason for implementation of such a policy. The magnitude ot these gains, however, must be large enough to offset and in most cases compensate for any losses to the private sector.

Most land use policies result in both gains and losses in the private sector. Although compensation to private landowners who lose as a result of implementation of a policy is not always necessary, it is usually desirable in cases where the magnitude of the loss is large. Funds for compensation to losers can be obtained either from the public sector or from individuals in the private sector who have gained as a result of implementation of the policy. Determination of the magnitude of losses in the private sector whether compensated or "not" and the sources of funds for compensation, if required, is a task which should be performed before a land use control policy is implemented.

## The Problem

Those involved in land use planning are currently faced with a situation in which there is an apparent need for new, more effective, and more comprehensive methods of regulation and control. Any change in the present pattern of land use regulation may result in a redistribution of wealth in the form of real property among existing property owners. Most policies will also affect the distribution of tax burden among property owners. The redistribution effect on property wealth and tax burden should be considered along with expected effectiveness in achieving other land use goals when a policy alternative is being chosen.

Progress in developing new and more effective methods of control is inhibited by a lack of knowledge concerning the impact of alternative control techniques on specific property owners. Information on both the direction and magnitude of the redistribution of property wealth and tax burden associated with alternative policies could aid planners in the decision making process. This information, however, can be obtained only from empirical analysis which is not currently available.

## Objectives

The general objective of this study is to evaluate the impact of a number of land use control policies on the distribution of property wealth and property tax burden in a sample study area. Specific objectives are:

(1) To identify the primary factors influencing land value in both rural and urban areas;

(2) To quantify the relationships between these factors and land value;

(3) To estimate current real property wealth and the distribution thereof in the study area;

(4) To simulate property wealth and the distribution thereof in the study area under a number of alternative land use policies; and

(5) To compare and contrast the property wealth impacts of these alternative land use policies.

The findings should be useful to planners and policy makers in that they should give an indication of the private gains and losses associated with alternative land use control policies.

## Approach

In endeavoring to achieve the objectives of this study, data on both urban and rural land sales within a study area in Payne County Oklahoma will be used to develop equations which will explain land values in the area. Coefficients from these equations, derived through the use of multiple regression analysis, will be used as parameters for a predictive model which will be capable of simulating property wealth and tax base and the distribution of both under different types of land use policies.[2] A base model will be created using the simulation process to estimate the current distribution of property wealth and tax base. This base model will be compared with simulated results under a number of land use policy alternatives to derive an estimate of the magnitude of the impact of these policy alternatives on the distribution of property wealth and tax burden within the area.

## Endnotes

1. Emphasis not in original.

2. Simulation in this sutdy refers to "what if" types of economic modeling rather than an interactive process.

# CHAPTER II

## REVIEW OF LAND USE POLICY ALTERNATIVES

Before beginning an analysis of the impact of various land use planning and control techniques on property wealth and tax base of local governments it is necessary to identify the viable policy alternatives which are available to planners. This chapter provides a brief review of land use control policies which are currently in use or being considered for use by planners in the United States. An evaluation of the effectiveness of these techniques as they are currently being used is also provided in cases of policies which have been in effect long enough for such evaluation to be meaningful.

### Identification of Policy Alternatives

Many alternative land use control policies are now being used or considered for use by planners in the Untied States. Most of these alternative policies can be classified into one of three broad categories. These categories are: control through taxation policy; control through the exercise of police power; and control through separation and restriction of development rights. Specific policy alternatives will be classified in one of these categories to facilitate an orderly discussion and evaluation.

## Land Use Control Through Taxation Policy

Taxation policy is the most commonly used method of land use control. Forty-two states are currently using taxation policies, either along or in conjunction with other types of policies, to influence land use. Unlike many other alternative control methods taxation policy relies on incentives provided to land owners rather than sanctions to influence land use patterns. The question of whether or not this incentive system can have a significant impact on land use patterns has by no means been resolved. A number of studies however, have addressed this question and should offer some insight into the effectiveness of taxation policy.

Three primary types of taxation policies are currently in use in the United States. These are preferential assessment, deferred taxation, and restrictive agreements. All taxation policies will be classified in one of these three categories for discussion. A review of case studies of effectiveness of specific state taxation policies will be made for each category.

### Preferential Assessment

Preferential assessment may be defined as policy "where land is valued according to its current use. Further, no penalty is exacted if it is later converted to another use" (4). This definition, however, does not account for the preference given to land in certain uses by simply assessing that land at a lower percentage of market value than land in other uses. Thus, preferential assessment can better be defined as a taxation policy which taxes property in different uses at different percentages of true market value with no penalty for conversion to other uses.

In practice preferential assessment has been used to provide tax breaks to farmers on equity grounds and to influence the pattern of residential and commercial development near urban areas. The equity argument is based on the fact that farmers pay a higher percentage of their income in property taxes than do non-farmers with equal incomes. Also, farmers near urban areas where land values are inflated by the potential for future conversion to urban uses pay taxes based on a market value of land which is much greater than the true value of that land in agricultural use.

The objective of influencing the pattern of development around urban areas is a concern because the present pattern of development is considered to be costly and inefficient from a societal point of view (5, 6). It is this objective of preferential assessment with which this study is concerned and the equity factor will thus be ignored in the following discussion.

Thirteen states are currently using some type of preferential assessment policy. One study (7) has indicated that these laws are ineffective in impeding the conversion of land from agricultural to non-agricultural uses. This conclusion is based on the finding that only 12 percent of land sales in the Northeast resulted in conversion and that 36 percent of all sales are prompted by life cycle factors upon which preferential assessment could have no effect. Thus, only 8 to 10 percent of land receiving preferential assessment is in the target population which has potential for conversion to urban uses and upon which preferential assessment can have an influence. This, along with the fact that preferential assessment laws exact no penalties and thus provide no counter force to offset the potential gains from conversion, was considered to be sufficient evidence to conclude that these laws are ineffective as methods of land use control.

Deferred Taxation

Deferred taxation is simply preferential assessment with a penalty added for conversion of land to non-preferred uses. Landowners who receive tax benefits from preferential assessment are required to repay at least a portion of those benefits upon conversion of their land to a non-preferred use. Also, in some states landowners are required to pay interest on the amount of the tax deferral at the time of conversion. In a few cases an added penalty is also exacted.

Twenty-four states are now using deferred taxation as a method of land use control. In most of these states the amount of the penalty for conversion is computed by taking the difference in taxes paid with preferential assessment and what would have been paid without preferential assessment for a number of years. The number of years in the "rollback" period (the period over which tax benefits must be repaid) varies between states. Generally, deferred taxation policies are classified as either short or long-term rollback policies. Short-term rollback policies are those in which the rollback period is from 3 to 5 years. Long-term rollback policies typically have a rollback period of about 10 years.

Since a key factor in determining the effect of a deterred taxation policy is the length of the rollback period, it is desirable to discuss the implications of policies with the two lengths of rollback periods separately. The deferred taxation law of the state of Washington will be evaluated as an example of a long-term rollback policy. New Jersey's deferred taxation law will be used for evaluation of a short-term rollback policy. Both of these policies have been in effect for a sufficient length of time to provide a great deal of insight into the effectiveness of these kinds of policies.

The Washington Plan (Long-term Rollback). The Washington deferred taxation policy enacted in 1970 is designed to retain land in agricultural, forestry, and other open space uses such as beaches, marches, and sanctuaries used for recreational or scenic purposes. Almost all land enrolled in the plan, however, has been agricultural land. The plan is quite stringent with regard to penalties assessed for conversion. The minimum participation term is ten years with notice of withdrawal being required in advance. In order to comply with the terms of the agreement a landowner must file a notice of withdrawal any time after the seventh year with subsequent release being granted three years from the date of filing. The owner is immediately assessed a penalty in the amount of the difference between taxes paid and what would have been due without preferential assessment in each of the seven previous years. A compound interest charge at the same rate used for delinquent taxes is also imposed on the amount of the penalty for each of the seven years. No preferential assessment is granted for the three years in the run-out period of the agreement. Thus, the landowner is left in the same situation he would have been in if no preferential assessment had been granted for the last ten years of the agreement.

Failure to comply with the requirements of the law results in an even greater penalty for conversion. In the case of conversion without the three-year notice required by law, everything is handled exactly as it is with compliance except that the rollback period is extended to 14 years and an additional penalty of 20 percent of the rollback is required.

A study, conducted in 1973 three years after the inactment of the Washington plan has indicated that the law is ineffective as a method of land use control (8). The reason for this ineffectiveness is that the only landowners who participate in the program are those who would keep their land in its present use even if there were no tax deferral. Only 30 percent of the land enrolled in the program is within three miles a city. Also, less than one-third of participants in the program have indicated that they feel it has any influence on their land use decisions.

The Washington plan has failed as a method of land use control because it provides no incentive for owners of land which is nearing conversion to urban uses to participate. The long term length of rollback is a major factor in discouraging this participation and is therefore a significant factor in the failure of the plan. The question of whether or not a reduction in the rollback period could make the plan more effective can best be answered by evaluating a plan such as New Jersey's which has a short rollback period.

<u>The New Jersey Plan (Short-term rollback).</u> The New Jersey deferred taxation plan is very much like the Washington plan except it limits the length of the rollback period to three years and exacts no penalty

or interest charge for conversion. The plan was instituted in 1964 and by 1974, 93.5 percent of all farm land in the state was enrolled. The high rate of participation is due to the fact that the difference in use and market value of farmland in the state is large, and also because there is no penalty for conversion.

One study (4) has concluded that the New Jersey plan in ineffective as a method of land use control because of these factors. Although there is incentive for all owners of qualifying land to participate in the program, the cost of conversion is so low as to provide almost no deterrent effect.

## Restrictive Agreements

Restrictive agreements are legally binding contracts between landowners and local governmental entities to limit the use of land to certain preferred uses for a given number of years. Because of the contractual agreement involved in a restrictive agreement, this type policy is more rigid than other types of taxation policies. Under a restrictive agreement program a landowner is reasonably certain that he will not be able to convert his land to a non-preferred use until the end of the run-out period without paying a substantial penalty.

California's restrictive agreement policy is the longest standing and most comprehensive such policy in effect in any state. It provides the best available empirical test of the effectiveness of this method of land use control.

The California Plan. Use of restrictive agreements as a method of land use control in California was made possible by the enactment of the Williamson Act of 1965. Since then 14,250,000 acres, or approximately 30 percent of the state's privately owned non-urban land, have been enrolled in the plan.

The eligibility criteria for enrollment in this program are quite complex. These criteria are the following (7):

1. The county or city within which the land is located must have a general plan which includes a mandatory open space element;
2. The county or city must, within two years of designation, restrict all land in the preserve area, by zoning or other means, to uses which are compatible with the uses to which lands under the act are limited; and
3. The land must be in one of three preferred use categories which are: agricultural uses, recreational uses, and open space uses.

It is clear from these criteria that enrollment in the program is not only dependent upon the willingness of the landowner but also requires positive action on the part of the local governmental entity in incorporating the land into a comprehensive land use plan.

Most agreements under the California plan are for a ten-year period. Termination of an agreement is achieved by the submission of a notice of non-renewal by either the landowner or the local governmental body or by a breach of contract on the part of either party.

Two types of actions can be taken upon breach of a specific performance contract. One of these actions which is available to either the landowner or the governmental entity is suit for specific performance or damages. This type of action has never been taken by either a landowner or a governmental body but is a definite possibility since there is a binding contractual agreement involved. Also, it is noteworthy that this is the only action available to a landowner who feels that the governmental body has failed to preform its obligations under the contract.

The second type of action available to the governmental entity upon breach of a restrictive agreement contract by a landowner involves the collection of a substantial cancellation fee. The amount of this fee is equal to 50 percent of the full assessed value of the land. Since the assessment rate is 25 percent, the cancellation fee amounts to 12.5 percent of full market value of the land.

When a restrictive agreement is terminated by the submission of a notice of non-renewal by either party the local assessor is required to calculate the amount of tax deferrals for the remainder of the contract period using a statutory formula. The use of this formula results in a tax deferral which compensates the owner for the present value of forgone development rights for the limited run-out peirod. Thus, there is a gradual reduction in the annual tax deferral for each successive year in the run-out period.

One author (7) has concluded that the California restricitive agreements policy has been ineffective as a method of land use control at the urban fringe. The reason cited for this ineffectiveness was that only remote land which is not at the threshold of conversion has been enrolled in the program. Thus, the tax incentives for enrollment in the plan are not large enough to attract the participation of owners of land at the urban fringe where the primary land use battle is being fought.

## Conclusions on Taxation Policy

Taxation policies as they are now being used for the purpose of fostering a more desirable pattern and rate of conversion of agricultural and other non-developed land to urban uses are largely ineffective. The reason for this ineffectiveness is that laws which lack strong sanctions are successful in attracting the enlistment of target land but offer no deterrent to conversion of this land at any time. Conversely, laws which do have strong sanctions are ineffective in attracting the participation of the transitional land at which they are aimed.

## Land Use Control Through Development Rights

Three alternative methods for using development rights as a land use control device are currently in use or have been used in the past. These methods can best be classified as government purchase of development rights, transfer of development rights, and development easements. Each of these alternatives will be evaluated with regard to effectiveness in achieving land use control goals.

### Public Purchase of Development Rights

Public purchase of development rights has been defined as consisting "of a public authority to purchase and hold the rights to develop land in exchange for the difference between the market value and the agricultural use value" (9). Little use of this type of policy has occurred in the United States but the British have made extensive use of such a system of land use control.

The British system of public purchase of development rights was created by the Town and Country Planning Act of 1947. It involved the governmental takeover of development rights on all land. Compensation was made to landowners in an amount equal to the difference in 1947 use and market value. An owner who subsequently wanted to develop his property was required to purchase back these development rights. Only owneres of land which was designated for development were allowed to buy back these rights. Other owners were left with no alternative but to maintain their land in its restricted use.

Despite the good intentions of the planners this system was ineffective in achieving the desired land use goals. This ineffectiveness has been attributed to the refusal of landowners to develop their land or sell it for less than full market value (10). Since buyers had to pay a development charge equal to the difference in current market value with development rights and 1947 use value, the marketability of the land was destroyed. By 1954 Parliament found it necessary to abolish the charge for development rights in order to revive the land market.

The development charge was reinstated in 1967 under a complex plan which set the price of development rights at 40 percent of the development value of the land. This plan, however, was no more effective than the first and was itself abolished in 1971.

Although the British plan was discontinued and has been labeled as ineffective as a method of land use control, it is important to recognize that this ineffectiveness is in regard to the operation of overall program. It should be noted that the system is successful in directing the flow of urban development through the discretionary granting of development rights at no cost. The failure of the system was in the fact that the government was never able to devise a system to make the development rights saleable at a sufficient price to recoup their cost.

Transfer of Development Rights

Transfer of development rights is a method of land use control which has seen very limited use (10) (11). The method has been used in an endeavor to attain certain specific land use goals in some cities. A look at the uses which have been made of transferable development rights, along with some recently proposed larger scale uses, should be helpful in evaluating the potential usefulness of this method of land use control.

The most common use which cities have made of transfer of development rights is in an effort to preserve historic landmarks. The problem encountered here is caused by the fact that land upon which buildings of historic value are located usually is capable of producing more income in other uses. The objective of planners has been to compensate the landowners for the loss in property value associated with preserving the historic landmark. In order to do this policymakers in New York City and Chicago have created a system which gives owners of this property development rights which can be sold to owners of other property in the cities. Ownership of these rights allows these other property owners to develop their property to a greater extent than normally allowed under city zoning ordinances. Thus, the right to develop on the historical site is taken away but is transferred through the sale of development rights to other property in the cities.

A proposal for the use of transferable development rights as a method of achieving land use goals in New Jersey is the best example of an attempt to use this method for purposes of comprehensive rural land use planning and control. This plan would set up open space preservation districts consisting of undeveloped farmland, woodland, flood plain, swamp, marsh, or land of steep slope. These districts would provide the jurisdictional areas within which planning would be done. Land in these areas would be designated for use in either residential development or agricultural and other open space uses.

Development rights would be created in a number consistent with the level of residential development desired within the district. These development rights would be distributed to landowners within the district based upon their proportion of total property value within the district.

Land in each district would be zoned for either residential or one of the other uses. In order to develop their property owners of land zoned for residential development would be required to hold development rights in a number equal to the number of residential units they wish to build. These development rights would have to be purchased from other landowners within the district. Thus, owners of land zoned for agricultural uses would have a market for their development rights.

Under the New Jersey plan taxation of development rights would be done in exactly the same manner as taxation of land. The county clerk would keep records of the ownership of development certificates and the assessor would place a value on these certificates equal to the difference in use value of land and market value of developable land with the use of these certificates. When certificates are used for the purpose of development they would be cancelled by the county clerk.

This plan is an innovative approach to land use control which appears to have great potential. A true test of the plan can be made only after it has been used for a number of years. The primary question is whether or not the development rights will prove to be saleable at a price which reflects true development value within a district.

Some problems will undoubtedly arise especially with regard to the method of apportioning development rights among landowners. One question which arises upon examination of the plan is whether distribution of development rights among landowners in proportion to their percentage of total property value within the district is equitable. An owner of land which is of steep slope or which is for some other reason non-developable would still recieve a portion of the development rights. Also, this method of allocation ties the distribution of development rights to the use value of land. Thus, owners of land with equal development value but different use value would receive different allocations of development rights. This inequity could be eliminated by the distribution of development rights based upon relative proportions of development value rather than total value of property within the district.

In conclusion, the use of transfer of development rights as a method of land use control is relatively new and untested. If the mechanics of such a system can be made to operate effectively, and if political acceptance can be attained, this type policy could prove to be quite useful to planners.

Development Easements

Public purchase of development easements is no new concept to those involved in land use planning. Under this type policy the government purchases the development rights on property on which a restriction of development is desired and holds these rights indefinitely.

The primary difference in a development easement policy and a policy of public purchase of development rights is that under a development easement program development rights are only purchased on selected tracts of land. This avoids the problem of having to resell development rights on property where development is desirable. Because of this, a development easement program is more easily administered than a public purchase of development rights policy.

One of the longest running development easement policies in existence in the United States is the Wisconsin plan which was instituted in 1962. This plan is fairly narrow in scope in that it is directed at controlling development along scenic highways only. As with most such programs the power of eminent domain is used where necessary to acquire the desired rights.

A study has shown that through 1964, the average cost of development easements was $43 per acre (10). Of this $43, slightly less than

$20 was paid to the landowners with the remainder being administrative cost.

The study concluded that this program is quite successful as used in Wisconsin. However, some doubt was expressed with regard to the usefulness of this type program as a method of large scale land use control. The reason for this skepticism was that it was felt that such a program would be too costly to implement at the urban fringe where the primary land use battle is being fought. It was concluded that the cost of easements on land which is ripe for development would be so high as to make such a program fiscally infeasible.

Although it is true that development easements on land at the threshold of development would be quite costly, the conclusion that development easements are unsatisfactory as a method of comprehensive land use control may not be justified. It is still possible that this could be an effective method of land use control if planning is done far enough in advance. If planners made their decisions on land use early enough easements could be purchased before their cost is overly inflated. This method could be especially effective as a second phase of an overall land use program. The first phase could use some other method to control the use of land currently at the threshold of development with purchases of development easements being used in conjunction with a long term plan to control development which is expected to occur ten years or more in the future.

## Land Use Control Through Police Power

The most commonly used police power method of land use control is zoning. Zoning is simply the delineation, by a planning authority, of boundaries within which certain land uses will be premitted and certain others will not. This method has been used extensively in cities to separate incompatible land uses such as residential and industrial. However, very little use has been made of zoning outside cities as a method of comprehensive rural land use control.

The primary advantage of zoning as a method of land use control is that it is the least costly method which can be used to obtain known results. Zoning laws are absolutely restrictive. Therefore, planners can be sure of their ability to restrict land use patterns as desired. Thus, land use goals can be achieved using zoning provided the zoners are successful in determining the optimal land use pattern.

One author (10) has pointed out that zoning outside city boundaries would undoubtedly face the same problems which have arisen in urban zoning. Most of these problems stem from the fact that planners have been subject to political pressure which has resulted in poor delineation of land use boundaries at the outset and then a piecemeal changing of these boundaries. This has greatly reduced the effectiveness of zoning within cities and could have the same effect on rural zoning.

Besides the political problems the equity factor is the greatest problem with the use of zoning as a method of land use control. Arbitrary delineations are made which have great impact on relative property values in an area. Furthermore, no compensation is paid to landowners whose property value is adversely affected by zoning laws. Thus, although zoning is potentially an effective method of controlling land use, it may be undesirable because it is arbitrary and offers no compensation to adversely affected landowners.

# CHAPTER III

## DEVELOPMENT OF EXPLANATORY EQUATIONS

This chapter begins with a description of the area selected for this study. The county in which the study area is located is described with regard to general characteristics which have an influence on land values within the area. The city of Stillwater, which is located within the study area, is then described with respect to those same economic factors. Finally, the specific study area is delineated and described in detail.

In the second part of this chapter estimated explanatory equations for rural and urban land value within the study area are presented. The specific factors which were expected to influence rural and urban land value are discussed. Finally, the "best" regression equations for explaining value of land in each of the two uses are presented and interpreted.

### Description of the Study Area

The area selected for this study is located in Payne county in north central Oklahoma. Stillwater is the principle city in the region and was used as the base point for delineation of the study area. The area was chosen because it contains a rapidly expanding urban center located within an agricultural region. Also, land in Payne County has recently been revalued by professional agronomists and appraisers.

Since assessed values of property are an essential part of the data base for the study, the area was considered to be ideal because these values are current, consistent, and professionally determined.

The County

Most land in Payne County is devoted to agricultural production. Land tenure patterns are generally of the small operation, mixed agriculture type. Beef production is the primary agricultural use of this land; however, the county does produce a significant output of crops, predominantly small grains and hay.

Total value of all agricultural products produced and sold in Payne county in 1969 was $10.3 million (12). Value of livestock production was $8.8 million and total crop production was valued at $1.5 million.

There are only four cities with population greater than 1,000 in Payne county. These cities are Stillwater, Yale, Perkins, and Cushing. 1970 populations as well as growth rates for the 10-year period from 1960-1970 are shown in Table I. It is interesting to note that while the populations of Yale and Cushing decreased during this period, Stillwater and Perkins experienced a fairly rapid rate of growth. The probable reason for the rapid growth of Perkins is its close proximity to the regional trade center of Stillwater. The loss of key industrial plants in Cushing was the probable cause of the decline in population in Yale and Cushing during the period. The population decline in these two towns has ended and both towns are currently growing at moderate rates.

TABLE I

1970 POPULATION AND RATE OF POPULATION GROWTH FOR CITIES IN THE PAYNE COUNTY

| City | 1970 Population | Percentage Change in Population for the Period 1960-1970 |
|---|---|---|
| Stillwater | 31,126 | 29.9 |
| Perkins | 1,029 | 33.8 |
| Yale | 1,239 | -9.5 |
| Cushing | 7,529 | -12.6 |

Source: Census of Population (12).

## Stillwater

Stillwater is a regional trade center for much of Payne county and parts of surrounding counties. It is located in the center of the county. The closest large industrial centers are Oklahoma City, 65 miles to the southwest, and Tulsa, 69 miles to the east. Two highways intersect at Stillwater, U.S. highway 177 running north and south, and State highway 51 running east and west. The closest interstate highway is I-35 which is 17 miles west of the city. Also of importance to transportation in Stillwater is the newly constructed Cimarron Turnpike which runs east and west five miles north of the city.

Rail service is provided to Stillwater by a spur of the Atchison, Topeka, and Santa Fe Railroad. This service is important to the economy of Stillwater and the surrounding area because it is essential to the maintenance of local grain elevator facilities in Stillwater.

## The Study Area

The study area (Figure 1) is located in central and eastern Payne county. The area contains 222 sections (square miles) or 142,080 acres. 6,400 acres are within current Stillwater city limits with the remaining 135,680 acres being in the rural area.

Most land in the rural portion of the study area is range land. Cow-calf type beef cattle operations are the predominate land use. Some crops are grown in the area but value of crop production is quite small as compared to value of livestock production.

Some residential development has occurred within the rural portion of the study area. Most of this development has been of a strip type

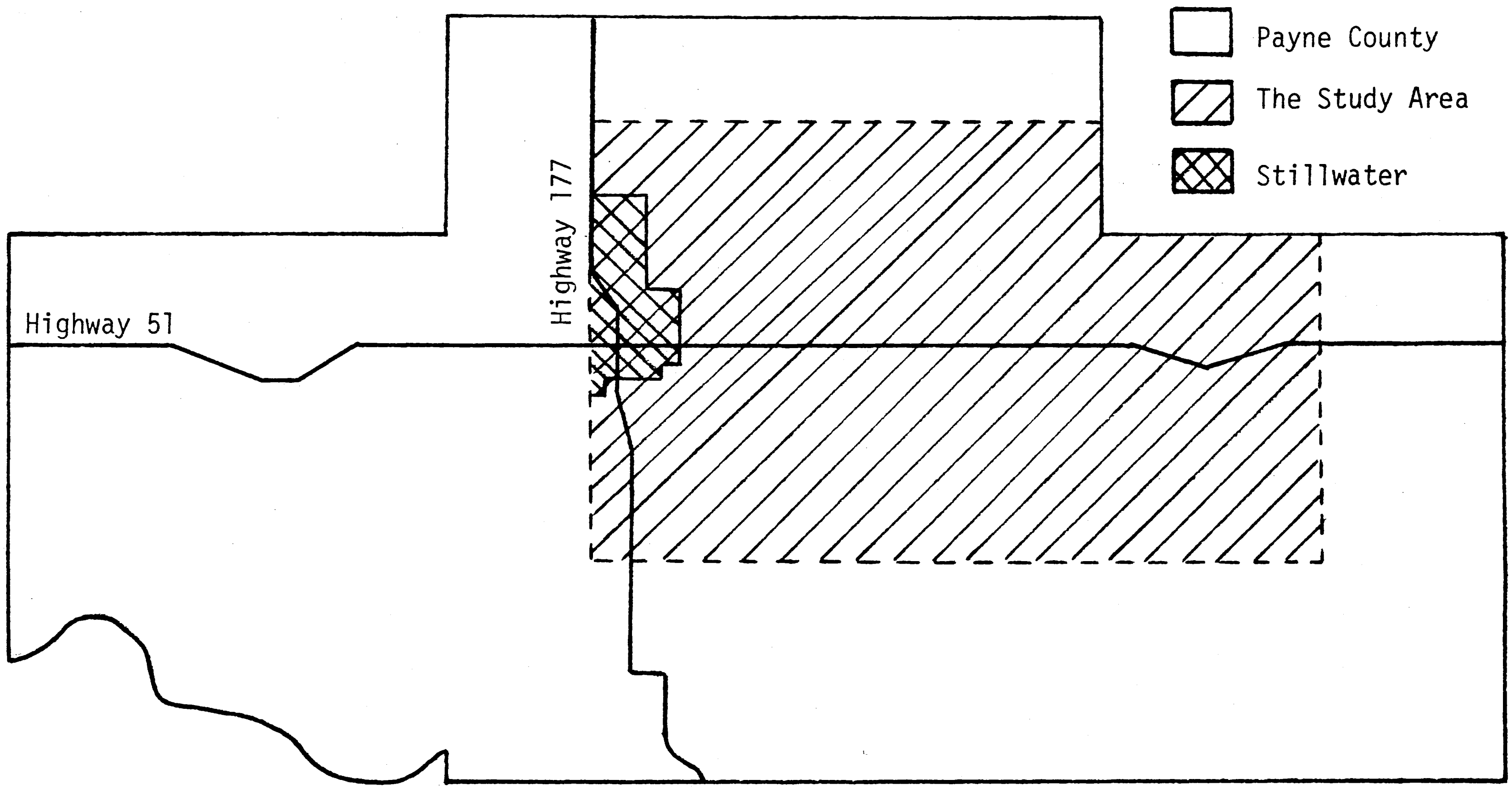


Figure 1: The Study Area

along highway 51. All of this development has been individual single family homes with no large-scale projects being located within the rural area.

## Development of Explanatory Equations

Identification of the factors which determine land value in the study area and estimation of explanatory equations for land value are necessary in order to evaluate the impact of various land use policies on property wealth and tax base in the study area. In order to do this multiple regression techniques were employed. The specific computer algorithm used for this purpose is the Statistical Analysis System (13). Coefficients derived by this method were used as parameters in predictive equations which were used to estimate total and per acre land value in every section within the study area for a variety of policy scenarios.

Prior studies (14, 15, 16, 17, 18, 19) were called upon to help in selection of the variables to be tested. Other variables were chosen because they were felt to have an impact on land value within the specific study area. Final estimating equations were selected based upon percentage of variation explained as measured by the coefficient of determination ($R^2$), the significance level of coefficients on each variable (measured by the students t test), and consistency of the signs on the coefficients with economic theory. Two "best" equations were selected based on these criteria, one which estimates value of land in rural use and the other which estimates value of land in urban use within the study area.

## Factors Influencing Rural Land Value

The factors expected to have an influence on rural land value were the following:

1. Time;
2. Size of Tract;
3. Property Tax Rate;
4. Distance to Stillwater;
5. Distance to Yale;
6. Distance to a Highway; and
7. Land Quality.

All of these factors except tax rate were found by Jennings (18) to have a significant influence on rural land value in Oklahoma. Tax rate has been found to have an impact on rural land value by Pasour (19) and others.

Estimates of values of each of these variables were collected or created from collected data for each sale used as an observation in the explanatory modeling. All data were taken from the records of the Payne county assessor's office with the exception of the distance measurement on maps.

The sample consisted of 70 sale tracts. All of these tracts were within the study area and were sold over a 6-year period. All sales were considered to be arms-length transactions with sale price reflecting true market value of the land.

### Time

Date of sale was expected to have an impact on rural land value because of the tendency of land prices to change over time. In recent years there has been a fairly consistent yearly increase in rural land value in most of the state of Oklahoma (20). Since there were not enough sales available in the study area in any one year to permit the use of cross-sectional data with respect to time, the use of time series data was necessary. In order to be able to identify the variation in land value caused by the differing dates of sale it was necessary to record the date of each property sale and include time as an explanatory variable in the regression analysis. The dates of sale for the tracts used in this study were between October 1971 and April 1976.

### Size of Tract

Size of tract was expected to have an influence on rural land value for two reasons. First, it was hypothesized that larger tracts could have greater value in agriculture use because some minimum size tract is required in order to realize economies of size in agricultural production. On the other hand, it was believed that small tracts could be of greater value because of the lesser capital requirement for purchase. Jennings (18) found that in northwestern Oklahoma size of tract has a negative influence on rural land value thus, substantiating the second argument. The size variable was measured in acres with the largest tract containing 240 acres and the smallest containing .33 acres. The mean observed value of the size variable was 68.48 acres.

### Property Tax Rate

Property taxes were expected to have an impact on rural land value because they are a part of the annual cost of ownership. The variable used as a measure of property tax rate was assessed value of land at the time of sale per dollar of revenue stamps on the deed which transferred title. This variable was analogous to taxes per dollar of land value or tax rate in relative terms.

The true tax rate could have been computed by multiplying the assessed value by the local millage rate and dividing the revenue stamps by .0011 (the ratio of revenue stamps to sale prices). The use of revenue stamps as a measure of sale price was considered to be acceptable because it has been proven to be so by previous studies (21). It was hypothesized that property tax rate would have a negative effect on land value since it increases the ownership cost and reduces the net profitability of the property.

### Distance to Stillwater

Distance to Stillwater should have an impact on rural land value in the study area because tracts nearer the city have greater potential for conversion to higher valued urban uses than more distant tracts. Also, previous studies (16, 18) have shown that proximity to trade centers has a large and significant influence on rural land value.

Distance to Stillwater was calculated for each sale by taking the east-west, north-south, deviation of the section within which the sale tract is located from the center of the city. This is also a measure of shortest travel distance to Stillwater in most cases.

### Distance to Yale

Distance to Yale was used as an explanatory variable in order to determine if proximity to a small trade center has the same impact on land value as distance to a large employment and trade center such as Stillwater. Distance to Yale was measured in the same manner as distance to Stillwater and the distances represent shortest travel distance to Yale.

### Distance to a Highway

Distance to a highway should have an influence on rural land value because of its effect on accessability of the land. The variable was measured by taking the distance from the nearest corner of the section within which each sale was located to the nearest highway.

### Land Quality

Land quality was expected to have an impact on value of rural land because the primary use of most rural land is for agricultural production. Value of land in an income producing use such as this is closely tied to annual net income or rent. Higher quality land will generate greater net income and the capitalization thereof results in a higher value for that land than less productive, lower quality land.

Quality of rural land is best measured by soil type. Unfortunately, soils maps for Payne county have not yet been completed by the Soil Conservation Service. The recent revaluation of Payne county, however, was preformed by professional agronomists and was based upon those agronomists evaluation of soil quality, and extensive work by the Agronomy Department of Oklahoma State University. Hence, the newly assessed values should be proportional to soil quality. New assessed value per acre was thus used as a proxy for quality.

## The Rural Explanatory Model

Equation 3.1, below, was chosen as the "best" explanatory equation for market value of land in the study area provided that land is in a rural use. This equation was selected based on the aforementioned criteria. The values in parenthesis below each coefficient are t values of those coefficients:

$$Y_R = 1.273 + 0.032\ R_1 - 0.165\ R_2 + 0.011\ R_3 - 0.213\ R_4 \qquad \text{Equation (3.1)}$$

$$\quad (5.6) \quad (1.8) \quad (3.0) \quad (28.8) \quad (5.4)$$

where: $Y_R$ = Per acre value of revenue stamps;

$R_1$ = Time (in years);

$R_2$ = Log of distance to Stillwater;

$R_3$ = Land quality index;

$R_4$ = Log of tax rate;

$R^2$ = 0.95;

Standard Deviation = 0.202;

$\overline{Y}_R$ = 0.657 (equivalent to \$593 per acre)[1];

Number of observations = 70.

### Interpretation of Estimated Coefficients

The dependent variable is revenue stamps per acre. Value in dollars per acre can be obtained by dividing by the revenue stamp rate of 0.0011.

Time. The coefficient on the time variable gives an estimate of the average yearly increase in rural land value in the study area during the 6-year period over which land sales were analyzed. Rural land values increased by an average of \$29.09 per acre yearly or

4.9 percent per year.[2] Thus, a tract of rural land which sold in 1976 is expected to have brought \$174.54 per acre more than the same tract, or another tract homogeneous with respect to all other factors, sold in 1971.[3]

<u>Distance to Stillwater</u>. The negative sign on the coefficient of distance to Stillwater indicates that rural land value decreases as distance to Stillwater increases. The log form of the variable indicates that the relationship is non-linear with the magnitude of the effect of proximity to Stillwater on property values decreasing at a decreasing rate as distance increases. Equal percentage changes in distance to Stillwater result in equal dollar changes in property value. Thus, a move from one to two miles away from Stillwater results in the same decrease in value as a move from 5 to 10 miles. A one acre tract located 20 miles from Stillwater is expected to be worth \$449 less than a similar tract, homogeneous with respect to all other characteristics, located 1 mile from Stillwater.[4]

<u>Land Quality</u>. The coefficient on the land quality variable is of great importance because it can be used to obtain an estimate of the true rate at which agricultural income is capitalized into land prices. This capitalization rate can be computed by the procedure outlined below: With an infinite discount period, value is dependent on expected annual income and the discount rate:

$$V = \frac{N}{r} \qquad \text{Equation (3.2)}$$

The discount rate is given by:

$$r = \frac{N}{V} \qquad \text{Equation (3.3)}$$

Assuming that the marginal discount rate is constant, equation 3.3 may be expressed as:

$$r = 1/\ \frac{\sigma V}{\sigma N} \qquad \text{Equation (3.4)}$$

Equation 3.1 may be expressed as:

$$V = 1157.27 + 29.09\ R_1 - 150.00\ R_2 + 10.00\ [(\frac{N}{r_1})A] - 193.64\ R_4. \qquad \text{Equation (3.5)}$$

Taking the partial derivative of V with respect to N yields:

$$\frac{\sigma V}{\sigma N} = 20 \qquad \text{Equation (3.6)}$$

Substituting into 4 gives:

$$r = 1/\frac{\sigma V}{\sigma N} = 1/20 = 5\% \qquad \text{Equation (3.7)}$$

Where: V = land value in dollars per acre;

N = Annual net income per acre;

r = True rate at which net income is capitalized into rural land value;

$R_1$, $R_2$, $R_4$ = Same definition as in equation (3.1);

$r_1$ = Capitalization rate used by assessors in computing use value (0.055); and

A = Assessment rate (0.11).

Thus, assuming that the marginal discount rate is constant, the estimated rate at which net income is capitalized into rural land value is approximately 5 percent.

Tax Rate. The negative sign on the coefficient of the tax rate variable indicates that as the tax rate increases the value of rural property decreases. The log form of the variable indicates that equal percentage changes in the tax rate result in equal dollar changes in property value. A 10 percent increase in tax rate at any level results in a $18.46 per acre decrease in average rural property value.

## Factors Influencing Urban Land Value

The factors expected to have an influence on urban land value were the following:

1. Time;
2. Size of lot;
3. Whether or not a corner lot;
4. Value of improvements;
5. Distance to Oklahoma State University; and
6. Tax Rate.

As with the rural model estimates of values of each of these variables were collected or created from collected data for each sale used as an observation in the explanatory modeling. Data were collected on 58 sale tracts which sold over a 6 year period from 1971-1976.[6]

The reasons for inclusion of the time and tax rate variable were the same as in the rural model. Thus, there is no need for discussing these variables. The four remaining variables will be discussed to aid in understanding the urban model.

### Size

It seems logical to assume that value of an urban lot is dependent upon lot size. The size variable was included in the urban regression to account for variation in lot value due to this factor.[7] The variable was measured in acres with mean size being .37 acres. The largest observed value was 2.5 acres and the smallest was .16 acres.

## Corner Lot

The corner lot variable was expected to have an impact on urban land value becasue street frontage is greater on a corner lot than on an interior lot of the same dimentions. The variable was used as a dummy in modeling, being given a value of one if a corner lot, and zero if not.

## Value of Improvements

Value of improvements on an urban lot should have an influence on the value of the land in that lot because the existence of improvements usually indicates that much landscaping and other such work has been done on the lot. Two variables were used to account for variation in land value due to this factor. The first was a dummy variable which took a value of zero on improved lots and one on unimproved lots. The second was simply the assessed value of improvements on the lot. It was expected that the coefficient on the dummy variable would be negative and the other positive, indicating that improvement of a lot results in an increase in value of that lot.

## Distance to Oklahoma State University

Distance to the Oklahoma State University campus should have an influence on urban land value in Stillwater because the University is the largest employer in the city and the campus is the center of activity in the city. Travel time to OSU is a major factor in selection of a home site for many residents of Stillwater. Because of these factors the sign on the coefficient was expected to be negative.

Measurement of the variable was done in a straight-line manner on a city map. Straight-line measurements were used in order to eliminate the problems and inaccuracy of trying to determine the best travel route from any location to the campus.

The Urban Explanatory Model

Equation 3.8 below was selected as the best estimating equation for urban land value based on the aforementioned criteria. (t values are included in parenthesis below each coefficient.)

$$\hat{Y}_U = \underset{(1.9)}{-1.181} - \underset{(2.0)}{0.051U_1} + \underset{(5.2)}{0.403U_2} - \underset{(2.1)}{0.133U_3} - \underset{(6.5)}{0.458U_4} + \underset{(6.2)}{3.974U_5} - \underset{(2.9)}{0.116U_6}. \quad \text{Equation (3.8)}$$

Where: $\hat{Y}_U$ = Revenue stamps per lot in log form;

$U_1$ = Time (in years);

$U_2$ = Size of lot in log form;

$U_3$ = Distance to OSU campus in log form;

$U_4$ = Assessed value of improvements;

$U_5$ = Vacant or improved lot;

$U_6$ = Log of tax rate;

$R^2 = 0.74$;

Standard Deviation = 0.240;

$\overline{Y}$ = 1.458 (equivalent to $3,907 per lot);[8] and

Number of observations = 58.

Interpretation of Estimated Coefficients

The dependent variable in this equation is revenue stamps per lot in log form. Per lot value was estimated because the results were far superior statistically to those obtained using per acre value as the dependent variable. The log form was also used because it yielded superior statistical results.

Time. The coefficient on time indicates that the average yearly increase in urban land value was $957 per lot.[9] Thus, the magnitude of the influence of time on urban land value in the study area is quite large.

Size of Lot. Since both the dependent variable and the size of lot variable are in log form, the coefficient of the variable is an elasticity. It indicates that a 1 percent increase in the size of an urban lot results in a .4 percent increase in value of the lot. The difference is estimated value of the largest and smallest lot due to size is $2,752 per acre.[10]

Distance to Oklahoma State University. As with the size variable, the coefficient on the distance to OSU campus variable is an elasticity. Value of urban lots is expected to decrease by .13 percent with a 1 percent increase in distance to the campus.

Value of improvements. The implication to be drawn from the coefficients on the two improvement value variables is that the existance of low-valued improvements on urban land reduces the value of that land while the existance of high-valued improvements increases the value of the land. This is logical since low-valued improvements either lock the lot into a low-valued use or require an expenditure for destruction before the land can be converted to a higher valued use. The coefficients indicate that urban land with improvements of value less than $34,595 have a land value less than it would have been had the lot been unimproved. Lots with improvement value greater than this have a land value which is greater than it would have been if unimproved.

Property Tax Rate. The coefficient on the tax rate variable indicates that a 1 percent increase in the effective tax rate on urban property causes a .12 percent decrease in the value of that property. Thus, a doubling of the effective tax rate on an urban lot with a value of $5,000 would result in a $600 reduction in the value of the lot.

## Implications of the Explanatory Equations

The rural and urban explanatory equations presented in this chapter were developed in order to determine the factors which influence land value in the study area. The coefficients from these equations provide an estimate of the magnitude of the impact of each factor on land value. These coefficients were used to develop a simulation process capable of estimating property wealth and the distribution thereof in the study area under current land use policy and under several alternative policies.

In Chapter IV the simulation process is described. Base models estimating value of land in the study area in rural and urban use and the overall base model which represents land value in the area based on current land use patterns are presented and explained in detail.

## Endnotes

1. Per acre value (in dollars) was computed by dividing revenue stamps per acre estimates by the revenue stamp rate (0.0011). Thus, average value per acre is 0.657/0.0011, or $593 per acre.

2. The yearly per acre increase was computed by dividing the coefficient on time by the revenue stamp rate (0.032/.0011 = $29.09/year). Percentage annual increase was computed by dividing the average annual increase by mean per acre value ($29.09/$593 = 4.9%).

3. Computed by multiplying the average annual increase times the number of years elapsed ($29.09/acre/year X 6 years = $174.54/acre).

4. Calculated as follows $\frac{b(\log \text{Distance})}{\text{revenue stamp rate}}$ = value attributed to proximity to Stillwater. Thus, the difference in value of tracts located 1 to 20 miles from Stillwater can be computed by multiplying the difference in the log of the two distances times the coefficient and dividing by the revenue stamp rate [-0.165(log 20 - log 1)/0.0011 = -0.165 (2.99)/0.0011 = $449 per acre].

5. The dependent variable and all coefficients have been divided by the revenue stamp rate (0.0011) so that value in dollars per acre is estimated. The land quality index $R_3$ in equation 3.1 has been restated as it was originally computed by estimating annual net income, dividing by an arbitrary capitalization rate of 0.055, and multiplying by the assessment rate of 11 percent.

6. Sale tracts used as observations in the urban regression were collected from within the entire city of Stillwater rather than just that portion of the city located in the study area.

7. The size variable in the urban equation was included for reasons quite different from those for including the size variable in the rural equation. In the urban equation the variable accounts for variation in "lot" value due to differences in size of lot. In the rural equation the time variable was included to explain differences in "per acre" value due to differences in tract size.

8. Per lot value in dollars was computed by dividing the antilog of the dependent variable (log of per lot value in revenue stamps) by the revenue stamp rate. Thus, it was computed as follows: Antilog (1.458/ 0.0011 = 4.297/.0011 = $3,907 per acre.

9. Average annual increase computed by dividing the antilog of the coefficient on time by the revenue stamp rate (Antilog 0.051/0.0011 = \$957 per acre).

10. Computed as follows: Change in value = antilog [0.403 (log $S_1$ - log $S_2$)]/R (where: $S_1$ = size of largest tract, $S_2$ = size of smallest tract and R = revenue stamp rate).

# CHAPTER IV

## DEVELOPMENT OF BASE MODELS

The regression equations presented in Chapter III provided the coefficients necessary to develop a simulation model capable of estimating the impact of various land use control policies on total and per acre land value within each section in the study area. This simulation process uses representative values of the variables found to have an impact on land value from each section to estimate the entire base whereas the regression process used individual samples to estiate area coefficients.

Two primary models, one which estimates urban market value and the other which estimates rural market value of property within the area, were developed using the previously estimated explanitory land value equations. These models provide much of the base upon which policy evaluation is done and thus are of great importance in succeeding chapters where policy evaluations are presented.

In this chapter the simulation process is discussed in detail. Development of urban and rural market value models using this process is explained and the combining of these two models into a base model which estimates the current distribution of property wealth within the study area is explained.

## The Rural Predictive Model

The rural explanatory equation presented in Chapter 3 indicated that 95% of variation in rural property values in the study area can be explained by four factors. These factors are time, distance to Stillwater, land quality, and tax rate. In order to use this information to estimate total and per acre rural market value of land within each section in the study area, representative values of the level of each of these variables were obtained for each section. In this section the rural predictive system is presented and explained. Special attention is given to the interpretation of the way in which the variables in the predictive system correspond to those in the explanatory model.

### The Rural Predictive Systems

The system of equations used to estimate rural market value per acre of land in each section in the study area was derived from the rural explanitory equation (Equation 3.1) and can be expressed as follows:

$$\hat{S} = 1.273 + 0.032R_1 - 0.165R_2 + 0.011R_3 - 0.213R_4 \quad \text{Equation (4.1)}$$

$$\hat{V} = \hat{S}/0.0011 \quad \text{Equation (4.2)}$$

Where:

$\hat{S}$ = Estimated per acre rural market value of land in any given section in the study area in revenue stamps;

$R_1$ = Time;

$R_2$ = Log of distance from the section to Stillwater;

$R_3$ = Land quality index for the section

$R_4$ = Log of tax rate in the section

$\hat{V}$ = Estimated per acre market value of land in the section in rural use.

Interpretation

Equation 4.1 uses coefficients from the rural explanitory equation to estimate value of land in each section in revenue stamps. Using equation 4.2, these estimates are converted to land value estimates in dollars per acre. This is done simply by dividing the per acre value estimates in revenue stamps (from equation 4.1) by the revenue stamp rate of 0.0011.

Time. The time variable in the predictive equation is simply used to adjust land value estimates to a base year (1976). Thus, the variable takes a constant value of 6 which was used for the year 1976 in the regression analysis.

Distance to Stillwater. The distance to Stillwater variable used in the predictive equation is identical to the one used in the explanitory model. Distances from each section in the study area to Stillwater were calculated by taking the east west, north south, deviation of that section from the section located in the center of Stillwater. These distances were measured in miles and represent shortest travel distance to Stillwater. Distance from each section to Stillwater is shown in the appendix. The log form of the variable was used in calculation because that was the form used in the explanitory equation.

Land Quality. The land quality index used in the predictive equation was derived in the same manner as the one used in obtaining the regression equation. The quality index used in the regression modeling was created by dividing the new agricultural assessed use value of land in each sale tract by the number of acres in the tract. Thus, it is assessed use value per acre.

The index for every section in the study area was created by collecting agricultural assessed values and acreages for the three largest tracts in each section, calculating assessed value per acre for each of these tracts, and taking a weighted average (by acreage) of these three values. Thus, the index used in the predictive system is an estimate of average land quality in the section.

Because some sections in the study area are school land and Indian land which is not a part of the county tax base and thus is not assessed, data were not available for direct calculation of the quality index for these sections. The index for these sections was created by averaging the indicies of adjoining sections.

Tax Rate. Data for the tax rate variable used in the predictive equation were obtained in two ways. For sections containing one or more sale tracts used in the explanatory modeling the tax rate variable was given the average value compiled for sale tracts within the section. For sections which did not contain a sale tract the variable was computed by taking a weighted average of values computed for three sample tracts in the section. Thus, the regression data were used where available and were supplemented by additional data in sections where not available.

As with the quality variable there are a number of sections in the study area where tax rate data are not available. The tax rate estimate for these sections was created by taking the average value of that variable in adjacent sections.

## The Rural Base Model

Rural market value of land in each section in the study area was estimated using equations 4.1 and 4.2 (Appendix). The rural base model, which is a summation of land value in sections equidistant from Stillwater, is shown in table II. The number of acres in sections at each distance from Stillwater along with per acre and total rural market value of land at each distance is shown. From this model it can be seen that rural property values are greatest near Stillwater and decline at a decreasing rate as distance from Stillwater increases. Figure 2 shows the rural rent gradient represented by these data. Rural property values decline fairly rapidly moving away from Stillwater for the first 10 miles. The decline then becomes more eratic. The reason for the occasional increase in property value with distance from that point on is that the magnitude of the effect of the tax rate and quality variables has become larger in relative terms as the magnitude of the effect of the distance variable has decreased. Thus, deviations from log normal are caused by the effects of the quality and tax rate variables.

## The Urban Predictive Model

The urban explanitory equation presented in Chapter 3 indicates that six factors can explain 74 percent of the variation in urban

TABLE II

THE RURAL BASE MODEL: PER ACRE AND TOTAL VALUE OF LAND AT EACH DISTANCE FROM STILLWATER IN RURAL USE

| Distance to Stillwater | Area | Per Acre Rural Value | Total Rural Value |
|---|---|---|---|
| Miles | Acres | Dollars | ($1,000) |
| 0 | 640 | 1,081 | 692 |
| 1 | 1,920 | 906 | 1,741 |
| 2 | 3,200 | 835 | 2,673 |
| 3 | 4,480 | 770 | 3,454 |
| 4 | 5,760 | 673 | 3,879 |
| 5 | 7,040 | 602 | 4,243 |
| 6 | 7,680 | 574 | 4,414 |
| 7 | 7,680 | 535 | 4,115 |
| 8 | 7,680 | 516 | 3,963 |
| 9 | 7,680 | 497 | 3,821 |
| 10 | 7,680 | 448 | 3,446 |
| 11 | 7,680 | 461 | 3,544 |
| 12 | 7,680 | 422 | 3,247 |
| 13 | 7,680 | 392 | 3,016 |
| 14 | 7,680 | 382 | 2,941 |
| 15 | 7,680 | 383 | 2,948 |
| 16 | 7,680 | 359 | 2,761 |
| 17 | 7,040 | 367 | 2,589 |
| 18 | 6,400 | 342 | 2,190 |
| 19 | 5,760 | 341 | 1,966 |
| 20 | 5,120 | 310 | 1,590 |
| 21 | 3,840 | 304 | 1,170 |
| 22 | 2,560 | 241 | 618 |
| 23 | 537 | 279 | 1,920 |
| 24 | 1,280 | 275 | 353 |
| 25 | 640 | 280 | 179 |
| Total or Average | 142,080 | 465 | 66,091 |

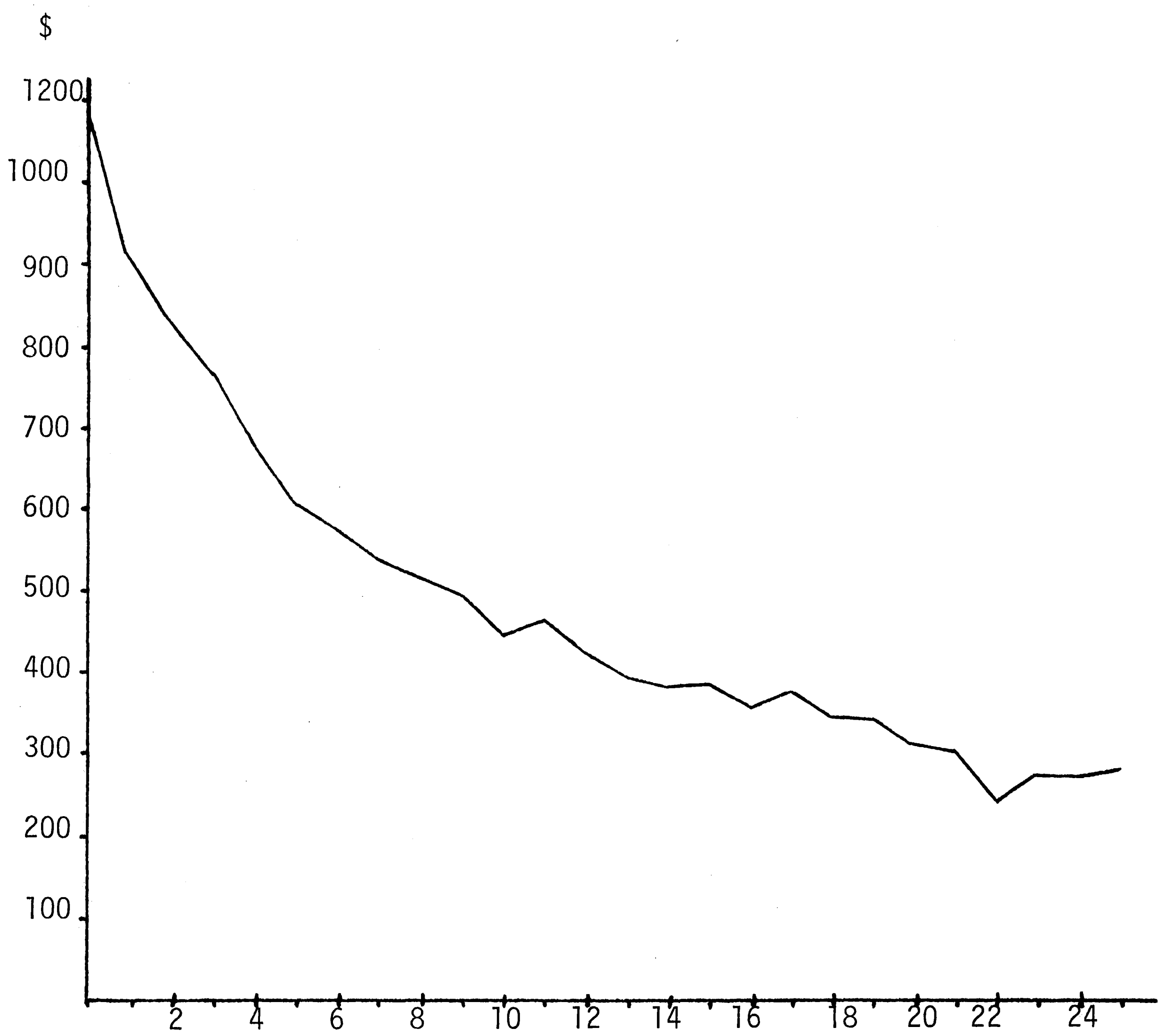


Figure 2. Rural Property Value Gradient

property values in the study area. These factors are time, size of lot, distance to Oklahoma State University Campus, value of improvements on the lot, whether the lot is improved or unimproved (vacant), and tax rate. Representatives values of these variables in each section were used to estimate per acre urban market value of land in each section in the study area.

This section provides a discussion of the development of the urban predictive system. The simulation process is explained in detail and the urban base model is presented and explained.

## The Urban Predictive System

The system of equations used to estimate urban market value of land in each section in the study area, derived using the coefficients from the urban explanitory model, is the following:

$$\hat{L} = \text{Antilog}\,(-1.181 + 0.051U + 0.403\overline{U}_2 - 0.133U_3 + 0.458\overline{U}_4 - 0.116U_6 \qquad \text{(Equation 4.3)}$$

$$\hat{S} = L/.37 \qquad \text{(Equation 4.4)}$$

$$\hat{V} = S/0.0011 \qquad \text{(Equation 4.5)}$$

Where: $\hat{L}$ = Estimated per lot urban market value (in revenue stamps) of land in any section in the study area;

$U_1$ = Time;

$\overline{U}_2$ = Log of mean size of sale lots used as observations in the regression analysis from which the urban explanitory model was obtained;

$U_3$ = Log of distance from the section to the Oklahoma State University campus;

$\overline{U}_4$ = Log of mean assessed value of improvements on sale lots used as observations in the regression analysis from which the urban explanitory model was obtained;

$U_6$ = Log of tax rate in the section;

$\hat{S}$ = Estimated per acre urban value (in revenue stamps) of land in the section;

$\hat{V}$ = Estimated per acre urban market value (in dollars) of land in the section.

Interpretation

Equation 4.3 of the urban predictive system was develop using the coefficients obtained from the urban explanitory model. The dependent variable is urban value (in revenue stamps per lot) of land in a given section.

Equations 4.4 and 4.5 simply convert the values obtained using equation 4.3 to an urban market value per acre basis. Equation 4.4 converts the per lot value estimates to per acre estimates by dividing by the average number of acres per lot. Equation 4.5 changes the unit of measurement on the dependent variable from revenue stamps to dollar market value.

The vacant lot variable from the urban explanatory equation was not included in the predictive equations because it is a dummy variable which was used to distinguish improved lots from unimproved lots. For predictive purposes it was decided that value of improved land would be estimated. It is noteworthy that because of the magnitude of the assessed value of improvements and vacant lot variables results would not have differed greatly if unimproved value had been estimated.

Time. The time variable is included in the urban predictive equation for the same purposes as in the rural model. As before, the time adjustment takes a constant value of .19 which bases the predicted urban values on 1976 value.

Size of Lot. The size of lot variable used in this equation has the effect of basing predicted urban value on the average size of sale lot used as an observation in the regression analysis from which the coefficients were obtained. This average size of lot was 0.370 acres. In order to be consistent with the explanatory equation the log of this mean size (-1.178) was used. Thus, the constant term created by this factor was the coefficient (0.403) times the log of average lot size (-1.178) or -0.475.

Distance From Oklahoma State University Campus. The distance to Oklahoma State University campus variable used in the predictive equation is the same as that used in the explanatory equation. The distances represent straight line distance from the center of each section to the OSU campus. Distance from each section in the study area to the campus is shown in the appendix.

Tax Rate. The tax rate variable used in the urban predictive model is the same as the one used in the rural model. It is an estimate of average tax rate within each section. Tax rate values for each section in the study area are shown in the appendix.

## The Urban Base Model

Urban market value of land in each section in the study area was derived using the urban predictive system of equations and is shown in the appendix. The urban base model which is a summation of these values by distance is shown in Table III. This table shows the number of acres in sections at each distance from Stillwater along with per acrea and total market value of land at each distance in urban use. The urban property value curve represented by these data is shown in Figure 3. Per acre urban land values are plotted by distance. The curve is very similar to a log normal curve with the slope decreasing as distance increases.

## The Overall Base Model

The overall base model (Table IV) is a combination of the rural and urban base models. In developing this model the assumption was made that all land within the present city limits is currently in urban use while all other land is in rural use. This model will serve as a standard of comparison for other simulation models.

Total value of land at each distance from Stillwater was calculated by multiplying the number of acres in urban use times per acre value in that use, doing the same for acres in rural use, and adding the two values. Per acre value of land at each distance was calculated by dividing the total value by total acreage at the distance. Thus, the overall base model provides an estimate of current property wealth and the distribution thereof in the study area.

TABLE III

THE URBAN BASE MODEL: PER ACRE AND TOTAL VALUE OF LAND AT EACH DISTANCD FROM STILLWATER IN URBAN USE

| Distance to Stillwater | Area | Per Acre Urban Value | Total Urban Value |
|---|---|---|---|
| Miles | Acres | Dollars | ($1,000) |
| 0 | 640 | 11,643 | 7,452 |
| 1 | 1,920 | 11,403 | 21,894 |
| 2 | 3,200 | 10,531 | 33,699 |
| 3 | 4,480 | 10,036 | 44,963 |
| 4 | 5,760 | 9,447 | 54,415 |
| 5 | 7,040 | 9,032 | 63,591 |
| 6 | 7,680 | 8,883 | 68,223 |
| 7 | 7,680 | 8,644 | 66,393 |
| 8 | 7,680 | 8,491 | 65,217 |
| 9 | 7,680 | 8,310 | 63,825 |
| 10 | 7,680 | 8,094 | 62,166 |
| 11 | 7,680 | 8,021 | 61,602 |
| 12 | 7,680 | 7,863 | 60,391 |
| 13 | 7,680 | 7,711 | 59,226 |
| 14 | 7,680 | 7,615 | 58,487 |
| 15 | 7,680 | 7,558 | 58,049 |
| 16 | 7,680 | 7,434 | 57,099 |
| 17 | 7,040 | 7,401 | 52,109 |
| 18 | 6,400 | 7,230 | 46,274 |
| 19 | 5,760 | 7,153 | 41,204 |
| 20 | 5,120 | 7,013 | 35,908 |
| 21 | 3,840 | 6,985 | 26,823 |
| 22 | 2,560 | 6,779 | 17,356 |
| 23 | 1,920 | 6,917 | 13,282 |
| 24 | 1,280 | 6,917 | 8,854 |
| 25 | 640 | 6,907 | 4,421 |
| Total or Average | 142,080 | 8,114 | 1,152,921 |

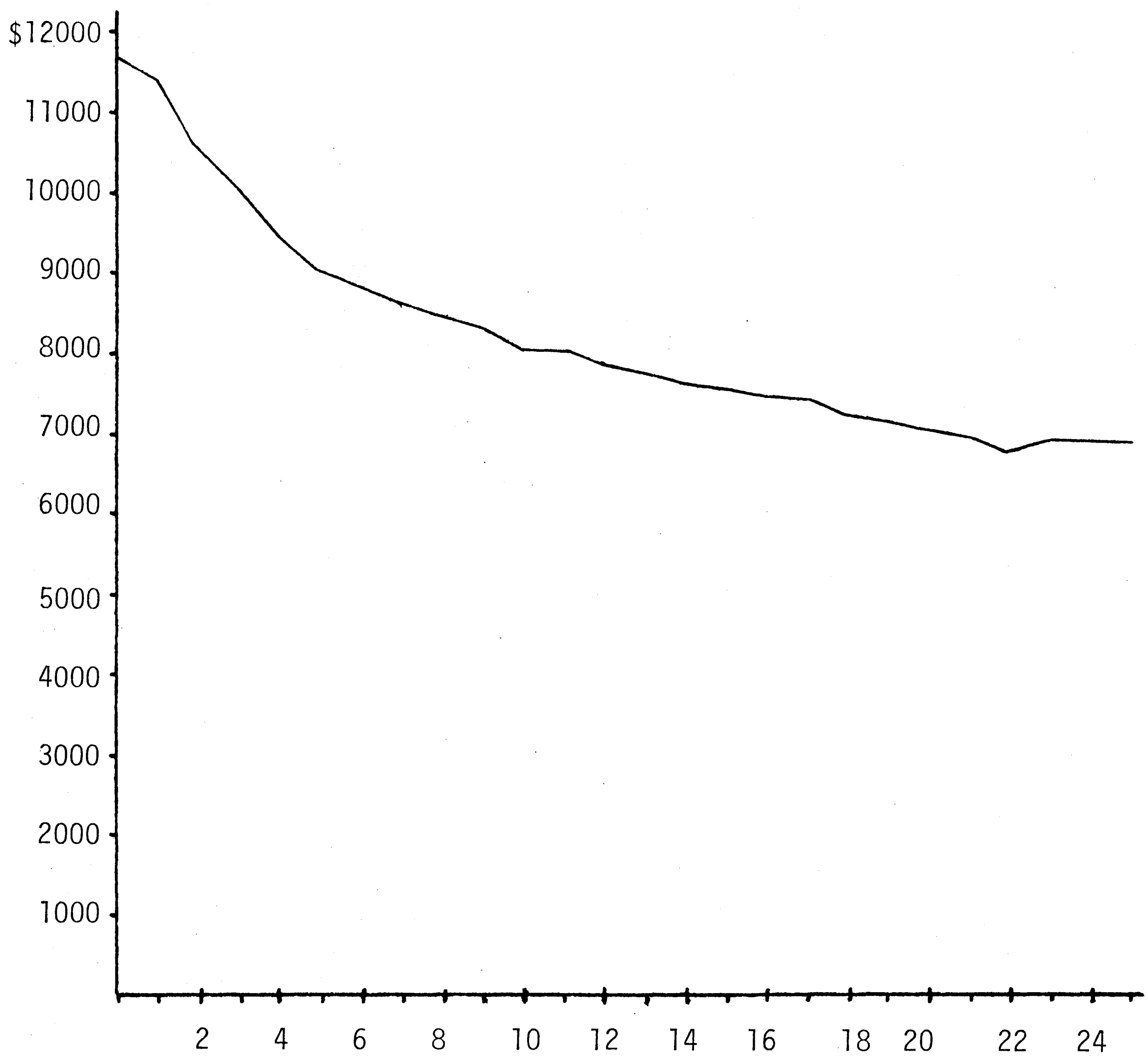


Figure 3. Urban Property Value Gradient

TABLE IV

THE OVERALL BASE MODEL: CURRENT PER ACRE AND TOTAL VALUE OF LAND AT EACH DISTANCE FROM STILLWATER

| Distance to Stillwater | Rural Area | Per Acre Rural Value with market Valuation | Per Acre Rural Value with use Valuation | Total Rural Value with market Valuation | Total Rural Value with use Valuation |
|---|---|---|---|---|---|
| Miles | Acres | Dollars | Dollars | ($1,000) | ($1,000) |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 960 | 835 | 877 | 802 | 842 |
| 3 | 3200 | 795 | 835 | 2545 | 2672 |
| 4 | 5440 | 678 | 712 | 3688 | 3874 |
| 5 | 7040 | 603 | 633 | 4243 | 4456 |
| 6 | 7680 | 575 | 604 | 4414 | 4638 |
| 7 | 7680 | 536 | 562 | 4115 | 4319 |
| 8 | 7680 | 516 | 541 | 3963 | 4157 |
| 9 | 7680 | 498 | 521 | 3821 | 4002 |
| 10 | 7680 | 449 | 470 | 3446 | 3609 |
| 11 | 7680 | 461 | 483 | 3544 | 3706 |
| 12 | 7680 | 423 | 442 | 3247 | 3396 |
| 13 | 7680 | 393 | 410 | 3016 | 3152 |
| 14 | 7680 | 383 | 400 | 2941 | 3071 |
| 15 | 7680 | 384 | 401 | 2948 | 3076 |
| 16 | 7680 | 360 | 375 | 2761 | 2878 |
| 17 | 7040 | 368 | 383 | 2589 | 2696 |
| 18 | 6400 | 342 | 355 | 2190 | 2274 |
| 19 | 5760 | 342 | 354 | 1966 | 2038 |
| 20 | 5120 | 311 | 321 | 1590 | 1643 |
| 21 | 3840 | 305 | 315 | 1170 | 1208 |
| 22 | 2560 | 241 | 248 | 618 | 634 |
| 23 | 1920 | 280 | 288 | 537 | 553 |
| 24 | 1280 | 276 | 284 | 353 | 364 |
| 25 | 640 | 280 | 288 | 179 | 184 |
| Total or Average | 135,680 | 447 | 468 | 60,686 | 63,442 |

# CHAPTER V

# PROPERTY WEALTH AND TAX BASE EFFECTS OF ALTERNATIVE POLICIES

In Chapters 3 and 4 the explanatory and predictive models used to evaluate alternative land use policies were described. Base models which estimate per acre and total value of land in sections at each distance from Stillwater and the overall base model which estimates land value under current land use patterns were presented in Chapter 4.

In this chapter policy alternatives are evaluated based upon comparison of simulated policy results with the base models. Three types of policy alternatives; tax strategies, development rights strategies, and rural zoning, are evaluated with regard to effects on property wealth and tax base in the study area.

Policy evaluation will be based on the assumption that encouragement or restriction of development in one section of the study area does not affect land value in other sections of the area. For example, the possibility that rural zoning restricting development in a part of the study area could result in an increase in land value in the part of the area where development can occur will be ignored. This will be done because estimation of such shifts in development value of land is beyond the scope of this study.

## Tax Strategies

The two tax strategies to be evaluated in this study are use valuation of rural land and equalization of rural and urban use value of rural land through a special tax rate. Although these are not the only taxation policies available to planners they are two representative policy alternatives. Evaluation of these two policies should yield an indication of the probable effect of most taxation policies.

### Use Valuation

The use valuation policy evaluated here is one in which all land in the rural portion of the study area is valued for tax purposes at agricultural use value. Since market value of land in all sections in the study area is substantially greater than agricultural use value, this policy results in a decrease in property taxes on all rural land. The magnitude of this decrease is largest in sections contiguous to Stillwater, decreasing as distance to Stillwater increases. The effects of this tax decrease and shift in tax burden on property wealth and tax base in the study area are estimated in the following sections.

#### Property Wealth Effects

The property wealth effect of use valuation of rural land in the study area can be estimated by comparing simulated property wealth with market and use valuation. Estimated property wealth in sections at each distance from Stillwater with market valuation can be taken from the overall base model (Table IV). Property wealth with use valuation can be computed using the following system of equations:

$$U_{JK} = Q_{JK}/R \qquad \text{(Equation 5.1)}$$

$$U_D = \Sigma_D(U_{JK})\ (A_{JK}) \qquad \text{(Equation 5.2)}$$

$$V_D = \frac{M_D + (M_D - U_D)\ T}{C} \qquad \text{(Equation 5.3)}$$

where: $U_{JK}$ = use value of land in each section (sections identified by the coordinates J, K for computational purposes_;

$Q_{JK}$ = Quality index of land in the section;

R = Assessment Rate (.11);

$U_D$ = Use value of rural land at distance D from Stillwater;

$A_{JK}$ = Number of rural acres in the section;

$V_D$ = Value of land at distance D from Stillwater with use valuation;

$M_D$ = market value of land at distance D from Stillwater with market valuation;

T = Tax Rate (0.34);

C = Capitalization rate (0.05).

Equation 5.1 estimates use value of rural land in each section in the study area. The quality index is used for this purpose because it is assessed rural use value per acre as determined by the appraisers and agronomists who did the use value assessment of the study area. This value is divided by the assessment rate to convert from assessed to appraised use value.

Equation 5.2 uses the per acre use value estimates from equation 5.1 to estimate total use value of rural land at each distance from Stillwater. This is done by multiplying per acre use value in each section times the number of rural acres in that section and summing for all sections equidistant from Stillwater.

Equation 5.3 estimates market value of rural land at each distance with use value assessment. Market value with market value assessment is increased by the capitalized value of the increase in annual net income or rent resulting from the tax reductions associated with use valuation.

The effect of use valuation of rural land on total property wealth in the study area is shown in table V. Average per acre value with use valuation is $468 while average per acre value with market valuation is $447. Thus, per acre property value with use valuation is $21 greater than with market valuation.

Total value of land in the study area with use valuation is slightly greater than with market valuation. Estimated total land value is $63.4 million with use valuation and $60.7 million with market valuation. Thus, use valuation results in an estimated $2.8 million increase in total land value.

The effect of use valuation of rural land on the distribution of property wealth in the study area is small (Table VI). With market valuation of rural land, 53.13 percent of total land value is in the urban area and 46.86 percent is in the rural area. With use valuation, 52.03 percent of total land value is in the urban area and 47.99 percent is in the rural area. Thus, use valuation results in a slight change in relative property wealth between rural and urban uses.

A second redistributional effect of use valuation of rural land occurs in the rural area. With use valuation a slightly larger percentage of total rural value is in sections nearer Stillwater than with market valuation. The reason for this is that the difference in market and use value is largest on land in sections near Stillwater where development value is large. The tax saving resulting from use valuation of this land

TABLE V

ESTIMATED VALUE OF RURAL LAND IN THE STUDY AREA WITH MARKET AND USE VALUATION

| Distance to Stillwater | Rural Area | Per Acre Rural Value | Total Rural Value | Urban Area | Per Acre Urban Value | Total Urban Value | Average Per Acre Value | Total Value |
|---|---|---|---|---|---|---|---|---|
| Miles | Acres | Dollars | ($1,000) | Acres | Dollars | ($1,000) | Dollars | ($1,000) |
| 0 | 0 | 0 | 0 | 640 | 11,643 | 7,452 | 11,643 | 7,452 |
| 1 | 0 | 0 | 0 | 1,920 | 11,403 | 21,894 | 11,403 | 21,894 |
| 2 | 960 | 835 | 802 | 2,240 | 10,605 | 23,756 | 7,674 | 24,558 |
| 3 | 3,200 | 795 | 2,545 | 1,280 | 9,946 | 12,731 | 3,410 | 15,276 |
| 4 | 5,440 | 678 | 3,688 | 320 | 9,227 | 2,953 | 1,150 | 6,640 |
| 5 | 7,040 | 603 | 4,243 | 0 | 0 | 0 | 603 | 4,243 |
| 6 | 7,680 | 575 | 4,414 | 0 | 0 | 0 | 575 | 4,414 |
| 7 | 7,680 | 536 | 4,115 | 0 | 0 | 0 | 536 | 4,115 |
| 8 | 7,680 | 516 | 3,963 | 0 | 0 | 0 | 516 | 3,963 |
| 9 | 7,680 | 498 | 3,821 | 0 | 0 | 0 | 498 | 3,821 |
| 10 | 7,680 | 449 | 3,446 | 0 | 0 | 0 | 449 | 3,446 |
| 11 | 7,680 | 461 | 3,544 | 0 | 0 | 0 | 461 | 3,544 |
| 12 | 7,680 | 423 | 3,247 | 0 | 0 | 0 | 423 | 3,247 |
| 13 | 7,680 | 393 | 3,016 | 0 | 0 | 0 | 393 | 3,016 |
| 14 | 7,680 | 383 | 2,941 | 0 | 0 | 0 | 383 | 2,941 |
| 15 | 7,680 | 384 | 2,948 | 0 | 0 | 0 | 384 | 2,948 |
| 16 | 7,680 | 360 | 2,761 | 0 | 0 | 0 | 360 | 2,761 |
| 17 | 7,040 | 368 | 2,589 | 0 | 0 | 0 | 368 | 2,589 |
| 18 | 6,400 | 342 | 2,190 | 0 | 0 | 0 | 342 | 2,190 |
| 19 | 5,760 | 341 | 1,966 | 0 | 0 | 0 | 341 | 1,966 |
| 20 | 5,120 | 311 | 1,590 | 0 | 0 | 0 | 311 | 1,590 |
| 21 | 3,840 | 305 | 1,170 | 0 | 0 | 0 | 305 | 1,170 |
| 22 | 2,560 | 341 | 618 | 0 | 0 | 0 | 341 | 618 |
| 23 | 1,920 | 280 | 537 | 0 | 0 | 0 | 280 | 537 |
| 24 | 1,280 | 276 | 353 | 0 | 0 | 0 | 276 | 353 |
| 25 | 640 | 280 | 179 | 0 | 0 | 0 | 280 | 179 |
| Total or Average | 135,680 | 447 | 60,686 | 6,400 | 10,748 | 68.786 | 911 | 129,472 |

TABLE VI

PROPERTY WEALTH DISTRIBUTION IN THE STUDY AREA WITH MARKET AND USE VALUATION

| Distance to Stillwater | Percentage of property wealth in urban area with market Value Assessment In Rural Area | Percentage of property wealth in rural area with market Value Assessment In Rural Area | Percentage of property wealth in urban area with use value Assessment In Rural Area | Percentage of property wealth in rural area with use Value Assessment In Rural Area |
|---|---|---|---|---|
| Miles | Percent | Percent | Percent | Percent |
| 0 | 5.76 | 0 | 5.64 | 0 |
| 1 | 16.71 | 0 | 16.56 | 0 |
| 2 | 18.35 | .62 | 17.97 | .64 |
| 3 | 9.83 | 1.97 | 9.63 | 2.02 |
| 4 | 2.28 | 2.85 | 2.23 | 2.93 |
| 5 | 0 | 3.28 | 0 | 3.37 |
| 6 | 0 | 3.41 | 0 | 3.51 |
| 7 | 0 | 3.18 | 0 | 3.27 |
| 8 | 0 | 3.06 | 0 | 3.14 |
| 9 | 0 | 2.95 | 0 | 3.03 |
| 10 | 0 | 2.66 | 0 | 2.73 |
| 11 | 0 | 2.74 | 0 | 2.80 |
| 12 | 0 | 2.51 | 0 | 2.57 |
| 13 | 0 | 2.33 | 0 | 2.38 |
| 14 | 0 | 3.04 | 0 | 2.32 |
| 15 | 0 | 2.28 | 0 | 2.33 |
| 16 | 0 | 2.13 | 0 | 2.18 |
| 17 | 0 | 1.20 | 0 | 2.04 |
| 18 | 0 | 1.69 | 0 | 1.72 |
| 19 | 0 | 1.52 | 0 | 1.54 |
| 20 | 0 | 1.23 | 0 | 1.24 |
| 21 | 0 | .90 | 0 | .91 |
| 22 | 0 | .48 | 0 | .48 |
| 23 | 0 | .41 | 0 | .42 |
| 24 | 0 | .27 | 0 | .28 |
| 25 | 0 | .14 | 0 | .14 |
| Total or Average | 53.13 | 46.86 | 52.03 | 47.99 |

is large and the capitalization of this saving into land value results in a significant increase in land value. Although the change in land value associated with use valuation is large in some sections in the rural area, the overall redistributional effect is very small, and thus, is of little significance in determing the usefulness of that type of policy.

### Effect on Tax Base

The effect of use valuation of rural land on the value of the tax base in the study area is large (Table VII). With market valuation taxable value of urban land is \$68.8 million and taxable value of rural land is \$60.7 million. With use valuation of rural land, urban tax base value is unchanged while value of rural tax base is \$20.2 million. Thus, total tax base value with use valuation of rural land is \$40 million less than with market valuation.

The distribution of tax base in the study area with market and use valuation is shown in table VIII. With market valuation of rural land, 53.13 percent of total tax base is in the urban area and 46.88 percent is in the rural area. With use valuation of rural land, 77.32 percent of total tax base is in the urban area and 22.65 percent is in the rural area. Thus, use valuation of rural land results in a shifting of relative tax burden from rural to urban land.

### Equalization of Rural and Urban Use Value of Rural Land Through a Special Tax Rate

The policy evaluated in this section is one which attempts to eliminate the economic incentive for sprawl type development by placing a special tax rate on urban use of rural land. This special tax rate is at

TABLE VII

COMPOSITION OF THE TAX BASE OF THE STUDY AREA
WITH MARKET AND USE VALUATION OF RURAL LAND

| Distance to Stillwater | Taxable Urban Value | Taxable rural value with market Valuation | Taxable rural value with use Valuation |
|---|---|---|---|
| Miles | ($1,000) | ($1,000) | ($1,000) |
| 0 | 7452 | 0 | 0 |
| 1 | 21894 | 0 | 0 |
| 2 | 23756 | 802 | 218 |
| 3 | 12731 | 2545 | 682 |
| 4 | 2953 | 3688 | 946 |
| 5 | 0 | 4243 | 1114 |
| 6 | 0 | 4414 | 1123 |
| 7 | 0 | 4115 | 1113 |
| 8 | 0 | 3963 | 1108 |
| 9 | 0 | 3821 | 1160 |
| 10 | 0 | 3446 | 1045 |
| 11 | 0 | 3544 | 1167 |
| 12 | 0 | 3247 | 1161 |
| 13 | 0 | 3016 | 1015 |
| 14 | 0 | 2941 | 1032 |
| 15 | 0 | 2948 | 1072 |
| 16 | 0 | 2761 | 1047 |
| 17 | 0 | 2589 | 1014 |
| 18 | 0 | 2190 | 960 |
| 19 | 0 | 1966 | 908 |
| 20 | 0 | 1590 | 810 |
| 21 | 0 | 1170 | 618 |
| 22 | 0 | 618 | 385 |
| 23 | 0 | 537 | 296 |
| 24 | 0 | 353 | 191 |
| 25 | 0 | 179 | 99 |
| Total or Average | 68,786 | 60,686 | 20,184 |

## TABLE VIII

## EFFECT OF USE VALUATION ON THE DISTRIBUTION OF TAX BASE IN THE STUDY AREA

| Distance to Stillwater | Percentage of total tax base in the urban area with market valuation of the rural area | Percentage of total tax base in the rural area with market valuation of the rural area | Percentage of total tax base in the urban area with use valuation of the rural area | Percentage of total tax base in the rural area with use valuation of the rural area |
|---|---|---|---|---|
| Miles | Percent | Percent | Percent | Percent |
| 0 | 5.76 | 0 | 8.38 | 0 |
| 1 | 16.91 | 0 | 24.61 | 0 |
| 2 | 18.35 | .62 | 26.70 | .25 |
| 3 | 9.83 | 1.97 | 14.31 | .77 |
| 4 | 2.28 | 2.85 | 3.32 | 1.06 |
| 5 | 0 | 3.28 | 0 | 1.25 |
| 6 | 0 | 3.41 | 0 | 1.26 |
| 7 | 0 | 3.18 | 0 | 1.25 |
| 8 | 0 | 3.06 | 0 | 1.25 |
| 9 | 0 | 2.95 | 0 | 1.30 |
| 10 | 0 | 2.66 | 0 | 1.17 |
| 11 | 0 | 2.74 | 0 | 1.31 |
| 12 | 0 | 2.51 | 0 | 1.19 |
| 13 | 0 | 2.33 | 0 | 1.14 |
| 14 | 0 | 2.27 | 0 | 1.16 |
| 15 | 0 | 2.28 | 0 | 1.20 |
| 16 | 0 | 2.13 | 0 | 1.18 |
| 17 | 0 | 2.00 | 0 | 1.14 |
| 18 | 0 | 1.69 | 0 | 1.07 |
| 19 | 0 | 1.52 | 0 | 1.02 |
| 20 | 0 | 1.23 | 0 | .91 |
| 21 | 0 | .90 | 0 | .69 |
| 22 | 0 | .48 | 0 | .43 |
| 23 | 0 | .41 | 0 | .33 |
| 24 | 0 | .27 | 0 | .21 |
| 25 | 0 | .14 | 0 | .11 |
| Total or Average | 53.13 | 46.88 | 77.32 | 22.65 |

a level which equalizes estimated value of rural land in rural and urban uses. With this policy there is no economic incentive for conversion of rural land to urban use and it will be assumed that no conversion will occur.

The tax rate increase on urban use necessary to equate rural and urban value of rural land in the study area can be estimated using the following equations:

$$C_D = \frac{R_D - U_D}{U_D} \qquad \text{(Equation 5.4)}$$

$$T_D = C_D/E \qquad \text{(Equation 5.5)}$$

where: $C_D$ = Percentage change in urban land value necessary to equate with rural value at distance D from Stillwater.

$R_D$ = Rural use value of land at distance D from Stillwater;

$U_D$ = Value of land at distance D from Stillwater, in urban use;

$T_D$ = Percentage change in tax rate on urban use necessary to equate rural and urban value of land at distance D from Stillwater; and

E = Elasticity of urban land value with respect to tax rate (.12).

In this system of equations the percentage change in urban value necessary to equate land value in rural and urban use is first computed. The percentage change in tax rate necessary to achieve this reduction in urban value is computed by dividing the percentage reduction required by the elasticity of urban land value with respect to tax rate.

Urban value is equated with rural use rather than market value in these computations based on the assumption that rural market value is made up of two components, rural use value, and discounted value of future gains from conversion to urban use. If this assumption is correct, an increase in tax rate on urban use will result in a simultaneous reduction in rural market value equal to the discounted value of the reduction in potential gains from future conversion. This reduction in rural market value resulting from increases in tax rate on urban use will continue until rural market value is equal to use value. At this point further increases in the tax rate on urban use will not affect land value in rural use. Thus, in order to equalize urban and rural value of land through a tax rate change it is necessary to increase the urban use tax rate until urban value is equal to rural use value.

The increase in urban use tax rate necessary to equate urban and rural value of rural land at each distance from Stillwater is shown in Table IX. The necessary increase ranges from 846 percent to 851 percent with the average being 849 percent. Thus, if the tax rate on urban use of property in the rural portion of the study area were increased to 3.23 percent of urban market value, urban and rural use value of the land would be approximately equalized.

## Property Wealth Effect

The effect of equalization of rural and urban use value of rural land on property wealth in the study area is shown in table X. With current taxation policy, average per acre value of rural land is $477. Per acre value of rural land with the special tax rate on urban use is $149. Thus, equlization of rural and urban value of rural land results in an estimated $298 decrease in per acre value of rural land.

TABLE IX

INCREASE IN URBAN TAX RATE NECESSARY TO EQUATE URBAN AND RURAL VALUE OF RURAL LAND

| Distance From Stillwater | Rural Use Value Per Acre | Urban Value Per Acre | Percentage increase in urban tax rate required to equate rural and Urban Value |
|---|---|---|---|
| (Miles) | Dollars | Dollars | Percent |
| 2 | 227 | 10531 | 848 |
| 3 | 213 | 10036 | 849 |
| 4 | 174 | 9447 | 850 |
| 5 | 158 | 9033 | 850 |
| 6 | 146 | 8883 | 851 |
| 7 | 145 | 8645 | 851 |
| 8 | 144 | 8492 | 851 |
| 9 | 151 | 8311 | 850 |
| 10 | 136 | 8095 | 851 |
| 11 | 152 | 8021 | 849 |
| 12 | 138 | 7863 | 850 |
| 13 | 132 | 7712 | 851 |
| 14 | 134 | 7615 | 850 |
| 15 | 149 | 7559 | 850 |
| 16 | 136 | 7435 | 850 |
| 17 | 144 | 7402 | 849 |
| 18 | 150 | 7230 | 848 |
| 19 | 158 | 7153 | 846 |
| 20 | 158 | 7013 | 846 |
| 21 | 161 | 6985 | 846 |
| 22 | 150 | 6780 | 846 |
| 23 | 154 | 6918 | 846 |
| 24 | 149 | 6917 | 847 |
| 25 | 154 | 6907 | 846 |
| Total or Average | 149 | 7991 | 849 |

TABLE X

ESTIMATED VALUE OF RURAL LAND WITH PRESENT TAXATION POLICY AND WITH A TAX POLICY WHICH EQUATES RURAL AND URBAN VALUE OF LAND IN THE RURAL AREA

| Distance to Stillwater | Rural Area | Per Acre rural value with present Taxation policy | Per Acre rural value with new Taxation Policy | Total rural value with present Taxation Policy | Total rural value with new Taxation Policy |
|---|---|---|---|---|---|
| Miles | Acres | Dollars | Dollars | ($1,000) | ($1,000) |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 960 | 835 | 227 | 802 | 218 |
| 3 | 3200 | 795 | 213 | 2545 | 682 |
| 4 | 5440 | 678 | 174 | 3688 | 946 |
| 5 | 7040 | 603 | 158 | 4243 | 1114 |
| 6 | 7680 | 575 | 146 | 4414 | 1123 |
| 7 | 7680 | 536 | 145 | 4115 | 1113 |
| 8 | 7680 | 516 | 144 | 3963 | 1108 |
| 9 | 7680 | 498 | 151 | 3821 | 1160 |
| 10 | 7680 | 449 | 136 | 3446 | 1045 |
| 11 | 7680 | 461 | 152 | 3544 | 1167 |
| 12 | 7680 | 423 | 138 | 3247 | 1061 |
| 13 | 7680 | 393 | 132 | 3016 | 1015 |
| 14 | 7680 | 383 | 134 | 2941 | 1032 |
| 15 | 7680 | 384 | 140 | 2948 | 1072 |
| 16 | 7680 | 360 | 136 | 2761 | 1047 |
| 17 | 7040 | 368 | 144 | 2589 | 1014 |
| 18 | 6400 | 342 | 150 | 2190 | 960 |
| 19 | 5760 | 342 | 158 | 1966 | 908 |
| 20 | 5120 | 311 | 158 | 1590 | 810 |
| 21 | 3840 | 305 | 161 | 1170 | 618 |
| 22 | 2560 | 241 | 150 | 618 | 385 |
| 23 | 1920 | 280 | 154 | 537 | 296 |
| 24 | 1280 | 276 | 149 | 353 | 191 |
| 25 | 640 | 280 | 154 | 179 | 99 |
| Total or Average | 135,680 | 447 | 149 | 60,686 | 20 184 |

The effect of the special tax rate policy on total land value in the study area is large. Total land value with current taxation policy is $60.7 million. With the special tax rate policy, estimated total land value is $20.2 million. Thus, estimated rural land value is $40.5 million less with the special tax rate policy than with current taxation policy.

The redistributional effect of the special tax rate policy on property value in the study area is the same as the effect of use valuation on tax base. This is true because land value in the study area under this policy is equal to use value. Table VIII can be used to illustrate this effect. Columns 1 and 2 now show the percentage of total land value in the urban and rural areas at each distance under current policy. The distribution of property value with the special tax rate policy can be seen in columns 3 and 4. Thus, under current policy 53.13 percent of total land value in the study area is in the urban area and 46.88 percent is in the rural area. With the special tax rate policy, 77.32 percent of land value is in the urban area and 22.65 percent in the rural area. Thus, the special tax rate policy on urban use of rural land results in a redistribution of relative land value in which urban land makes up a much larger and rural land a much smaller percentage of total land value in the study area.

The effect of the special tax rate policy on the distribution of land wealth within the rural area is shown in tabel XI. It is clear this policy results in a more even distribution of property wealth over distance in the study area than current taxation policy. Uncer current taxation policy 51.14 percent of total rural land value

TABLE XI

DISTRIBUTION OF PROPERTY WEALTH IN THE RURAL AREA WITH PRESENT TAXATION POLICY AND WITH A SPECIAL TAX RATE POLICY TO EQUALIZE RURAL AND URBAN VALUE OF RURAL LAND

| Distance to Stillwater | Percentage of rural property wealth within each distance under current Taxation Policy | Percentage of rural property wealth within each distance with equalization Policy |
|---|---|---|
| Miles | Percent | Percent |
| 0 | 0 | 0 |
| 1 | 0 | 0 |
| 2 | 1.32 | 1.08 |
| 3 | 5.51 | 4.46 |
| 4 | 11.59 | 9.15 |
| 5 | 18.58 | 14.67 |
| 6 | 25.85 | 20.23 |
| 7 | 32.63 | 25.74 |
| 8 | 39.16 | 31.23 |
| 9 | 45.46 | 36.98 |
| 10 | 51.14 | 42.16 |
| 11 | 56.98 | 47.94 |
| 12 | 62.33 | 53.20 |
| 13 | 67.30 | 58.23 |
| 14 | 72.15 | 63.30 |
| 15 | 77.01 | 68.61 |
| 16 | 81.56 | 73.80 |
| 17 | 85.83 | 78.82 |
| 18 | 89.44 | 83.58 |
| 19 | 92.68 | 88.08 |
| 20 | 95.30 | 92.09 |
| 21 | 97.23 | 95.15 |
| 22 | 98.25 | 97.06 |
| 23 | 99.13 | 98.53 |
| 24 | 99.71 | 99.48 |
| 25 | 1.00 | 99.97 |

is within 10 miles of Stillwater. With the special tax rate policy 42.16 percent of total rural land value is within 10 miles of Stillwater. This pattern is true throughout the entire rural area.

### Effect on Tax Base

The effect on tax base of a special tax rate policy to equalize rural and urban value of rural land is the same as its effect on total property value. Estimated urban tax base value is the same as under current policy while estimated value of rural tax base is equal to use value of $20.2 million. Thus, total tax base value is approximately $40.5 million less than with current taxation policy.

The redistributional effect of this special tax rate policy on tax base in the study area is the same as its effect on distribution of land value (Table VIII). With the special tax rate on urban use of rural land, urban land makes up 77.32 percent of total tax base while rural land constitutes 22.65 percent of tax base value. This is compared to values of 53.13 percent and 46.88 percent respectively for urban and rural land with current taxation policy.

## Development Rights Policy

The development rights policy evaluated in this study is one in which the public sector purchases the development rights on all rural land in the study area. The price paid for these rights is equal to the difference in rural market and use value of the land. The cost of such a program is shown in Table XII. Per acre cost of development rights ranges from $609 per acre on rural land located

2 miles from Stillwater to $91 per acre on rural land located 22 miles from Stillwater. Average per acre cost of development rights is $299.

Total cost of development rights associated with this public purchase of development rights program is $40.5 million. The expected returns from resale of a part of these development rights could partially offset this cost. This aspect of the program, however, will not be considered because the number of acres on which resale is desirable and the resale price on those acres is not known.

## Property Wealth Effect

The effect of public purchase of development rights on all rural land on property wealth in the study area is the same as that of the taxation policy (equalization of rural and urban value of rural land through a special tax rate on urban use of rural land) described in the previous section (Table VII). Land value in the urban area remains constant at $68.8 million while rural value is reduced from market value of $60.7 million to use value of $20.2 million. Thus, total land value in the area is 31 percent less under this policy than under current taxation policy.

The redistribution effect on property wealth between the rural and urban portions of the study area resulting from the public purchase of development rights policy is the same as the tax base redistribution resulting from use valuation of the rural portion of the study area (Table VIII). Without the policy, 53.13 percent of total property wealth is in the urban area and 46.88 percent is in

TABLE XII

ESTIMATED COST OF DEVELOPMENT RIGHTS ON RURAL LAND IN THE STUDY AREA

| Distance to Stillwater | Rural Area | Development Value Per Acre | Total Development Value |
|---|---|---|---|
| Miles | Acres | Dollars | ($1,000) |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 2 | 960 | 609 | 584 |
| 3 | 3200 | 582 | 1863 |
| 4 | 5440 | 504 | 2742 |
| 5 | 7040 | 444 | 3129 |
| 6 | 7680 | 429 | 3291 |
| 7 | 7680 | 291 | 3002 |
| 8 | 7680 | 382 | 2855 |
| 9 | 7680 | 346 | 2661 |
| 10 | 7680 | 313 | 2401 |
| 11 | 7680 | 309 | 2377 |
| 12 | 7680 | 285 | 2186 |
| 13 | 7680 | 261 | 2001 |
| 14 | 7680 | 249 | 1909 |
| 15 | 7680 | 244 | 1876 |
| 16 | 7680 | 223 | 1714 |
| 17 | 7040 | 224 | 1575 |
| 18 | 6400 | 192 | 1230 |
| 19 | 5760 | 184 | 1058 |
| 20 | 5120 | 152 | 780 |
| 21 | 3840 | 144 | 552 |
| 22 | 2560 | 91 | 233 |
| 23 | 1920 | 126 | 241 |
| 24 | 1280 | 127 | 162 |
| 25 | 640 | 126 | 80 |
| Total or Average | 135,680 | 299 | 40,502 |

the rural area. With the public purchase of development rights policy 77.32 percent of total property value is in the rural area.

The effect of public purchase of development rights on rural land on the distribution of property wealth within the rural portion of the study area can be seen in Table XI. This effect is the same as that of a tax policy to equalize rural and urban value of rural land. Without the public purchase of development rights policy property wealth in the rural area is heavily concentrated in the sections nearer Stillwater. With the public purchase of development rights policy land value in each section is equal to rural use value and is fairly evenly distributed throughout the area.

### Effect on Tax Base

The effect of public purchase of development rights on rural land in the study area on value of tax base in the area is the same as its effect on total property value. Value of rural land in the tax base is reduced to use value, reducing the tax base by $40.5 million.

The redistribution of tax base between the rural and urban area and within the rural area resulting from public purchase of development rights policy is the same as the redistributional effect on property wealth. Tax base is shifted from rural to urban land and from land nearer Stillwater to more distant land.

## Rural Zoning

The rural zoning policy to be evaluated in this study is one which limits residential development in the study area to the area within the projected year 2000 city limits of Stillwater. For these

TABLE XIII

PROPERTY WEALTH AND TAX BASE IN THE STUDY AREA WITH CURRENT TAXATION POLICY AND WITH RURAL ZONING

| Distance to Stillwater | Rural Area | Per Acre value of rural land with no Zoning | Per Acre value of rural land with Zoning | Total rural value with no Zoning | Total rural value with agricultural use zoning boundary at projected 2,000 City Limits |
|---|---|---|---|---|---|
| Miles | Acres | Dollars | Dollars | ($1,000) | ($1,000) |
| 2 | 960 | 835 | 835 | 802 | 802 |
| 3 | 3200 | 795 | 795 | 2545 | 2545 |
| 4 | 5440 | 678 | 663 | 3688 | 3607 |
| 5 | 7040 | 603 | 480 | 4243 | 3378 |
| 6 | 7680 | 575 | 301 | 4414 | 2310 |
| 7 | 7680 | 536 | 145 | 4115 | 1113 |
| 8 | 7680 | 516 | 144 | 3963 | 1108 |
| 9 | 7680 | 498 | 151 | 3821 | 1160 |
| 10 | 7680 | 449 | 136 | 3446 | 1045 |
| 11 | 7680 | 461 | 152 | 3544 | 1167 |
| 12 | 7680 | 423 | 138 | 3247 | 1061 |
| 13 | 7680 | 393 | 132 | 3016 | 1015 |
| 14 | 7680 | 383 | 134 | 2941 | 1032 |
| 15 | 7680 | 384 | 140 | 2948 | 1072 |
| 16 | 7680 | 360 | 136 | 2761 | 1047 |
| 17 | 7040 | 368 | 144 | 2589 | 1014 |
| 18 | 6400 | 342 | 150 | 2190 | 960 |
| 19 | 5760 | 341 | 158 | 1966 | 908 |
| 20 | 5120 | 311 | 158 | 1590 | 810 |
| 21 | 3840 | 305 | 161 | 1170 | 618 |
| 22 | 2560 | 241 | 150 | 618 | 385 |
| 23 | 1920 | 280 | 154 | 537 | 296 |
| 24 | 1280 | 276 | 149 | 353 | 191 |
| 25 | 640 | 280 | 154 | 179 | 99 |
| Total or Average | 135,680 | 447 | 212 | 60,686 | 28,743 |

purposes year 2000 city limits are assumed to be circular with radius calculated as follows:

$$D = \frac{P_{1975}}{A_{1975}} = \frac{36,100}{25,600} = 1.41 \qquad \text{(Equation 5.1)}$$

$$A_{2000} = \frac{P_{2000}}{D} = \frac{63,600}{1.41} = 45,106 \qquad \text{(Equation 5.2)}$$

$$r = \frac{A_{2000}}{640\pi} = 4.74 \text{ miles} \qquad \text{(Equation 5.3)}$$

where:

D = Population density in Stillwater based on 1975 population and acreage;

$P_{1975}$ = Stillwater Population in 1975;

$A_{1975}$ = Area of Stillwater in 1975 in acres

$P_{2000}$ = Stillwater Population in 2000; and

r = radius of Stillwater.

Thus, the expected radius of the Stillwater city limits in the year 2000 is 4.74 miles and the subject area can be zoned into urban and rural use areas on this basis.

## Property Wealth Effect

A comparison of base model property wealth in the study area and property wealth with rural use zoning on all land outside the projected year 2,000 city limits is shown in Table XIII. Without zoning per acre value of land in the rural area ranges from $835 per acre on land located 2 miles from Stillwater to $241 per acre on land located 22 miles from Stillwater. Average per acre value is $447. With rural zoning, per acre value of rural land ranges from $835 on land in sections 2 miles from Stillwater to $132 on land in sections 13 miles from Stillwater. Average per acre value of rural land with rural zoning in $212.

The effect of rural zoning on total land value in the rural portion of the study area is shown in columns 4 and 5. Total rural land value with zoning is $28.7 million while total land value without zoning is $60.7 million. Thus, rural zoning results in a $31.9 million decrease in total property wealth in the study area.

The effect of the rural zoning policy on the distribution of property wealth between urban and rural uses in the study area is shown in Table XIV. Without rural zoning 53.13% of total property wealth is in the urban area and 46.88% is in the rural area. With rural zoning 70.53% of property wealth is in the urban area and 29.46% is in the rural area. Thus, rural zoning results in a redistribution of property wealth in which the urban area becomes relatively more valuable than the rural area.

The effect of rural zoning on the distribution of property wealth within the rural portion of the study area is significant (Table XIV). Rural zoning results in an increase in the proportion of total rural land value located in sections nearest Stillwater. For instance, with current taxation policy 18.58 percent of total rural property wealth in in sections within 5 miles of Stillwater. With rural zoning, 35.94 percent of total rural property value is in sections within 5 miles of Stillwater. Thus, the impact of rural zoning on the distribution of rural property wealth area space is large, especially in sections nearer Stillwater.

TABLE XIV

ESTIMATED DISTRIBUTION OF PROPERTY WEALTH AND TAX BASE IN THE STUDY AREA WITH AND WITHOUT RURAL ZONING

| Distance to Stillwater | Current Property Wealth Distribution | | Property Wealth Distribution With Rural Zoning | | Rural Property Wealth Distribution | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Urban | Rural | Urban | Rural |
| Miles | Percent | Percent | Percent | Percent | Percent | Percent |
| 0 | 5.76 | 0 | 7.64 | 0 | 0 | 0 |
| 1 | 16.91 | 0 | 22.45 | 0 | 0 | 0 |
| 2 | 18.35 | .62 | 24.36 | .82 | 1.32 | 2.79 |
| 3 | 9.83 | 1.97 | 13.05 | 2.61 | 5.51 | 11.64 |
| 4 | 2.28 | 2.85 | 3.03 | 3.70 | 11.59 | 24.19 |
| 5 | 0 | 3.28 | 0 | 3.46 | 18.58 | 35.94 |
| 6 | 0 | 3.41 | 0 | 2.37 | 25.85 | 43.98 |
| 7 | 0 | 3.18 | 0 | 1.14 | 32.63 | 47.85 |
| 8 | 0 | 3.06 | 0 | 1.14 | 39.16 | 51.70 |
| 9 | 0 | 2.95 | 0 | 1.19 | 45.46 | 55.74 |
| 10 | 0 | 2.66 | 0 | 1.07 | 51.14 | 59.38 |
| 11 | 0 | 2.74 | 0 | 1.20 | 56.98 | 63.46 |
| 12 | 0 | 2.51 | 0 | 1.09 | 62.33 | 67.15 |
| 13 | 0 | 2.33 | 0 | 1.04 | 67.30 | 70.68 |
| 14 | 0 | 2.27 | 0 | 1.06 | 72.15 | 74.27 |
| 15 | 0 | 2.28 | 0 | 1.10 | 77.01 | 78.00 |
| 16 | 0 | 2.13 | 0 | 1.07 | 81.56 | 81.64 |
| 17 | 0 | 2.00 | 0 | 1.04 | 85.83 | 85.17 |
| 18 | 0 | 1.69 | 0 | .98 | 89.44 | 88.51 |
| 19 | 0 | 1.52 | 0 | .93 | 92.68 | 91.67 |
| 20 | 0 | 1.23 | 0 | .83 | 95.30 | 94.49 |
| 21 | 0 | .90 | 0 | .63 | 97.23 | 96.64 |
| 22 | 0 | .48 | 0 | .39 | 98.25 | 97.98 |
| 23 | 0 | .41 | 0 | .30 | 99.13 | 99.01 |
| 24 | 0 | .27 | 0 | .20 | 99.71 | 99.67 |
| 25 | 0 | .14 | 0 | .10 | 100.00 | 100.00 |
| | 53.13 | 46.88 | 70.53 | 29.46 | | |

Effect on Tax Base

The effect of rural zoning on the tax base in the study area is the same as its effect on property wealth. Estimated urban tax base value remains unchanged as does the value of rural tax base zoned for urban use. This conclusion is based on the assumption that the reduction in developable acres does not increase the value of developable land. Since little of the rural land is currently at the threshold of development, this assumption should be realistic in the present time period. Value of rural land in the area zoned for rural use is equal to rural use value. Thus, the reduction in tax base resulting from rural zoning is $31.9 million.

The redistributional effect of a rural zoning policy on tax base of the study area is also the same as the effect on distribution of property wealth. The distribution of tax base with rural zoning is much more heavily weighted toward urban land than it is with current taxation policy. The tax base in the rural area is more concentrated in sections nearer Stillwater. Thus, rural zoning results in the same shift in tax base as in property wealth with land zoned for urban uses becoming relatively more valuable than land zoned for rural uses.

# CHAPTER VI

## TAX EFFECTS OF ALTERNATIVE LAND USE POLICIES

In the previous chapter four land use policy alternatives were evaluated with regard to effect on property wealth and tax base. All of these policies were found to result in a substantial reduction in tax base in the study area. The loss in tax revenues resulting from this reduction in tax base would be large for all four policies.

In this chapter the analysis is centered on the effects of each alternative policy on property tax rate and tax incidence. Total tax revenues are assumed to be the same under each policy and equal to tax revenues under current taxation policy. This assumption is made because none of the tax policies is expected to reduce the cost of providing public services in the study area below current cost.

The nominal tax rate at which tax revenues are equal to current tax revenues is estimated.[1] Property tax incidence associated with each policy is discussed.[2] Finally, the effective tax rate on urban and rural land is estimated for each policy alternative.[3]

### Current Tax Situation

Property tax revenues in the study area with current taxation policy can be estimated by multiplying the current nominal tax rate of 0.34 percent times the tax base estimate of $129.5 million from the previous chapter. Estimated total tax revenues are $440,205 with $233,872 coming from the urban area and $206,333 coming from the rural area (Table XV). Thus, average taxes in the urban area are $36.54 per acre or $13.52 per lot. Average taxes in the rural area are $1.52 per acre.

Since land in both urban and rural uses is currently taxed on a market value basis, the effective tax rate on land in both uses is the nominal tax rate of 0.34 percent. Thus, property tax incidence is proportionate to land value with all land being taxed at 0.34 percent of true market value.

## Tax Effect of Use Value Assessment

Use value assessment has been shown to reduce tax base in the rural portion of the study area by $40.5 million (Table VII). With the current nominal tax rate of 0.34 percent estimated total tax receipts in the study area are reduced from $440,205 to $302,498. Thus, if the nominal tax rate remains constant, use valuation of rural land results in an estimated $137,707 reduction in total tax revenues. Estimated taxes on urban land remain constant at $233,872 while estimated rural taxes are reduced from $206,333 to $68,626.

### Effect on Nominal Property Tax Rate

The urban and rural explanatory equations (Equations 3.1 and 3.8) have indicated that as tax rate increases value of both urban and rural land decreases. Thus, the increase in nominal tax rate required to compensate for a decrease in tax base is proportionately larger than the initial reduction in tax base.

Since current value of rural and urban tax base along with current nominal tax rate and tax revenues are known, the nominal tax rate at which tax revenues are equal with market and use valuation of rural land can be calculated as follows:

Tax revenues are equal to tax rate times tax base:

$$T = (U + R)\, t \qquad \text{Equation (6.1)}$$

where:

$T$ = Tax revenues;

$U$ = Value of urban tax base;

$R$ = Value of rural tax base; and

$t$ = Tax rate.

Given knowledge of current nominal tax rate and tax revenues, estimated tax revenues associated with a change in tax rate are:

$$T_1 = ([U - (U)\,(E_u)\,(\frac{t_1 - t}{t})] + [R - (R)\,(E_R)\,(\frac{t_1 - t}{t})])\; t_1 \qquad \text{Equation (6.2)}$$

where:

$T_1$ = Tax revenues with new tax rate;

$E_u$ = Elasticity of urban land value with respect to tax rate (-0.116);

$E_R$ = Elasticity of rural land value with respect to tax rate (-0.324);

$t$ = Current nominal tax rate (0.34 percent); and

$t_1$ = New nominative tax rate.

Substituting the desired level of tax revenues (440,205) along with values of urban and rural tax base with use valuation yields the following quadratic:

$-4.270{,}323{,}942t_1^2 - 103{,}488{,}792t_1$ Equation (6.3)

$-440{,}205 = 0$

Solving equation 6.3 for t indicates that a nominal tax rate of 0.55 percent is required to obtain current tax revenues with use valuation of rural land. Thus, a 62 percent increase in the nominal tax rate is required to compensate for a 31 percent reduction in tax base.

Effect on Property Tax Incidence

Estimated tax revenues from the urban area with use valuation of rural land and a nominal tax rate of 0.55 percent on all land can be calculated as follows:

$$U_2 = U_1 - U_1\,(E_u)\,\left(\frac{t_1 - t}{t}\right) \qquad \text{Equation 6.4)}$$

$$= \$68{,}786{,}000 - \$68{,}786{,}000\,(0.116)\,\left(\frac{0.0055 - 0.0034}{0.0034}\right)$$

$$= \$68{,}857{,}685$$

$$T_u = (U_2)\,(t_1)$$

$$= (63{,}857{,}685)\,(0.0055)$$

$$= \$351{,}217$$

Where: $U_2$ = Estimated value of urban tax base with use valuation and a 0.55 percent tax rate;

$U_1$ = Estimated value of urban tax base with current taxation policy;

$E_u$ = Elasticity or urban land value with respect to tax rate;

$t$ = Current nominal tax rate (.0034); and

$t_1$ = Nominal tax rate required to attain current tax revenues with use valuation of rural land (0.0055).

Thus, estimated urban tax base value with a 0.55 percent nominal tax rate is \$63,857,685 and tax collections on urban land are \$351,217. This is a tax level of \$54.88 per acre or \$20.30 per lot in the urban area (Table XV).

Value of rural tax base and tax collections on rural land with use valuation and a 0.55 percent nominal tax rate can be estimated as follows:

$$U_2 = U_1 - U_1 \, (E_u) \, \left(\frac{t_1 - t}{t}\right) \qquad \text{(Equation 6.4)}$$

$$= \$68{,}786{,}000 - \$68{,}786{,}000 \, (0.116) \, \left(\frac{0.0055 - 0.0034}{0.0034}\right.$$

$$= \$68{,}857{,}685$$

$$T_u = (U_2)\,(t_1)$$

$$= (63{,}857{,}685)\,(0.0055)$$

$$= \$351{,}217$$

Where:

$U_2$ = Estimated value of urban tax base with use valuation and a 0.55 percent tax rate;

$U_1$ = Estaimted value of urban tax base with current taxation policy;

$E_u$ = Elasticity of urban land value with respect to tax rate;

$t$ = Current nominal tax rate (.0034); and

$t_1$ = Nominal tax rate required to attain current tax revenues with use valuation of rural land (0.0055).

Thus, estimated urban tax base value with a 0.55 percent nominal tax rate is \$63,857,685 and tax collections on urban land are \$351,217. This is a tax level of \$54.88 per acre or \$20.30 per lot in the urban area (Table XV).

Value of rural tax base and tax collections on rural land with use valuation and a 0.55 percent nominal tax rate can be estimated as follows:

$$R_2 = R_1 - R_1 (E_R) \left(\frac{t_1 - t}{T}\right) \qquad \text{(Equation 6.6)}$$

$$= \$20,184,000 - \$20,184,000 (0.324) \left(\frac{0.0055-0.0034}{0.0034}\right)$$

$$= \$16,144,825$$

$$T_R = (R_2)(t_1) \qquad \text{(Equation 6.7)}$$

$$= (\$16,144,825)(0.0055)$$

$$= \$88,797$$

Where: $R_2$ = Estimated value of rural tax base with use valuation and a 0.55 percent tax rate;

$R_1$ = Estimated value of rural tax base with use valuation and a 0.34 percent tax rate;

$E_R$ = Elasticity of rural land value with respect to tax rate;

$t$ = Current tax rate (0.0034); and

$t_1$= Tax rate to equate tax revenues with use valuation, with current tax revenues.

Thus, estimated value of rural tax base with use valuation and a 0.55 percent nominal tax rate is $16,144,825 and tax revenues from rural land are $88,797 or $0.65 per acre.

Estimated total tax receipts with use valutaion and a 0.55 percent tax rate are $440,014. This is approximately equal to the $440,205 level of estimated tax receipts with market valuation and a 0.34 nominal tax rate.

Use valuation and compensating tax rate change result in a shifting of tax burden from rural to urban land. With use valuation 80 percent of estimated total tax base is in the urban area and 20 percent is in the rural area. Thus, land owners in the urban area bear 80 percent of the tax burden rather than the 53 percent they bear with current taxation policy. Rural landowners pay only 20 percent of total taxes rather than the 47 percent they pay under current policy.

Effective tax rate on both rural and urban land with use valuation and a 0.55 percent nominal tax rate can be estimated by dividing tax revenues on each class of land by land value. Tax revenues on urban and rural land have already been estimated so all that is needed is an estimate of land value in both areas with this taxation policy.

Estimated urban land value with use valuation of rural land and a 0.55 percent nominal tax rate is $63,857,685. This is $9,978 per acre or $3,692 per lot. Thus, urban land value is 7 percent less with use valuation and the increased tax rate than with current taxation policy.

Rural land value with use valuation and the increased tax rate can be estimated as follows:

$$R_2 = R_1 + \frac{R_1 t_1 - U_2 t_2}{C} \qquad \text{(Equation 6.8)}$$

$$= 60{,}686{,}000 + \frac{(60{,}686{,}008)\ (0.0034) - (16{,}144{,}825)\ (0.0055)}{.05}$$

$$= \$63{,}036{,}720$$

Where:

$R_2$ = Estimated Market value of rural land with use valuation and a tax rate of 0.55 percent;

$R_1$ = Estimated Market value of rural land with current taxation policy;

$t_1$ = Current tax rate;

$t_2$ = Tax rate with use valuation;

$U_2$ = Use or taxable value of rural land with use valuation and a 0.55 percent tax rate; and

C = Rate at which net income is capitalized into rural land value.

Thus, estimated rural land value with use valuation and a 0.55 percent tax rate is $63,036,720, or $464 per acre. This is equal to estimated rural land value with current taxation policy plus the capitalized value of the tax savings resulting from use valuation with the tax rate increase.

Estimated effective tax rate in the urban area with this policy is 0.55 percent. Estimated rural effective tax rate is 0.14 percent. Thus, effective tax rate in the urban area is increased by 62 percent while effective tax rate on rural land is 59 percent less than with current taxation policy.

## Tax Effects of a Special Tax Rate on Urban Use of Rural Land

In the previous chapter, the average tax rate increase on urban use of rural land necessary to equate rural and urban use value of that land was estimated to be 849 percent. Based on the current nominal tax rate of 0.34 percent the special nominal tax rate at which rural and urban use value is equalized was estimated to be 3.23 percent.

This policy is expected to reduce tax base value in the rural area to use value. Thus, value of urban tax base was estimated to be $68.8 million and estimated rural tax base value is $20.2 million (Table XV). Estimated total tax revenues would be $302,398, $137,707 less than tax revenues with current taxation policy.

Effect on Nominal Tax Rate

As with use valuation the nominal tax rate necessary to achieve current tax revenues with this policy is 0.55 percent. This increase in nominal tax rate results in a change in the special tax rate on urban use of rural land necessary to equate estimated rural land value in both uses. The nominal tax rate at which urban and rural use value are equal is 4.09 percent. Thus, the policy is one in which both urban land and rural land in urban use are taxed at a nominal rate of 0.55 percent while rural land in urban use is taxed at a nominal rate of 4.09 percent. With these tax rates estimated tax revenues are equal to estimated current tax revenues and rural land value is equal in both urban and rural uses.

Effect on Tax Incidence

The effects of this policy to equalize rural land value in rural and urban uses on tax base and tax revenues in the study area are the same as that of use valuation. A summary of these effects is shown in Table XV. Estimated value of urban tax base is $63,857,685. Estimated value of rural tax base is $16,144,825. Total tax base value is estimated at $80,002,510. Estimated tax revenues from the urban area are $351,217 ($54,88 per acre or $20.30 per lot), while rural tax revenues are estimated at $88,797 ($0.65 per acre), and estimated total tax revenues are $440,014. Thus, 80 percent of estimated total tax revenues come from the urban area and 20 percent from the rural area.

The property wealth effect of this special taxation policy is different from that of use valuation of rural land. As with use valuation estimated urban land value is $63,857,685 ($9,977 per acre or $3,691 per lot). Estimated rural land value is reduced to rural use value of $16,144,825 of $118 per acre. Thus, estimated rural land value is 74 percent less than with use valuation and 73 percent less than with current taxation policy.

Effective tax rate on urban land with this policy is 0.55 percent the same as with use valuation and 62 percent larger than with current taxation policy. Effective tax rate on rural land is also 0.55 percent, 62 percent larger than with current taxation policy and 293 percent larger than with use valuation.

## Tax Effects of Public Purchase of Development Rights

As shown in the previous chapter public purchase of all development rights in the rural portion of the study area results in a reduction in rural property value and tax base value to rural use value. With the current 0.34 percent nominal tax rate urban property wealth and tax base value remain constant at $68.8 million while rural property wealth and tax base is reduced to $20.2 million (Table XV). As with the previous two policies, estimated tax revenues with this policy and no change in nominal tax rate would be $302,498, 137,707 less than with current taxation policy.

Effect on Nominal Tax Rate

Since public purchase of development rights has the same effect on value of tax base as use valuation, the nominal tax rate at which estimated tax revenues are equal to estimated current tax revenues is also the same as with use valuation. Thus, the effect of this polciy on nominal tax rate in the study area is an increase from 0.34 to 0.55 percent.

Effect on Property Tax Incidence

The effect of public purchase of all rural development rights on property tax incidence in the study area is the same as that of the previous policy and is shown in Table XV. With this policy estimated urban tax base and land value are both $63,857,685. Estimated rural tax base and land value are equal to use value of $16,144,825. Estimated tax revenues are $351,217 in the urban area and $88,797 in the rural area. Effective tax rate with this policy as with the previous policy is 0.55 percent on both urban and rural land.

## Effects of Rural Zoning

The rural zoning policy evaluated here is the same as the one discussed in Chapter V. With this policy all rural land beyond the estimated 2000 Stillwater city limits is assumed to be zoned for rural use only. The tax effects of this policy are shown in Table XV.

Effect on Nominal Tax Rate

The nominal tax rate at which tax revenues with this rural zoning policy are equal to current tax revenues is 0.49 percent.[4] This is 44 percent greater than with current taxation policy but 11 percent less than with the other two taxation policies.

Effect on Property Tax Incidence

Estimated value of urban tax base in the study area with rural zoning of all land beyond the projected 2000 Stillwater city limits and a nominal tax rate of 0.49 percent is $65,265,775. Value of rural tax base is estimated at $24,635,298. Thus, estimated total tax base value is $89,901,073.

Estimated urban and rural tax revenues with this policy are $319,802 and $120,713 respectively. This indicates that rural zoning results in a shifting of tax burden from rural to urban land. With rural zoning 73 percent of estimated total tax revenues come from the urban area and 27 percent from the rural area. This is compared to values of 53 percent and 47 percent respectively under current taxation policy.

The effect of rural zoning on property wealth in the study area is the same as its effect on tax base. Total property value with rural zoning and the tax rate increase is $89,900,217. Rural property value is estimated at $24,635,298 and urban at $65,267,775. Thus, compared with current property wealth (Table XV), rural zoning results in a large decrease in rural land value and a much smaller decrease in urban land value.

With rural zoning all land in the study area is taxed on a market value basis. Thus, the estimated effective tax rate on all land in the area is 0.49 percent.

TABLE XV

EFFECTS OF ALTERNATIVE POLICIES WITH TAX RATE INCREASES TO EQUATE TAX REVENUES WITH CURRENT LEVEL

| | Current Taxation Policy | Use Value Assessment of Rural Land | Equalization of Rural and Urban Value of Rural Land Through a Special Tax Rate | Rural Zoning Boundary at the 2000 City Limits |
|---|---|---|---|---|
| Value of Tax Base | | | | |
| Urban | $ 68,786,000 | $ 63,857,685 | $ 63,857,685 | $ 65,265,775 |
| Rural | 60,686,000 | 16,144,825 | 16,144,825 | 24,635,298 |
| Total | 129,472,000 | 80,002,510 | 80,002,510 | 89,900,217 |
| Tax Revenues | | | | |
| Urban | $ 233,872 | $ 351,217 | $ 351,217 | $ 319,802 |
| Rural | 206,333 | 88,797 | 88,797 | 102,713 |
| Total | 440,205 | 440,014 | 440,014 | 440,515 |
| Per Acre Tax Revenues | | | | |
| Urban | $ 36.54 | $ 54.88 | $ 54.88 | $ 49.97 |
| Rural | 1.52 | 0.65 | 0.65 | 0.76 |
| Distribution of Tax Burden | | | | |
| Urban | 53% | 80% | 80% | 73% |
| Rural | 47% | 20% | 20% | 27% |
| Property Wealth | | | | |
| Urban | $ 68,786,000 | $ 63,857,685 | $ 63,857,685 | $ 65,265,775 |
| Rural | 60,686,000 | 63,056,726 | 16,144,825 | 24,635,298 |
| Total | 129,472,000 | 126,914,411 | 80,002,510 | 89,901,973 |
| Nominal Tax Rate | | | | |
| Urban | 0.34% | 0.55% | 0.55% | 0.49% |
| Rural | 0.34% | 0.55% | 0.55% | 0.49% |
| Effective Tax Rate | | | | |
| Urban | 0.34% | 0.55% | 0.55% | 0.49% |
| Rural | 0.34% | 0.14% | 0.55% | 0.49% |

## ENDNOTES

[1]Nominal tax rate is defined as being property tax as a percentage of tax base value.

[2]Property tax incidence refers to the distribution of property tax burden between the rural and urban areas and within the rural area.

[3]Effective tax rate is defined as being property tax as a percent of total property wealth.

[4]Tax rate computed using equation 6.1.

# CHAPTER VII

## SUMMARY AND CONCLUSIONS

The property wealth and property tax effects of many alternative land use policies are large. The effects are of great significance in the land use planning process. The redistirbution impacts of land use policies on property wealth and tax burden are of special importance in the consideration of alternative policies. Currently the magnitude of the property wealth and tax burden redistribution associated with many land use policies is not known. Therefore, planners are working with limited knowledge about an important factor which should be considered in the planning process.

The objective of this study is to estimate the redistribution of the tax base and tax incidence caused by a number of alternative land use policies. These objectives were accomplished through: (1) the identification and quantification of the factors affecting land value in the study area, (2) estimation of the magnitude of the effect of each factor, (3) development of a simulation system capable of estimating rural and urban land value associated with each alternative policy, and (4) comparison of estimated policy results with the current situation.

## Approach

The area studied includes 222 sections or 141,080 acres in and around the city of Stillwater in Payne County Oklahoma. Land use in the area is primarily either urban or agricultural. Urban use is concentrated on the 6,400 acres of the study area located within the current Stillwater city limits. The remaining acreage, located outside Stillwater, is rural land predominately in agricultural use with some intermittent residential development.

Sales data were collected on both urban lots and rural tracts within the study area. Relevant characteristics of each sale tract or lot such as date of sale, size of parcel, distance from Stillwater, etc., were recorded.

Multiple regression was used to quantify the relationships between sale tract or lot characteristics and value of those tracts or lots. The "best" regression models for estimating rural and urban land values were selected for use in developing the policy simulation system. The simulation system was developed to estimate value of all land in the study area in both rural and urban use. This system incorporates the coefficients from the explanatory equations and estimates of average values of each variable in each section into a system of predictive equations for urban and rural land value.

Current property wealth in the study area based on present Stillwater city limits was estimated using the system of predictive equations. Property wealth associated with alternative land use policies was estimated based on deviations they would cause from the current situation.

Estimated land wealth under alternative policies was compared to current land wealth in the study area. The distribution of land wealth between the rural and urban areas as well as within the rural area was estimated for each policy. The value of the tax base and the distribution thereof was also estimated for each policy alternative.

Finally, the property tax effects of each alternative policy were estimated based on two primary assumptions. These assumptions are that the nominal tax rate on all land in the study area is the same and that tax revenues in the study area with each taxation policy are equal to current tax revenues. Based on these assumptions, the nominal and effective tax rates on each type of land were estimated for each alternative policy.

## Policy Evaluation

The policies evaluated in this study were the following: (1) agricultural use valuation of all rural land in the study area, (2) equalization of rural and urban value of rural land in the study area through a special tax rate on urban development on rural land, (3) public purchase of all development rights on rural land, and (4) rural use zoning of all land outside the projected city limits of Stillwater in the year 2000. All of these policies were found to result in a redistribution of property wealth, tax burden, or both in the study area.

Use Valuation

The redistribution effect of use valuation of rural land on property wealth and tax incidence in the study area is significant. Use valuation with no change in nominal tax rate results in an estimated 4.6 percent increase in rural alnd value while urban land value remains constant.

With this policy estimated urban tax base value remains constant while estimated rural tax base value is reduced by 67 percent. Thus, tax incidence is shifted toward urban land.

The nominal tax rate at which estimated tax revenues with use valuation are equal to current estimated tax revenues is .55 percent. With this nominal tax rate, effective tax rate on urban land is .55 percent while effective tax rate on rural land is .14 percent.

Special Tax Policy on Urban Use of Rural Land

The redistribution effect on property wealth of a special tax rate to equate rural and urban value of rural land is an increase in relative property wealth in the urban portion of the study area. Estimated urban land value is the same as with current policy. Estimated rural value is reduced to rural use value, a 67 percent reduction from current value.

The effect of this policy on tax base is the same as its effect on land value. Therefore, there is no change in property tax incidence associated with this policy.

As with use valuation, the nominal tax rate at which tax revenues with this policy are equal to current tax revenues is 0.55 percent, 62 percent greater than the current rate. Effective tax rate on both rural and urban land with this policy is also 0.55 percent, 62 percent greater than current effective tax rates.

Public Purchase of Development Rights

The effect on property wealth of a policy of public purchase of all development rights on rural land is the same as that of the previous policy. Estimated urban land value remains constant while estimated rural land value is reduced by 67 percent.

The effect of this policy on the tax base is the same as its effect on property wealth. Thus, property tax incidence is the same as with current policy.

Current tax revenues are attained with this policy with an estimated nominal tax rate of .55 percent which is also the effective tax rate. Thus, with this policy both nominal and effective tax rate would be 62 percent greater than with current policy.

Rural Zoning

Rural zoning of land beyond the estimated Stillwater city limits in the year 2000 results in a 53 percent reduction in estimated rural property wealth. Urban property wealth with this policy is the same as with current taxation policy. Therefore, with this policy a larger proportion of total property wealth is located in the rural area than with current taxation policy.

The effect of rural zoning on tax base is the same as its effect on property wealth. Therefore, property tax incidence with this policy is the same as current property tax incidence.

The nominal tax rate at which tax revenues with rural zoning are equal to current tax revenues is 0.49 percent. Thus, both the nominal and effective tax rates are 44 percent greater with this policy than with current taxation policy.

## Limitations and Need for Further Research

The primary assumption upon which this analysis is based is that any restriction of development in one section of the study area has no effect on land use and property wealth in other sections of the area. For instance, a policy which limits the area in which urban development may occur through rural zoning is assumed to have no effect on the value of developable land.

In reality the price or value of developable land is determined by the supply of and demand for that land. Unless the demand curve for developable land is perfectly elastic a restriction of the supply of such land should result in an increase in the value of that land. Thus, all land use policies which restrict or encourage development in a given area should have an effect on the value of contiguous developable land. The neglect of these indirect effects may have resulted in an underestimation of the relative shift in property value associated with selected policy alternatives.

Future research in this area should concentrate on the effects of land use control policies on land value in areas surrounding the area where the policy is applied. Knowledge gained from such research could be used in making much more accurate estimates of the true effect of alternative policies on the distribution of property wealth and tax burden in and around the area to which the policies apply.

Further research should also take into account the administrative costs associated with alternative policies. Large tax rate increases may be necessary to provide funding for the administration of some policies. These policies, although desirable based on all other considerations, may be infeasible because of this factor.

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# APPENDIX

## QUALITY, URBAN DISTANCE, RURAL DISTANCE, TAX RATE PROXY, ESTIMATED URBAN PER ACRE VALUE, AND ESTIMATED RURAL PER ACRE VALUE, FOR EACH SECTION IN THE STUDY AREA

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 2 | 12.69 | 4.12 | 5.00 | 9393.81 | 621.96 | 18.67 |
| 2 | 18 | 2 | 14.35 | 4.00 | 4.00 | 9386.01 | 657.57 | 19.47 |
| 11 | 18 | 2 | 17.95 | 5.00 | 5.00 | 8981.95 | 641.81 | 22.03 |
| 12 | 18 | 2 | 16.53 | 5.10 | 6.00 | 8921.37 | 597.56 | 22.84 |
| 13 | 18 | 2 | 18.31 | 6.08 | 7.00 | 8478.84 | 549.26 | 28.94 |
| 14 | 18 | 2 | 19.46 | 6.00 | 6.00 | 8556.36 | 592.87 | 27.18 |
| 1 | 19 | 2 | 16.56 | 2.24 | 3.00 | 10204.81 | 723.24 | 18.47 |
| 2 | 19 | 2 | 22.04 | 2.00 | 2.00 | 10479.19 | 840.14 | 16.69 |
| 11 | 19 | 2 | 22.04 | 1.00 | 1.00 | 11493.33 | 901.12 | 16.69 |
| 12 | 19 | 2 | 27.52 | 1.41 | 2.00 | 11117.87 | 915.97 | 14.92 |
| 13 | 19 | 2 | 21.96 | 1.00 | 1.00 | 11440.51 | 892.58 | 17.37 |
| 14 | 19 | 2 | 27.52 | 0.0 | 0.0 | 11643.41 | 1081.20 | 14.92 |
| 23 | 19 | 2 | 27.87 | 1.00 | 1.00 | 11276.28 | 926.67 | 19.69 |
| 24 | 19 | 2 | 23.05 | 1.41 | 2.00 | 10624.77 | 795.76 | 22.10 |
| 25 | 19 | 2 | 27.87 | 2.24 | 3.00 | 9883.12 | 781.14 | 24.37 |
| 26 | 19 | 2 | 27.87 | 2.00 | 2.00 | 10160.37 | 845.86 | 21.81 |
| 35 | 19 | 2 | 18.30 | 3.00 | 3.00 | 9776.38 | 734.19 | 19.07 |
| 36 | 19 | 2 | 18.21 | 3.16 | 4.00 | 9563.61 | 674.60 | 21.71 |
| 23 | 20 | 2 | 21.74 | 5.00 | 5.00 | 8634.70 | 613.13 | 30.99 |
| 24 | 20 | 2 | 16.06 | 5.10 | 6.00 | 8838.79 | 577.40 | 24.75 |
| 25 | 20 | 2 | 15.63 | 4.12 | 5.00 | 9186.71 | 613.53 | 22.64 |
| 26 | 20 | 2 | 10.20 | 4.00 | 4.00 | 9248.72 | 591.92 | 22.12 |
| 35 | 20 | 2 | 14.13 | 3.00 | 3.00 | 9664.08 | 673.62 | 21.08 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 36 | 20 | 2 | 16.68 | 3.16 | 4.00 | 9227.08 | 599.48 | 29.60 |
| 1 | 18 | 3 | 16.36 | 8.06 | 11.00 | 7966.35 | 427.47 | 35.87 |
| 2 | 18 | 3 | 16.75 | 7.21 | 10.00 | 8211.19 | 470.18 | 31.39 |
| 3 | 18 | 3 | 27.18 | 6.40 | 9.00 | 8554.71 | 629.62 | 25.25 |
| 4 | 18 | 3 | 13.15 | 5.66 | 8.00 | 8580.84 | 484.41 | 28.38 |
| 5 | 18 | 3 | 11.19 | 5.00 | 7.00 | 8978.49 | 531.11 | 22.11 |
| 6 | 18 | 3 | 13.59 | 4.47 | 6.00 | 9012.20 | 556.29 | 24.34 |
| 7 | 18 | 3 | 13.35 | 5.39 | 7.00 | 8817.04 | 538.66 | 23.74 |
| 8 | 18 | 3 | 14.52 | 5.83 | 8.00 | 8639.72 | 516.12 | 25.83 |
| 9 | 18 | 3 | 16.98 | 6.40 | 9.00 | 8575.11 | 532.95 | 24.74 |
| 10 | 18 | 3 | 16.47 | 7.07 | 10.00 | 8393.75 | 499.90 | 26.55 |
| 11 | 18 | 3 | 23.36 | 7.81 | 11.00 | 7947.59 | 485.48 | 37.98 |
| 12 | 18 | 3 | 18.98 | 8.60 | 12.00 | 8051.21 | 473.48 | 30.37 |
| 13 | 18 | 3 | 17.73 | 9.22 | 13.00 | 7983.59 | 451.34 | 30.16 |
| 14 | 18 | 3 | 15.47 | 8.49 | 12.00 | 8144.80 | 455.17 | 27.92 |
| 15 | 18 | 3 | 14.72 | 7.81 | 11.00 | 8240.86 | 460.94 | 27.75 |
| 16 | 18 | 3 | 16.08 | 7.21 | 10.00 | 8398.13 | 501.27 | 25.84 |
| 17 | 18 | 3 | 17.69 | 6.71 | 9.00 | 8539.02 | 543.28 | 24.32 |
| 18 | 18 | 3 | 19.79 | 6.32 | 8.00 | 8450.96 | 549.32 | 28.47 |
| 1 | 19 | 3 | 14.72 | 7.28 | 9.00 | 8419.19 | 508.55 | 25.01 |
| 2 | 19 | 3 | 16.11 | 6.32 | 8.00 | 7965.63 | 413.86 | 47.50 |
| 3 | 19 | 3 | 15.83 | 5.39 | 7.00 | 8631.60 | 527.45 | 28.54 |
| 4 | 19 | 3 | 14.10 | 4.47 | 6.00 | 9133.53 | 583.71 | 21.68 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 5 | 19 | 3 | 17.55 | 3.61 | 5.00 | 9024.09 | 572.66 | 30.85 |
| 6 | 19 | 3 | 19.23 | 2.83 | 4.00 | 9464.73 | 642.28 | 27.02 |
| 7 | 19 | 3 | 19.16 | 2.24 | 3.00 | 10335.29 | 770.16 | 16.54 |
| 8 | 19 | 3 | 22.50 | 3.16 | 4.00 | 9634.10 | 729.24 | 20.37 |
| 9 | 19 | 3 | 14.06 | 4.12 | 5.00 | 9000.51 | 563.78 | 27.03 |
| 10 | 19 | 3 | 14.06 | 5.10 | 6.00 | 8689.61 | 529.13 | 28.68 |
| 11 | 19 | 3 | 15.12 | 6.08 | 7.00 | 8649.97 | 551.20 | 24.35 |
| 12 | 19 | 3 | 14.52 | 7.07 | 8.00 | 8530.93 | 537.95 | 23.07 |
| 13 | 19 | 3 | 15.50 | 7.00 | 7.00 | 7625.79 | 375.13 | 61.62 |
| 14 | 19 | 3 | 15.50 | 6.00 | 6.00 | 8369.69 | 516.79 | 32.89 |
| 15 | 19 | 3 | 17.07 | 5.00 | 5.00 | 8785.22 | 596.00 | 26.69 |
| 16 | 19 | 3 | 20.20 | 4.00 | 4.00 | 9212.20 | 683.95 | 22.89 |
| 17 | 19 | 3 | 32.02 | 3.00 | 3.00 | 10222.36 | 944.28 | 12.96 |
| 18 | 19 | 3 | 19.25 | 2.00 | 2.00 | 10273.11 | 779.29 | 19.82 |
| 19 | 19 | 3 | 21.90 | 2.24 | 3.00 | 10168.12 | 769.93 | 19.05 |
| 20 | 19 | 3 | 26.47 | 3.16 | 4.00 | 9709.16 | 781.39 | 19.05 |
| 21 | 19 | 3 | 18.78 | 4.12 | 5.00 | 9467.64 | 695.16 | 17.45 |
| 22 | 19 | 3 | 16.62 | 5.10 | 6.00 | 8970.98 | 607.75 | 21.77 |
| 23 | 19 | 3 | 18.49 | 6.08 | 7.00 | 8361.20 | 527.59 | 32.66 |
| 24 | 19 | 3 | 17.94 | 7.07 | 8.00 | 8386.81 | 543.17 | 26.74 |
| 25 | 19 | 3 | 18.46 | 7.28 | 9.00 | 8200.25 | 501.26 | 31.41 |
| 26 | 19 | 3 | 14.75 | 6.32 | 8.00 | 8724.61 | 552.97 | 21.61 |
| 27 | 19 | 3 | 14.80 | 5.39 | 7.00 | 8898.35 | 568.31 | 21.93 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 28 | 19 | 3 | 15.98 | 4.47 | 6.00 | 8903.79 | 559.61 | 27.03 |
| 29 | 19 | 3 | 17.72 | 3.61 | 5.00 | 9131.16 | 594.09 | 27.86 |
| 30 | 19 | 3 | 23.16 | 2.83 | 4.00 | 9578.39 | 701.11 | 24.37 |
| 31 | 19 | 3 | 17.60 | 3.61 | 5.00 | 9331.75 | 629.35 | 23.08 |
| 32 | 19 | 3 | 18.07 | 4.24 | 6.00 | 9009.96 | 588.34 | 25.92 |
| 33 | 19 | 3 | 20.27 | 5.00 | 7.00 | 8563.93 | 541.51 | 33.28 |
| 34 | 19 | 3 | 19.65 | 5.83 | 8.00 | 8596.28 | 558.34 | 26.98 |
| 35 | 19 | 3 | 17.32 | 6.71 | 9.00 | 8609.94 | 553.50 | 22.64 |
| 36 | 19 | 3 | 16.33 | 7.62 | 10.00 | 8251.27 | 486.35 | 28.26 |
| 19 | 20 | 3 | 16.35 | 5.39 | 7.00 | 8782.81 | 561.69 | 24.56 |
| 20 | 20 | 3 | 13.47 | 5.83 | 8.00 | 8660.23 | 509.76 | 25.30 |
| 21 | 20 | 3 | 12.88 | 6.40 | 9.00 | 8532.50 | 484.06 | 25.83 |
| 22 | 20 | 3 | 15.80 | 7.07 | 10.00 | 7813.76 | 373.29 | 49.34 |
| 23 | 20 | 3 | 17.05 | 7.81 | 11.00 | 8304.23 | 496.81 | 25.97 |
| 24 | 20 | 3 | 14.09 | 8.60 | 12.00 | 8035.17 | 421.85 | 30.90 |
| 25 | 20 | 3 | 14.88 | 8.06 | 11.00 | 8266.06 | 474.67 | 26.06 |
| 26 | 20 | 3 | 17.14 | 7.21 | 10.00 | 8355.99 | 503.33 | 26.99 |
| 27 | 20 | 3 | 15.52 | 6.40 | 9.00 | 8556.44 | 514.89 | 25.21 |
| 28 | 20 | 3 | 12.31 | 5.66 | 8.00 | 8725.68 | 504.20 | 24.55 |
| 29 | 20 | 3 | 16.33 | 5.00 | 7.00 | 8983.79 | 582.89 | 21.99 |
| 30 | 20 | 3 | 17.80 | 4.47 | 6.00 | 8837.41 | 564.99 | 28.84 |
| 31 | 20 | 3 | 20.68 | 3.61 | 5.00 | 8424.18 | 488.25 | 55.95 |
| 32 | 20 | 3 | 15.19 | 4.24 | 6.00 | 9354.42 | 622.75 | 18.73 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 33 | 20 | 3 | 15.80 | 5.00 | 7.00 | 8966.65 | 574.39 | 22.36 |
| 34 | 20 | 3 | 16.59 | 5.83 | 8.00 | 8801.59 | 567.70 | 21.99 |
| 35 | 20 | 3 | 15.40 | 6.71 | 9.00 | 8373.98 | 487.98 | 28.79 |
| 36 | 20 | 3 | 15.56 | 7.62 | 10.00 | 8052.49 | 437.89 | 34.90 |
| 1 | 18 | 4 | 16.88 | 13.60 | 17.00 | 7424.40 | 370.31 | 36.11 |
| 2 | 18 | 4 | 12.13 | 12.65 | 16.00 | 7461.21 | 324.13 | 37.62 |
| 3 | 18 | 4 | 13.88 | 11.70 | 15.00 | 7657.56 | 376.73 | 32.85 |
| 4 | 18 | 4 | 14.28 | 10.77 | 14.00 | 7708.45 | 382.91 | 34.15 |
| 5 | 18 | 4 | 14.65 | 9.85 | 13.00 | 7918.50 | 422.01 | 30.00 |
| 6 | 18 | 4 | 14.68 | 8.94 | 12.00 | 8072.36 | 444.19 | 28.38 |
| 7 | 18 | 4 | 14.49 | 9.43 | 13.00 | 7943.29 | 416.01 | 30.69 |
| 8 | 18 | 4 | 13.42 | 10.30 | 14.00 | 7796.24 | 383.34 | 32.61 |
| 9 | 18 | 4 | 15.44 | 11.18 | 15.00 | 7585.00 | 365.91 | 37.61 |
| 10 | 18 | 4 | 10.89 | 12.08 | 16.00 | 7602.29 | 332.99 | 33.72 |
| 11 | 18 | 4 | 15.97 | 13.00 | 17.00 | 7380.87 | 341.34 | 40.03 |
| 12 | 18 | 4 | 17.83 | 13.93 | 18.00 | 7294.43 | 345.24 | 40.93 |
| 13 | 18 | 4 | 26.09 | 14.32 | 19.00 | 7094.44 | 380.61 | 50.44 |
| 14 | 18 | 4 | 18.06 | 13.42 | 18.00 | 7444.75 | 375.37 | 35.82 |
| 15 | 18 | 4 | 11.11 | 12.53 | 17.00 | 7379.42 | 284.84 | 41.83 |
| 16 | 18 | 4 | 13.16 | 11.66 | 16.00 | 7573.88 | 341.19 | 36.29 |
| 17 | 18 | 4 | 14.92 | 10.82 | 15.00 | 7665.95 | 371.12 | 35.65 |
| 18 | 18 | 4 | 16.55 | 10.00 | 14.00 | 7626.61 | 370.82 | 40.80 |
| 1 | 19 | 4 | 13.18 | 13.15 | 15.00 | 7361.78 | 329.79 | 40.39 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 2 | 19 | 4 | 12.58 | 12.17 | 14.00 | 7496.03 | 346.50 | 37.79 |
| 3 | 19 | 4 | 11.32 | 11.18 | 13.00 | 7624.41 | 354.02 | 35.96 |
| 4 | 19 | 4 | 15.04 | 10.20 | 12.00 | 7852.84 | 430.82 | 30.97 |
| 5 | 19 | 4 | 15.74 | 9.22 | 11.00 | 7921.45 | 441.79 | 32.27 |
| 6 | 19 | 4 | 12.01 | 8.25 | 10.00 | 8065.79 | 423.44 | 31.39 |
| 7 | 19 | 4 | 16.35 | 8.06 | 9.00 | 7366.93 | 323.66 | 70.60 |
| 8 | 19 | 4 | 12.08 | 9.06 | 10.00 | 7562.69 | 337.05 | 49.21 |
| 9 | 19 | 4 | 16.46 | 10.05 | 11.00 | 7938.51 | 471.72 | 28.68 |
| 10 | 19 | 4 | 14.94 | 11.05 | 12.00 | 7720.59 | 419.13 | 32.72 |
| 11 | 19 | 4 | 12.94 | 12.04 | 13.00 | 7502.98 | 359.63 | 37.93 |
| 12 | 19 | 4 | 11.49 | 13.04 | 14.00 | 7475.89 | 346.65 | 35.71 |
| 13 | 19 | 4 | 12.29 | 13.00 | 13.00 | 7477.63 | 364.69 | 35.76 |
| 14 | 19 | 4 | 14.00 | 12.00 | 12.00 | 7663.77 | 416.03 | 31.70 |
| 15 | 19 | 4 | 11.62 | 11.00 | 11.00 | 7825.47 | 420.12 | 29.25 |
| 16 | 19 | 4 | 12.35 | 10.00 | 10.00 | 7791.90 | 411.91 | 33.89 |
| 17 | 19 | 4 | 11.69 | 9.00 | 9.00 | 7975.99 | 435.34 | 31.27 |
| 18 | 19 | 4 | 17.63 | 8.00 | 8.00 | 7837.71 | 454.21 | 41.67 |
| 19 | 19 | 4 | 15.22 | 8.06 | 9.00 | 8022.55 | 455.43 | 33.75 |
| 20 | 19 | 4 | 12.62 | 9.06 | 10.00 | 8033.16 | 443.53 | 29.19 |
| 21 | 19 | 4 | 15.34 | 10.05 | 11.00 | 7913.11 | 455.30 | 29.48 |
| 22 | 19 | 4 | 15.07 | 11.05 | 12.00 | 7539.91 | 380.74 | 40.16 |
| 23 | 19 | 4 | 14.57 | 12.04 | 13.00 | 7650.15 | 408.33 | 32.06 |
| 24 | 19 | 4 | 15.41 | 13.04 | 14.00 | 7562.07 | 404.55 | 32.34 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 25 | 19 | 4 | 17.69 | 13.15 | 15.00 | 7343.41 | 370.12 | 41.27 |
| 26 | 19 | 4 | 18.03 | 12.17 | 14.00 | 7448.81 | 389.67 | 39.92 |
| 27 | 19 | 4 | 15.74 | 11.18 | 13.00 | 7704.61 | 415.16 | 32.85 |
| 28 | 19 | 4 | 17.48 | 10.20 | 12.00 | 7872.56 | 459.08 | 30.31 |
| 29 | 19 | 4 | 19.38 | 9.22 | 11.00 | 8020.93 | 498.59 | 28.97 |
| 30 | 19 | 4 | 16.44 | 8.25 | 10.00 | 8204.46 | 495.72 | 27.09 |
| 31 | 19 | 4 | 15.83 | 8.54 | 11.00 | 8144.54 | 472.27 | 27.70 |
| 32 | 19 | 4 | 15.50 | 9.49 | 12.00 | 7946.22 | 439.00 | 30.39 |
| 33 | 19 | 4 | 15.93 | 10.44 | 13.00 | 7800.20 | 422.46 | 31.95 |
| 34 | 19 | 4 | 14.47 | 11.40 | 14.00 | 7594.22 | 372.43 | 36.39 |
| 35 | 19 | 4 | 13.04 | 12.37 | 15.00 | 7552.02 | 357.52 | 34.76 |
| 36 | 19 | 4 | 16.47 | 13.34 | 16.00 | 7355.66 | 354.99 | 40.01 |
| 19 | 20 | 4 | 15.19 | 9.43 | 13.00 | 7852.25 | 403.62 | 33.91 |
| 20 | 20 | 4 | 12.97 | 10.30 | 14.00 | 7665.50 | 350.54 | 37.75 |
| 21 | 20 | 4 | 13.15 | 11.18 | 15.00 | 7676.82 | 363.48 | 33.89 |
| 22 | 20 | 4 | 15.31 | 12.08 | 16.00 | 7594.77 | 375.02 | 34.01 |
| 23 | 20 | 4 | 16.84 | 13.00 | 17.00 | 7487.34 | 374.00 | 35.36 |
| 24 | 20 | 4 | 14.74 | 13.93 | 18.00 | 7487.10 | 360.45 | 32.67 |
| 25 | 20 | 4 | 14.83 | 13.60 | 17.00 | 7539.39 | 375.82 | 31.61 |
| 26 | 20 | 4 | 16.67 | 12.65 | 16.00 | 7591.46 | 397.93 | 32.38 |
| 27 | 20 | 4 | 16.71 | 11.70 | 15.00 | 7649.75 | 402.90 | 33.15 |
| 28 | 20 | 4 | 14.14 | 10.77 | 14.00 | 7738.47 | 387.98 | 33.02 |
| 29 | 20 | 4 | 16.94 | 9.85 | 13.00 | 7704.20 | 398.57 | 38.04 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 30 | 20 | 4 | 14.28 | 8.94 | 12.00 | 7643.93 | 348.81 | 45.50 |
| 31 | 20 | 4 | 19.91 | 8.54 | 11.00 | 7764.90 | 432.48 | 41.87 |
| 32 | 20 | 4 | 12.82 | 9.49 | 12.00 | 7818.39 | 385.36 | 34.97 |
| 33 | 20 | 4 | 12.67 | 10.44 | 13.00 | 7378.41 | 297.06 | 51.70 |
| 34 | 20 | 4 | 16.45 | 11.40 | 14.00 | 7699.45 | 415.03 | 32.30 |
| 35 | 20 | 4 | 17.38 | 12.37 | 15.00 | 7614.32 | 414.08 | 32.38 |
| 36 | 20 | 4 | 14.65 | 13.34 | 16.00 | 7480.19 | 365.09 | 34.60 |
| 1 | 18 | 5 | 16.50 | 19.42 | 23.00 | 6735.32 | 239.54 | 55.64 |
| 2 | 18 | 5 | 15.82 | 18.44 | 22.00 | 6668.14 | 210.92 | 64.41 |
| 3 | 18 | 5 | 18.15 | 17.46 | 21.00 | 6692.35 | 234.48 | 66.46 |
| 4 | 18 | 5 | 16.08 | 16.49 | 20.00 | 6777.83 | 235.44 | 63.61 |
| 5 | 18 | 5 | 17.78 | 15.52 | 19.00 | 7010.44 | 296.75 | 50.93 |
| 6 | 18 | 5 | 16.98 | 14.56 | 18.00 | 6975.69 | 273.90 | 57.25 |
| 7 | 18 | 5 | 17.69 | 14.87 | 19.00 | 7149.89 | 319.14 | 45.15 |
| 8 | 18 | 5 | 17.60 | 15.81 | 20.00 | 6986.22 | 285.94 | 51.38 |
| 9 | 18 | 5 | 17.90 | 16.76 | 21.00 | 6861.82 | 264.77 | 56.12 |
| 10 | 18 | 5 | 16.19 | 17.72 | 22.00 | 6733.09 | 221.93 | 62.01 |
| 11 | 18 | 5 | 17.77 | 18.68 | 23.00 | 7006.75 | 309.69 | 41.33 |
| 12 | 18 | 5 | 16.57 | 19.65 | 24.00 | 6907.39 | 279.01 | 44.13 |
| 13 | 18 | 5 | 16.98 | 19.92 | 25.00 | 6907.39 | 280.28 | 43.42 |
| 14 | 18 | 5 | 16.19 | 18.97 | 24.00 | 6927.48 | 272.29 | 44.80 |
| 15 | 18 | 5 | 16.53 | 18.03 | 23.00 | 7011.41 | 290.58 | 42.81 |
| 16 | 18 | 5 | 16.94 | 17.09 | 22.00 | 6927.16 | 268.86 | 50.56 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 17 | 18 | 5 | 16.50 | 16.16 | 21.00 | 7143.93 | 310.27 | 41.32 |
| 18 | 18 | 5 | 17.21 | 15.23 | 20.00 | 7246.79 | 335.06 | 39.08 |
| 1 | 19 | 5 | 16.87 | 19.10 | 21.00 | 7485.30 | 429.58 | 22.73 |
| 2 | 19 | 5 | 15.58 | 18.11 | 20.00 | 6835.66 | 259.81 | 53.05 |
| 3 | 19 | 5 | 15.73 | 17.12 | 19.00 | 7299.66 | 366.07 | 32.07 |
| 4 | 19 | 5 | 16.50 | 16.12 | 18.00 | 7324.90 | 373.82 | 33.35 |
| 5 | 19 | 5 | 12.68 | 15.13 | 17.00 | 7564.31 | 383.93 | 27.16 |
| 6 | 19 | 5 | 13.23 | 14.14 | 16.00 | 7461.21 | 359.91 | 33.07 |
| 7 | 19 | 5 | 15.59 | 14.04 | 15.00 | 7590.87 | 419.48 | 28.74 |
| 8 | 19 | 5 | 15.70 | 15.03 | 16.00 | 7498.40 | 406.20 | 29.52 |
| 9 | 19 | 5 | 17.88 | 16.03 | 17.00 | 7125.39 | 347.94 | 42.64 |
| 10 | 19 | 5 | 16.84 | 17.03 | 18.00 | 7137.75 | 345.99 | 39.17 |
| 11 | 19 | 5 | 16.06 | 18.03 | 19.00 | 7039.97 | 320.19 | 41.33 |
| 12 | 19 | 5 | 17.16 | 19.03 | 20.00 | 6984.13 | 322.40 | 41.61 |
| 13 | 19 | 5 | 11.69 | 19.00 | 19.00 | 7105.09 | 304.21 | 35.92 |
| 14 | 19 | 5 | 15.95 | 18.00 | 18.00 | 7043.69 | 327.36 | 41.22 |
| 15 | 19 | 5 | 16.22 | 17.00 | 17.00 | 7142.84 | 348.86 | 39.01 |
| 16 | 19 | 5 | 16.66 | 16.00 | 16.00 | 7402.27 | 407.99 | 30.72 |
| 17 | 19 | 5 | 16.59 | 15.00 | 15.00 | 7452.63 | 413.40 | 31.21 |
| 18 | 19 | 5 | 17.60 | 14.00 | 14.00 | 7574.28 | 444.79 | 29.38 |
| 19 | 19 | 5 | 16.67 | 14.04 | 15.00 | 7552.21 | 421.62 | 30.04 |
| 20 | 19 | 5 | 17.58 | 15.03 | 16.00 | 6776.57 | 255.11 | 70.90 |
| 21 | 19 | 5 | 17.09 | 16.03 | 17.00 | 7608.59 | 450.20 | 24.16 |

| LEGAL DESCRIPTION SEC | TWSP | RNG | QUALITY | URBAN DISTANCE | RURAL DISTANCE | URBAN VALUE @ACRE | RURAL VALUE @ACRE | TAX RATE PROXY |
|---|---|---|---|---|---|---|---|---|
| 22 | 19 | 5 | 17.81 | 17.03 | 18.00 | 7457.25 | 429.00 | 26.82 |
| 23 | 19 | 5 | 16.88 | 18.03 | 19.00 | 7110.26 | 344.90 | 37.93 |
| 24 | 19 | 5 | 16.50 | 19.03 | 20.00 | 7102.87 | 344.17 | 35.96 |
| 25 | 19 | 5 | 19.99 | 19.10 | 21.00 | 6776.67 | 293.70 | 53.77 |
| 26 | 19 | 5 | 16.82 | 18.11 | 20.00 | 7002.96 | 312.58 | 43.03 |
| 27 | 19 | 5 | 16.34 | 17.12 | 19.00 | 7146.46 | 336.56 | 38.53 |
| 28 | 19 | 5 | 16.50 | 16.12 | 18.00 | 7124.12 | 327.24 | 42.42 |
| 29 | 19 | 5 | 15.40 | 15.13 | 17.00 | 7447.10 | 384.65 | 31.09 |
| 30 | 19 | 5 | 17.60 | 14.14 | 16.00 | 7418.94 | 393.44 | 34.74 |
| 31 | 19 | 5 | 19.43 | 14.32 | 17.00 | 7320.34 | 383.28 | 38.45 |
| 32 | 19 | 5 | 13.93 | 15.30 | 18.00 | 7013.93 | 264.01 | 51.58 |
| 33 | 19 | 5 | 17.84 | 16.28 | 19.00 | 7424.74 | 404.13 | 29.34 |
| 34 | 19 | 5 | 21.65 | 17.26 | 20.00 | 7170.02 | 388.98 | 37.09 |
| 35 | 19 | 5 | 16.83 | 18.25 | 21.00 | 6951.28 | 294.95 | 45.49 |
| 36 | 19 | 5 | 17.19 | 19.24 | 22.00 | 6789.68 | 264.16 | 52.47 |

## VITA

Thomas Oneal Knight

Candidate for the Degree of

Master of Science

Thesis: AN ECONOMIC ANALYSIS OF THE PROPERTY WEALTH AND PROPERTY TAX EFFECTS OF ALTERNATIVE LAND USE CONTROL POLICIES

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Ardmore, Oklahoma, January 10, 1952, the son of Mr. and Mrs. A.L. Knight.

Education: Graduated from Fox High School, Fox, Oklahoma, in May, 1970; received the Bachelor of Science degree from Oklahoma State University with a major in Agricultural Economics in May, 1975; completed requirements for the Master of Science degree in December, 1977.

Professional Experience: Graduate research assistant, Oklahoma State University, September, 1975, to July, 1977.