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AN ANALYSIS OF LAND USE TRANSFERS, AGRICULTURAL PRODUCTION,
AND RURAL ZONING REQUIREMENTS IN SELECTED
UTAH COUNTIES, 1974 THROUGH 1976

by

Eldon James White

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Agricultural Economics

UTAH STATE UNIVERSITY
Logan, Utah

1978

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And to a loving wife who acted as personal secretary and gave unending encouragement during this project, I give special thanks.

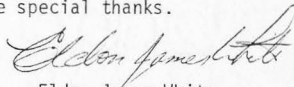

Eldon James White

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ABSTRACT

An Analysis of Land Use Transfers, Agricultural Production,
And Rural Zoning Requirements in Selected
Utah Counties, 1974 through 1976

by

Eldon James White, Master of Science
Utah State University, 1978

Major Professor: Dr. Lynn H. Davis
Department: Agricultural Economics

Increased incomes, better transportation, and the desirability of country living all create the demand for land in the agricultural-urban fringe areas to increase. High land values, low returns on investment, and residential encroachment place farmers in a situation where continued agricultural production is difficult. As ownership transfer occurs, the use of land is often changed. This study is directed at measuring the effects of ownership transfers in rural areas of rapidly urbanizing counties on the local agricultural industries, and the effect of zoning requirements on these transfers.

The study sample consisted of land buyers recorded at the Utah State Tax Commission. Data were obtained from (1) a mail questionnaire sent to the recorded land buyers, (2) soil classification, and (3) zoning requirements.

General conclusions from the study were:

1. The average land buyer was a professional, managerial or technical middle-aged worked with an annual income of twice the average

income in his area.

2. Over three-fourths of the land involved in the transfer was in agricultural use. After the transfer, one-fourth of the agricultural land changed use.

3. Area zoning requirements may have altered the development pattern and acreage bought, but no conclusive results were obtained.

The study's conclusions apply only to recorded land transfers on file at the Utah State Tax Commission for the years 1974 through 1976.

(100 pages)

INTRODUCTION

Recent studies completed at Utah State University indicate that a land use change is occurring in rural Utah counties (Snow, 1975). A conference for rural governmental leaders on population distribution has confirmed this conclusion, signifying that a rural to urban migration has begun to reverse itself. Agricultural land surrounding metropolitan areas has seen rapid land use transfer from agricultural use to residential use (Beale, 1975). These rural communities are increasing in population, yet the number of individuals in these areas actually engaged in the farming industry is declining. Land initially being used for agricultural purposes is rapidly being changed to non-agricultural uses.

Pressure for land use transfers is exerted largely in the urban-rural fringe areas. These areas are characterized by being predominantly open agricultural land interspersed with rapidly developing residential areas. The proximity of markets, employment opportunities and labor pools, together with better and faster transportation facilities create a demand for the use of this land to be altered. The increasing affluence and mobility of our modern society make this outward migration to the urban-rural fringe areas possible. Lower land prices, less crime, less congestion and lower pollution, among other factors, make this relocation desirable (Hushak and Bovard, 1975).

The interspersing of residential developments among land areas being used for agricultural purposes is known as urban sprawl, or

perhaps more clearly defined, suburban sprawl. Suburban sprawl creates several problems for the planning boards and county commissioners in affected counties. The most visible evidence of the land use transfer trend is agricultural land being broken up for residential subdivisions. This use transfer is also evident in the reduction of agricultural production in these areas. This situation is compounded by the economic loss to the business sector. These land use transfers also create problems of land use conflicts. Relocated residents enjoy the environmental amenities of rural life but do not accept the often unpleasant side effects of agriculture production (e.g., unpleasant odor from confined livestock, methods of waste handling, open-ditch irrigation hazards, etc.).

To solve some of these problems, many local leaders have turned to zoning to regulate land use. Zoning regulations provide an element of land use control on the local level and are widely used throughout the state of Utah. Through zoning, land can be reserved and restricted for a particular use subject to control by the local county commissioners or city councils (Block, 1968).

The effect of rapid land use transfers on predominately agricultural land in urbanizing areas was analyzed in this study. It was hypothesized that conditions enabling an active land market in rural areas results in the local agricultural industries. This study identified the general characteristics of these effects and estimated the land buyer demand for land for agricultural uses.

This study also analyzed the interaction between area zoning regulations and land use transfer trends in selected counties in Utah.

Many county planning commissions in Utah have adopted large lot restrictions in their zoning ordinances, while other counties have one acre or less restrictions. Some counties maintain rigid exclusionary agricultural zones, and others have no zoning restrictions at all. It was hypothesized that some restrictive zoning policies, aimed at protecting agricultural production, cause more land to be taken out of agricultural production and the land use changed to residential use than would otherwise occur. It was also hypothesized that some policies cause more dispersion of development. This study identified two types of area zoning restrictions which were in effect in rapidly-urbanizing areas and measured how these restrictions affected local land use transfer trends and development patterns.

OBJECTIVES

The objectives of the study were:

1. To ascertain the general characteristics of landowners and parcels of land which were involved in ownership transfers and subsequent use transfers along the rural-urban fringe areas in rapidly urbanizing counties.

2. To identify the general characteristics of agricultural production in the rapidly urbanizing counties, and to estimate the land buyer demand for land for agricultural uses resulting from land use transfers.

3. To measure the influence of area zoning regulations for residential development on land purchasing decisions, rate and pattern of land use transfers, and agricultural production.

REVIEW OF THEORY

Generally accepted theories of land rent determination, location equilibrium and land market equilibrium will be discussed in this section. An understanding of these principles is important to the analysis of land use development and transfer patterns. The principles are the base or starting point and will be expanded upon by illustrating the interactions between residential and agricultural land use.

Land rent, use, and equilibrium theories

Theories of land rent determination explain how values are placed on land and why rents differ between locations. A simple model of land rent analysis for agricultural land will be used to introduce distance in establishing land use patterns. An expansion of the agricultural land-rent theory will then be made to develop the bid-rent theory of residential land use. Finally, the theory of land market equilibrium between two uses, agricultural and residential, will be discussed. This theory will review the process of spatial ordering of uses in the land market, how much land will be allocated to each use, and conditions for land market equilibrium.

Land rent. The formal theory of land rent began, to a large extent, with the discussion of agricultural rent by David Ricardo at the beginning of the nineteenth century (Ricardo, 1817). Ricardo assumed that all land surrounding a market center is suitable for production and that this land varies in fertility. The land is given

a classifying number according to the fertility of the soil and all the land of the same fertility is in the same class. He assumed also that the amount of labor, and other non-land inputs, are fixed per acre of land (i.e., fixed proportions production function), and are not dependent on the level of fertility. Finally, he assumed that land available for agricultural production is not suited for any other use.

Ricardo illustrated that the most fertile land is brought into production first. As the demand for production increases, more land is brought into use. When all the land of the highest fertility class is brought into production, land of the next highest fertility class is brought into use. Rent accruing to the most productive land is based on its advantage over the less productive land. Competition among farmers will assure that all the land of one fertility level will be fully used before any land of a lower fertility level will be brought into production, also that the full advantage of productivity will go to the landlords in the form of rents.

In 1826, Johann H. von Thunen developed the theory of land rent more fully (von Thunen, 1863). Whereas Ricardo emphasized land rent determination in terms of fertility differentials, von Thunen based his analysis of differing land rents on the distance from the market area around which land is situated, the highest bidder for the land at a certain spatial distance from the market center will use the land. As distance is increased, costs of transporting goods to the market center become larger. Therefore, as distance is increased, the rent available for land decreases. At some distance from the market center,

total non-land costs of production, including transportation costs, will just equal the price of the goods. At that point rent will be zero.

Dunn (1954) and Isard (1956) follow von Thunen's theory of land rent determination by recognizing that the most important factor in determining the use of land is the rent commanded for that land. The use which can pay the highest rent for land will use it. A single firm producing a single good will have a bid function derived from the following formula:

$$R = Q_a (P_a - C_a) - Q_a Ut \quad [1]$$

In this equation, rent is expressed as a function of distance. (R) is rent per unit of land. (Q_a) is output per unit of land. (P_a) is price per unit for the output at the market center. (C_a) is total cost per unit of output. (U) is distance to the market center, and (t) is transportation cost per unit of output per unit of distance. Rent decreases linearly as distance is increased. The decrease in rent resulting from one unit increase in distance is the marginal rent per unit of distance. The bid function could be referred to as the marginal rent curve. At any distance from the market center, rent will be equal the value of the marginal product (VMP) of land at that point.

Classical (Ricardo/von Thunen) theory and neoclassical (marginal productivity) theory were originally viewed as completely opposing approaches to the determination of land rent. Classical theorists explain land rents in terms of fertility differentials or locational

differentials. Neoclassicists suggest that land rents are measured by the value marginal products of the land, when equating VMP equal to the rental rate.

Wicksteed (1955) and Wicksell (1934-1935) conducted studies to correlate the two theories into a common theory of land rents. Their theory suggested that land rents can both exhaust residual revenues and still equate VMP to rental rates. Based on Euler's Theorem¹ it was shown that the sum of the costs of the inputs equals total receipts. The results indicated the similarities of the two classes of thought with constant returns to scale production functions. Wicksell tested the theory further and concluded that the above holds true even if the production function doesn't have constant returns to scale.

Most modern economists discuss land rents in a manner similar to the form set forth above. Modern theory of land rent assumes that supply of land is fixed and price is determined by shifts in demand for the product. If the demand for the land were to shift downward, the same quantities of land would be used but at lowering prices until rent equals zero. Rent is the payment above the minimum necessary to attract a given amount of land (Mansfield, 1975).

Agricultural land use model. A simplified agricultural land use model is introduced to illustrate what rent is received when producing a single crop at a given spatial distance from the market. Distance

¹Euler's theorem states that if the production function has constant returns to scale at all input and output combinations, every possible combination of inputs and output will satisfy the following:
 $X = MP_L(L) + MP_K(K) + MP_N(N)$.

is then altered to determine the rents received as distance is increased away from the market. Finally, a multiproduct model will indicate how land is to be allocated among more than one crop given a certain fixed market.

Consider a potential individual operator of a single agricultural firm. Before he begins production he is faced with decisions regarding the location of his enterprise, the variety of crops to be produced, the best combination of resources to use in production, and the optimum level of output (Isard, 1956).

The farm operator is faced with a production function which has an area of increasing returns to scale, followed by constant returns to scale, and finally decreasing returns to scale. The price received by the farmer is set in the market center and the farmer takes the price as given. To the farm operator the costs of production, excluding transport costs, will remain the same no matter where he locates in the land market. The goal of the operator will be to maximize rents.

The operator will begin by estimating the cost curves for a single crop. This is illustrated in Figure 1. MC and AC are the estimated marginal cost and average cost curves. Price line E is price of the good at market center and price line D is price received by the operator (market price minus commodity transportation costs per unit of output). In this case MC and AC curves are estimated where the price of the land is zero. Production is then expanded until MC is equal to the price the farmer received at his production site. This will be at Q_1 in Figure 1. Total surplus of revenue over total costs is equal to the area ABCD.

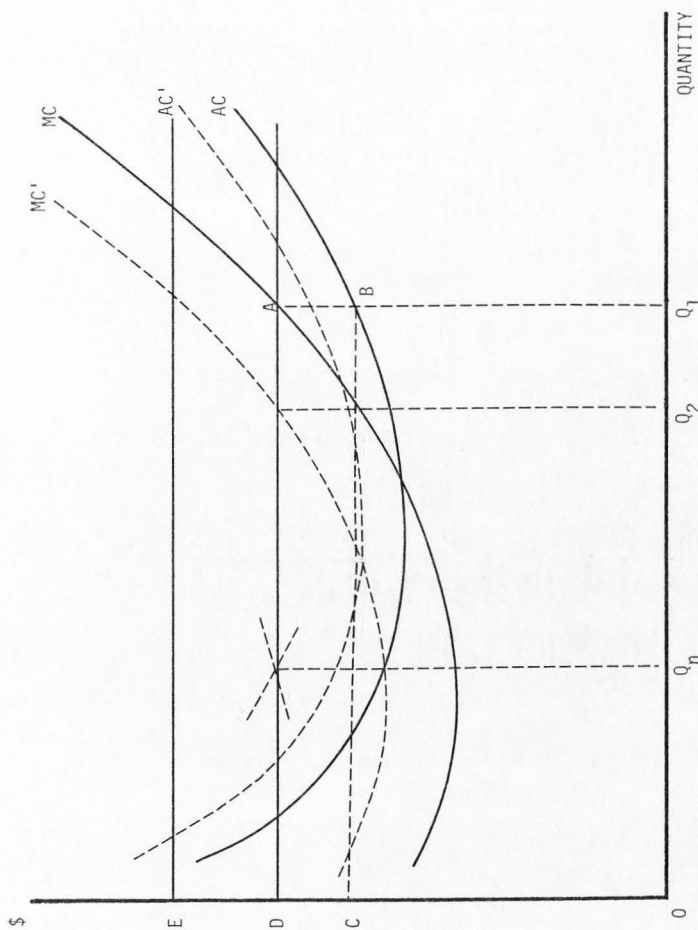


Figure 1. Cost curves for a single crop.

The price of land will not be positive. This positive price for land will be included in the cost schedules, and will shift the marginal cost curve and average cost curve up to MC' and AC' , respectively. Surplus of revenues over total costs no longer measure the total rent received. As the curves were shifted, part of the rent was included into the cost of production. Output is reduced from Q_1 to Q_2 as land rents become a positive value.

Equilibrium condition will occur where maximum rent is included in the cost schedule. This will shift marginal cost and average cost curves until marginal cost, average cost and local price are equated. That is: $MC = AC = \text{Local price}$. This will result in output Q_n as illustrated in Figure 1.

The equilibrium process followed by an individual farm operator producing a single crop located at a certain distance from the market center was described above. This same analysis can be used to describe the equilibrium condition which will result for the same farmer but locating at different distances from the market. Referring back to Figure 1, the marginal cost and average cost curves will remain unchanged. As distance to market center is increased, the price the farmer receives will be less. This will shift the local price curve downward. As the equilibrium process occurs, the overall equilibrium level of output will be the same as the original location but more land will be used in relation to non-land inputs. As the operator moves closer to the city center, equilibrium will result with less land and more non-land inputs being used.

At distances close to the market center, rent received per acre will be higher than at distances further from the center. With the

same level of output at all locations and with production costs remaining constant, the closest location still has lower transportation costs, and residual revenues (rents) will be greater. Likewise, as distance is increased, transportation costs become larger, reducing the rents received. Rents are therefore a function of distance and transport costs for agricultural production.

In a multiproduct situation, the individual producer will be faced with separate MC and AC curves for each product. Prices received by the operator will differ by the difference in original prices at the market center, and by the difference in the cost of transporting the goods. The combination of inputs and scale of output would be adjusted to the optimum equilibrium for each crop and a schedule of rents received by each crop would be determined at each distance from the market. From this schedule a bid-rent function could be developed showing the relationship between distance and rent. Bid-rent functions for two crops are illustrated in Figure 2. Marginal rent received by crop A is depicted by the curve AB, and marginal rent received by crop B is curve CD. The producer would not be willing to produce crop B at a distance less than that distance depicted at point E. If he were to produce at a distance to the left of point E, he would forgo rents that could be obtained by producing crop A in that region. The relevant area of production for crop A will be from point O to point E, commanding rents in the range from point A to point F. Crop B will be produced from point E out to point D receiving rents from point F to point O.

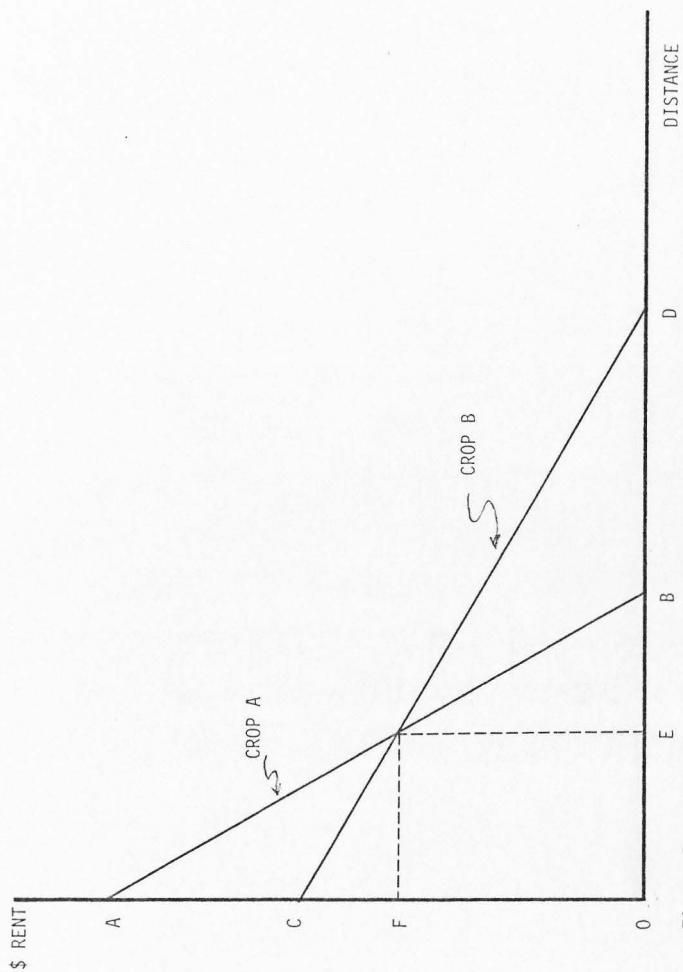


Figure 2. Bid-rent functions for two crops.

In summary, optimum level of output and combination of inputs, as well as rent and distance from the market, can now be determined for each crop an operator may decide to produce. A land-rent map can be constructed from rent and distance information.

Every individual agricultural producer does not approach the location decision in the same manner as was done in this section. All points on the MC or AC curves may not be readily measurable, or one crop cannot be compared to another, yet decisions are made as if all the necessary information is available.

The equilibrium process is enhanced by the relative freedom of entry and exit from agricultural production. A farmer will be forced to produce the crop which is feasible at a particular distance, force him to relocate at another location where he could produce his desired crop, or causes him to cease production if he persists at that location. Thus, for one distance from the market center there exists a farm operation which optimizes enterprize size, intensity of land use, and ratios of factor inputs which yields maximum rents per acre.

Residential bid-rent model. The basis for the residential bid-rent model was developed in large part from early theories of agricultural land rent and firm location theory. There exists a close relationship between location equilibrium analysis discussed in theories of agricultural land rent and location decision, and the theory of consumer equilibrium (Alonso, 1964).

The farm firm is motivated by trying to maximize rents. Goods and services are produced using land, labor, and capital and are sold at the market for market price. Optimum combination of these inputs and scale of production yields maximum rents per acre of land. The

management's decision of how much land to use, at what distance from the market center to locate, and optimum level of production are all solved in an effort to maximize rents.

The consumer is motivated to maximize utility. A budget constraint, measured as the value of time spent working in the market, is allocated among his choice of goods and services. The individual household tries to obtain the highest level of utility, given the budget constraint. Utility is commonly discussed in terms of indifference curves (Mansfield, 1975). The point of tangency between the budget constraint curve and the individual's highest indifference curve is the equilibrium solution for the individual household. This equilibrium solution dictates distance from the market center, quantity of land, and percentage of income spent on land and all other goods. From this solution a bid-rent function, similar to the land-rent function for agricultural land, can be developed. A price for land can be determined at every distance from the market by multiplying income available by percentage of income spent on land at that distance, then dividing that value by the quantity of land purchased at that distance. This will result in a rent per acre offered by the individual. This bid-rent curve for residential land can be graphed in a distance-rent space.

Mills (1972) illustrated that the bid-rent function for the household is steeper close to the city center than in the suburbs. Suburban residents will also tend to purchase larger quantities of land to achieve the same level of utility as those living within the market center. This implies that the population density will be less as

distance from the market center is increased.

Mills indicated that an increase in income in the urban area will increase the demand for housing in the suburban regions. Assuming the income elasticity of demand for housing is greater than 1.0, as income rise demand for housing may cause the price of housing to rise, but the effect of increased income on housing demand will not be completely offset by the price rise. The excess demand for housing in the urban area will then spill over into the suburban area, creating rapid growth there. Mills also illustrated that a reduction in commuting costs will tend to flatten the bid-rent function. With lower commuting costs, income remaining for other expenditures will be greater. This is the same effect as a rise in income.

In summary, optimum combination of land, all other non-land goods and distance will occur where the budget constraint for the individual is tangent to the highest attainable indifference curve. From this equilibrium situation rent and distance parameters for a bid-rent function can be determined. Bid-rent functions generally have a negative slope. The actual slope of the curve depends on individual's tastes and preferences and upon marginal cost of commuting to the market. The slope of the function may be altered by a change in income or cost of commuting.

Land market equilibrium. Both the land-rent curve in the agricultural use, and the bid-rent curve in residential use are defined by the same parameters, i.e., dollar rent and distance. By combining the two curves on one graph, the market equilibrium solution for agricultural and residential use in the land market of a city and its surrounding

countryside can be ascertained.

Location of the agricultural producer or household is dictated by the point of tangency between price structure and their lowest rent curve (Alonso, 1964). Every user of land will therefore locate according to this point of tangency. The relevant price structure is the envelope of the highest price bid for land at each distance from the city center. The individual producer will locate where maximum rent attainable from production is equal to a point on the relevant price structure.

For market equilibrium to occur, two conditions must be met. First, all land up to the edge of use must be sold, and second, the amount of land sold must be equal to the amount available at that distance. This first condition requires that no land be left idle when a positive rent could be received. If speculation were to be excluded, the rational individual (land owner) would not hold land out of production when a positive rent could be received. The second condition is a logical requirement, no more of a good can be sold than is available. Overall market equilibrium will be achieved when (1) the user of land is indifferent as to the land which is now occupied and any other land which could be occupied, and (2) no landlord can increase revenue by changing the price of land.

Market equilibrium can be illustrated graphically by combining the bid-rent curve for residential use and land-rent curve for agricultural use. These curves represent the aggregate industry-wide curve for each use. As can be seen from Figure 3, the residential bid-rent curve is above the land-rent curve at distances close to the

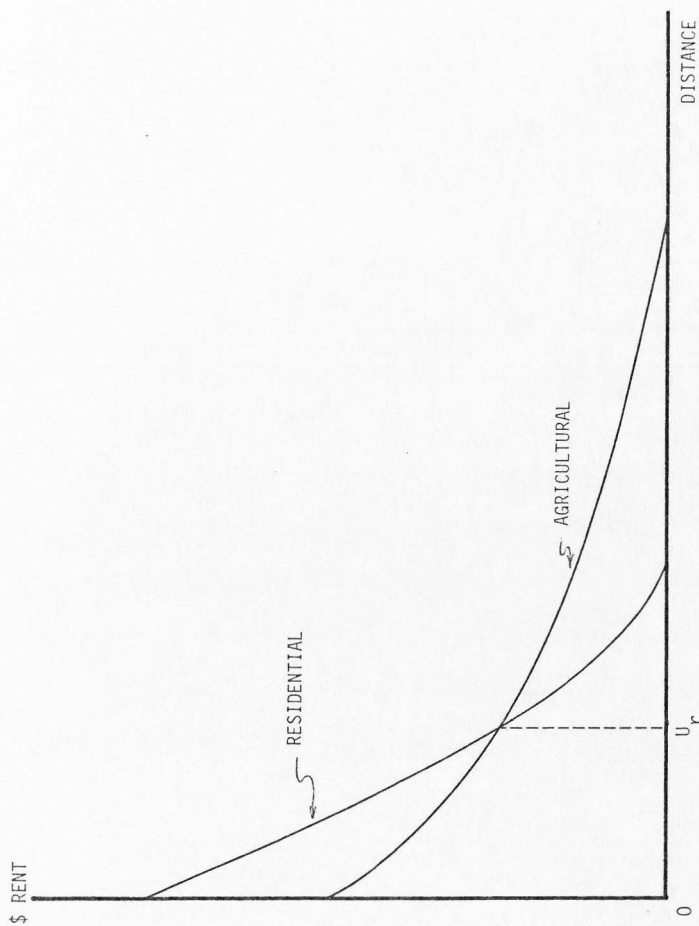


Figure 3. Ordering of land uses.

market center, and its slope is steeper. Ordering of land uses is determined in the same manner as the ordering of two crops in the agricultural mode. Land up to distance U_r will be used for residential purposes. Agricultural producers will use land at distances greater than U_r .

Given several uses for land, ordering becomes more complicated, and becomes almost incomprehensible when all possible combinations of uses between and within each aggregate use is allowed to be considered. Alonso (1964) developed the theory of land use ordering according to steepness of the separate rent functions. This theory became somewhat more complicated when the shapes of the bid-rent curves are allowed to be altered. It is possible that the slope of the curve would be steep close to the market and become less steep as distance is increased, to a certain distance, then become steeper once again. This situation would lead to crossing of the next lowest rent curve in more than one location.

The preceding discussion pertained to a wholly static situation with very rigid assumptions. In the real world almost everything is in a dynamic state. Introducing change into the model allows for the shifting of the relevant rent functions, creating a new land use pattern.

REVIEW OF LITERATURE

In the previous section a cursory review of land use theory was presented. The purpose of that section was not to review current literature, but rather to acquaint the reader with the background upon which current literature is based. This section will now review current literature in the area of land use transfer patterns, current trends in agricultural production, and methods of land use control and their effects on agricultural land preservation.

A publication written by Beale (1975) discussed the migration trends in the United States. After World War II, metropolitan areas experienced rapid population growth. Natural population increases accounted for some of this growth, but a larger percentage resulted from a general migration from rural to urban areas. Technological advancements in agriculture freed many laborers from farm work. These laborers were attracted towards metropolitan areas where rapid industrial growth provided jobs at higher wages.

During the 1960's several signs indicated that a reversal in the migratory trend was occurring. Beale used data from the Bureau of the Census, County Estimates, to illustrate that new trend. During 1970-1973 non-metropolitan areas gained 4.2 percent in population while metropolitan areas gained only 2.9 percent. The hypothesis was proposed that metro-sprawl into non-metro areas would account for this non-metro increase. However, even when adjustments were made for metro-sprawl, non-metro areas grew 3.7 percent as compared to 2.9 percent in metro areas.

Several factors were discussed as being important in enhancing in-migration to rural non-metro areas. Small rural economies have been stimulated by the decentralization of manufacturing activities. This has increased employment opportunities as well as stimulated local business and residential demands. In some rural areas in the United States, increased recreation and retirement activities have resulted in extremely rapid in-migration. Among non-economic factors, a change in attitudes towards residential preferences may be of extreme importance. Recent public polls indicate an unrest among metro dwellers in regards to urban life styles. Over sixty-five percent of these urbanites said they preferred a nearby rural or small town residence over their current urban residence. "General affluence, low total population growth, easy transportation and communication, modernization of rural life, and urban populations massing so large that they diminish the advantages of urban life--these factors may make a downward shift to smaller communities seem both feasible and desirable" (Beale, 1975).

Hushak and Bovard (1975) conducted a study, for Ohio Agricultural Research and Development Center, to estimate and analyze demand determinants for undeveloped farm land along city boundaries, in suburbs, and partially developed countryside surrounding cities. Data were obtained from the Ohio State Board of Tax Appeals for counties including a 25 mile radius of Columbus, Ohio. Information was gathered about the: (1) location of parcel, (2) type of local government, (3) assessed value of the land and buildings, (4) selling price, (5) acreage, and (6) zonal requirements. A micro, point in time, urban model was developed to estimate the demand function. The

general form of the demand function was:

PRICE = F (size, distance to city, distance to access highway, distance to railroad, location, zone restrictions, tax, other characteristics)

Price for the land did not include cost for buildings and improvements.

General results indicated that per acre land values decline with increasing size of parcel. Values for residential land declined \$200 to \$1,150 per acre for each additional mile from the urban center. Commercial land declined more rapidly than residential land as distance was increased. Location of the parcel near an access highway or railroad were both significant at the 10 percent level for residential usage, but commercial land was more valuable closer to access highways and railroads. Zoning laws greatly affected the value of the land for different uses. Land zoned for commercial uses was valued at \$13,500 more than residential uses. Property taxation was significant and negatively related to land value. A one mill increase in the real property tax rate was estimated to decrease land value per acre by \$146 to \$592. Further proposed areas of study included studying the effects of differing zoning and property tax policies on land values.

A study conducted by Snow (1975) gathered general characteristics about changes in land use in the state of Utah. Objectives of the study were:

1. To determine the characteristics of Utah lands being transferred such as location, land-use and improvements on the land.
2. To determine what land-use changes have recently taken place,

what land-use changes are anticipated in the future, improvements added since the purchase and improvements planned in the future.

3. To determine the motives of the buyers for purchasing rural land, their annual income, occupations, residence and age.

4. To determine the effect of location and land-use on land prices.

Date for this study were obtained through a mail questionnaire sent to buyers of land between 1969 and 1971 in rural Utah counties. Counties with high levels of urbanization were excluded from the study.

The number of ownership transfers increased significantly each year of the study. Sixty percent of land which was involved in ownership transfer was in agricultural use. The most active land market was located within city limits, followed by open countryside. In the open countryside the largest number of parcels were located near hunting areas, fishing and public land. Land originally in agricultural use was found to be transferred largely to residential and recreational uses. Upon ownership transfer, only 18 percent of the buyers did not add improvements to the parcel. Personal residences and fences were the most frequent improvements. The most frequent motives for buying the land were for investment and retirement purposes. The northwest and northeast regions of the State experienced the largest number of transfers. Further studies on the effect of land-use transfers on agricultural production, recreation, and provision of public services was recommended.

To measure the urbanization of land in the Western States, Dill and Otte (1970) obtained air photographs from the Agricultural

Stabilization and Conservation Service (ASCS). These photos were used to establish and compare land uses between 1960 and 1970. The study area included counties in Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, and Washington. In the forty-eight counties studied, about 465,000 acres were found to have shifted to urban uses over a time span of eleven years. Seventy-five percent of the land being urbanized was devoted to crop production, usually of high valued irrigated crops. Overall, eighty-four percent of the land which was urbanized was transferred to residential use. This study concluded that urbanization of rural land did pose a possible threat to agricultural productivity in the study counties.

Zeimetz et al. (1976) approached the land-use transfer situation on a national level. Fifty-three counties were selected throughout the United States based on rapid population growth and having ASCS aerial photographs available for two years with a ten-year interval. From the ASCS maps twenty points per square mile were selected at random with the same point being used for each year. Twelve land use categories were distinguished and net acreage changes between these land uses were measured

That study indicated that national land-use patterns have not changed dramatically during the study period. Urban uses increased by only 3.5 percent between 1960 and 1970. Cropland was shown to decrease by 2.5 percent, but only forty-nine percent of this decrease was a transfer into residential use. In urban areas the trend in residential land use was more intensive rather than using more land. Less land is being used per person for residences in 1970 than in 1960.

Another study aimed at measuring major changes in land use was conducted by the State Mountaineers for Rural Progress Land Use Committee (1976). This study described some of the significant land use changes which had occurred in the state of Virginia between 1970 and 1974. Mail questionnaires were sent to county assessors, county planning commissions, and county Mountaineers for Rural Progress Units. Eight major land use categories were identified: (1) recreation, (2) housing, (3) extraction, (4) industrial, (5) commercial, (6) community facilities, (7) public utilities, and (8) transportation. Land throughout the state was then measured as to land use transfers between uses. Comparisons were also developed between income, population density, and/or land-use regulations.

Land being reconverted from farmland to forest accounted for the largest percentage of change. In counties with large or rapidly growing population, land use predominately transferred from agricultural to residential uses. There existed a significant change in land-use patterns in Virginia. Very few of those changes resulted from articulated land use policies.

Gray (1975) addressed some of the economic and social aspects of agricultural land use preservation. The question of agricultural land preservation was analyzed from the standpoint of: (1) why does land change from one use to another?, and (2) is there something special about agricultural land which makes it desirable to preserve?

Over the past twenty-five years there has been a gradual decline in total cropland base in the United States. It was estimated that in 1974 a total of 331 million acres were in cropland use. This

cropland base is not fixed as to its size nor is it very static in nature. In 1973, when agricultural prices rose drastically, 29 million acres of cropland were added in just that one year. The amount of land being taken out of agricultural production for other uses is hardly significant when compared to the quantity of marginal agricultural land being abandoned each year or the acreage reclaimed and brought into production by private reclamation efforts.

Economic pressure is the most prevalent reason for land use transfer. Increased population growth and large price differentials between agricultural and residential usage are the main pressures exerted on agricultural land. These pressures make farming more costly, and make selling farmland more rewarding.

Agricultural land use serves the community in many ways. Local food production isn't as important now as it was after World War II, yet locally grown fruits and vegetables provide seasonal competition and are significant to local economies. Land is needed for further expansion, not only in this century, but centuries to come. Open land is also needed to maintain aesthetic values. Finally, agriculture provides employment and economic stimulus to otherwise declining rural communities. Gray (1975) estimated that for each dollar received by the immediate farm communities from a final purchaser, an additional two dollars of economic activity is stimulated.

Knowing how uses are transferred and that preservation is desirable still does not answer the question of "what tools should be used to preserve (agricultural) land." This question was posed as an area for future study.

Seitz (1974) agreed with Gray as to the National picture of land use. In the United States, the cropland base decreased from 403 to 376 million acres during the time period from 1944 to 1964. On the average, 2.6 million acres of cropland use were abandoned each year. At the same time, 1.3 million acres were added to the cropland base through reclamation. This resulted in a net decrease of 1.3 million acres per year over the study period.

An increase of 80 million people to the population would require an estimated 20 million acres of additional land. One-half of this 20 million acres increase would be expected to come from the cropland base. This reduction in the cropland base figures to be only 2-3 percent of the total cropland base. On the national level, the assumption that agricultural production is threatened by the conversion process is not founded. However, in certain specific regions, the conversion process may induce large acreages of productive agricultural land to be taken out of agricultural production.

Seitz (1974) then measured land uses, via aerial maps, for the Decatur, Illinois area for 1950 and 1970. During this time period, roughly 4,000 acres were transferred to residential usage. Given the rate of growth, the actual city development pattern was compared to a model development pattern. The model pattern did not allow for any idle or speculative uses for land. By 1970 the actual area of development in the city covered 11 square miles. Using the model, the projected city size would cover only 6 square miles. The effects of this discontinuous development was then measured in terms of extra costs to local residents and to local governments. These extra costs amounted

to over \$4 million in initial costs and over \$10 million in annual operating costs. It was estimated that 57.5 percent of these extra costs were born by initial residents while 42.5 percent were borne by others.

The goal of society should be to devise land-use policies that will have significant positive aesthetic value, that will reduce the cost of operating urban areas, and that will preserve agricultural land in the face of possible needs in the long run without significantly impeding the progress of society.

Cotner (1977) places the National food capacity argument into perspective. Then he addressed the agricultural land-use issues at the state and local levels.

The United States is not running out of cropland. Farmers are now cropping about 367 million acres, out of 385 million acres available for cropping. About 27 million crop acres are taken out of cropland use each year, with 500,000 acres going to urbanization and development of public facilities while 22 million acres are converted to more extensive uses such as grass and trees. An additional 1.3 million acres are added to the cropland base each year through expanded irrigation, drainage, land clearing, and development of dryland farming. Therefore, a total of about 1.4 million acres is lost from cropping each year. This loss of cropland is augmented by new technologies and production capacities. Given existing and foreseeable conditions, we see no crisis in the national farmland situation.

Despite the above argument, loss of land out of agricultural use is of concern to state and local economies. Agriculture imparts a way

of life unlike any other. This social impact on a local economy is extremely important. Rural land use policy planning groups must recognize that their local lifestyle relies greatly on the type of agriculture surrounding them. Among other factors which are affected by agricultural use of land, environmental considerations, uncertain growth patterns, and rising taxes are all important to weak local economies.

Keene (1976) evaluated the effectiveness of various types of differential assessment laws in achieving the expressed goals of tax relief and open space preservations. The states of New Jersey, Maryland, Hawaii, Oregon, Washington, California, Connecticut, and New York comprised the study area. Each state was categorized according to the type of differential assessment programs enforced. A statistical analysis was conducted to estimate relationships between the loss rate of land in farms and variables representing supply and demand factors bearing on the conversion of land from agricultural to urban uses. It was concluded that a reduction in property taxes might reduce the rate of loss of farmland over the short run but not significantly over the long run.

Hady (1974) also reviewed the role of differential assessment programs in the preservation of farm and open space land. By November of 1973, thirty-one states in the United States had enacted some form of differential or use value assessment law. These laws were classified into three categories.

1. Preferential assessment - land is valued according to its present use; no penalty is enacted if the use changes.

2. Deferred tax - land is valued at present use, but when the use is changed, back taxes are charged.

3. Restrictive agreement - land owner and local government agree to restrict use of the land in return for differential assessment.

These laws are passed for one of two reasons. First, a feeling that property taxes are not equitable towards farmers, and second, a desire to influence land use. Adequate studies had not been conducted to determine if tax relief programs did indeed meet any one of the above objectives.

"How can New Jersey, the most densely populated state in the nation, preserve open space and ensure the quality of life which its residents desire?" To answer this question, Chavooshian and Thomas (1973) reviewed the current and past attempts at land use control methods. Among the current control methods, zoning and restrictive covenants were the most widely accepted and used. However, land was being taken out of agricultural usage and patterns of urban sprawl and environmental degradation were common throughout the United States. These methods are not the answer.

To develop a more comprehensive land use control program, buying and selling development rights has been given the spotlight. Among the early known areas adopting the program of transfer of development rights was Southhampton Township in Suffolk County, Long Island. Since then, isolated areas have adopted this practice of land development rights transfers, however, no widespread acceptance has been met.

The principle of land development transfers is the same as that of mineral or water right transfers. A value would be placed on the right of development which the landowner would include in the price for the land. The development right could be sold without including the actual physical quantity of land. Since the development right could be bought and sold, the planning commission could then designate certain areas as restrictive use areas. The police power associated with this type of action would undoubtedly deprive the landowner of his right to develop since a nonconforming use could not be undertaken. The planning commission would also designate areas where intensive, moderate or low density development could occur. The landowner in restricted areas could then sell his development right to a developer wishing to develop in a residential area.

This type of land use control is not without its problems. A comprehensive planning scheme would need to be developed so that the needs of the community far into the future could be determined. The value of development rights must be developed and the marketability of these rights must be insured. However, it was generally agreed that this approach would compensate the landowner for the restrictions imposed upon his land due to zoning or other land use restriction.

White and Abbitt (1974) studied the effect of taxation and land use controls on agricultural land transfers in the Middle Georgia Planning and Development Area. Specific objectives included: (1) examine factors which affect individual transfers of agricultural land around major urban centers, (2) analyze the profitability of land investment on the urban-rural fringe, including the impact of

property taxes on profitability, and (3) examine the cost and effectiveness of selected land use controls.

The desirability of land as an investment is determinant upon the use and earning capacity of the land as a resource. The demand for land increases as investors anticipate a change away from agricultural uses. Conversion of agricultural land is eminent once the value for alternative uses of land exceeds the value for agricultural use.

In the middle Georgia area, as agricultural land was transferred, occupations of landowners changed significantly with 67 percent of the landowners indicating a higher income after the sale. Characteristics of the sale tracts showed that agricultural land was largely being converted to nonagricultural uses and that the market value of the land increased dramatically when use was transferred.

Easements and deferralment of property taxes were discussed as possible preservation policies. These policies were shown to have little if any influence on the farmers' decision to sell. A recommendation was made to develop a policy which would incorporate both programs together with strict zoning policies.

Block (1968) studied the question of "why rural zoning hasn't been more widely accepted throughout the United States?" A survey of the Cooperative Extension personnel was conducted to determine reasons in favor of and against rural zoning. Among things that rural zoning could do was: (1) help protect agricultural operations by controlling leapfrog movement of residential subdivisions into farming areas, (2) help avert the limitations on normal farming operations, and (3) help to control farm property taxes which have

been forced up by urban sprawl. Zoning should not be expected to maintain productive capacity in agriculture. This report proposes that rural zoning is useful and desirable in controlling land use and control of development.

Ohls, Weisburg, and White (1974) conducted a study to identify the key variables which determined the effect of zoning on land prices. Two types of zoning were discussed. The first was fiscal zoning and the second was externality zoning.

Fiscal zoning was defined as "zoning which creates a different pattern of land use because policy makers have an objective other than economic efficiency." Externality zoning is used when the use of land by an individual creates external effects on the land uses by neighboring individuals. The zoning board uses fiscal zoning when trying to meet the overall objectives of the community, usually non-economic in nature. Externality zoning is used to aid market functions in providing an efficient allocation of resources. The paper demonstrates that both types of zoning can either raise or lower aggregate land values depending upon the economic and noneconomic conditions which prevail in the area.

METHOD OF STUDY

The study area was defined according to several criteria. First, areas of rapid population growth were essential to analyze land use transfer patterns. The study area had to have an active agricultural industry. This was necessary to measure the effects of land use transfers on agricultural production. Areas of similar density, size of urban center, industrial and commercial activity, and demographic characteristics were also essential in the study area. Finally, the area had to be comprised of two sub-areas where area zoning regulations differed. This provided the basis for determining the effect of area zoning regulations on the rate and pattern of land-use transfers and its effect on agricultural production. The counties of Weber and Utah in the state of Utah were chosen as the study areas based on the criteria.

Both Utah and Weber counties have experienced rapid population growth. Utah County increased from 106,991 population in 1960 to more than 160,000 population in 1974, an increase of 49.5 percent over 15 years. Weber County has experienced similar growth, increasing from 110,744 population in 1960 to over 134,500 population in 1974. This represented an increase of 21.5 percent over the same time period (Bradley, 1971; and Utah Population Work Committee, 1974). In 1970, Weber County had 12.7 percent of its population in the rural area of the county. Utah County had 12.5 percent rural residents (U. S. Department of Commerce, 1972).

One measure of land use transfer activity is new housing starts. As population and affluency increase, new construction is most active at the periphery of existing development. This new development usually creates a new land use pattern throughout the entire area. Between 1969 and 1972, Weber County averaged 1,111 new housing starts per year and Utah County averaged 1,773 new starts. This compares with the state-wide county average of 403 new starts per year (Billings, 1973). This data suggested that land use patterns in the two counties have experienced dramatic change.

The agricultural industry in both county areas was significant. Utah County comprised 13 percent of the total number of farms in the State, providing 11 percent of the total value of agricultural products produced. Weber County had 6 percent of the total number of farms providing 8 percent of the total value of agricultural products produced. Of significance in assessing the agricultural industry in the study area was the relative change in magnitude over time. In both counties the total farm numbers decreased from 1964 to 1974. Utah County decreased 25 percent, with an average decrease of 59 farms per year. Weber County decreased 11 percent, losing 11 farms per year. Total land in farms also decreased over the same time period. Utah County lost 234,836 acres, averaging 23,483 acres per year. Weber County declined from 255,770 acres in 1964 to 208,277 acres in 1974, representing a loss of 4,749 acres per year (USDA, 1976). These trends indicated that land was being transferred out of agricultural uses into non-agricultural uses.

The two county areas were extremely similar in population density, industrial and commercial activity, and other demographic characteristics. Both Utah and Weber Counties are located along the Wasatch Mountain range in Northern Utah. Weber County is located north of the county in which the capital city is located (Salt Lake County). Weber County's largest city, and county seat, is Ogden. Ogden City had a 1974 estimated population of 69,478 people, and is located directly south of Salt Lake City (the State Capital). Utah County is located directly south of Salt Lake County, and the county seat and largest city is Provo. Provo City had a 1974 estimated population of 53,131 people, and is located forty miles from the State Capital. Both counties have active industrial and commercial sectors. Utah County's employment is dominated by Geneva Steel Corporation and Brigham Young University. Weber County has the Defense Depot at Ogden within the county and Hill Air Force Base in the neighboring county (Davis). Weber County also has Weber State College and industries which contribute to employment.

Utah County was the first county in the State of Utah to adopt a comprehensive county-wide zoning ordinance. The rural area in the county was broken down into residential and agricultural areas. Different minimum size requirements for residential development was the primary area restriction between differing areas. The Utah County Ordinance specified one acre, ten acres, and twenty acres per residence for residential and agricultural use areas.

Weber County first adopted a county zoning ordinance in 1958. When the ordinance was first adopted it provided for areas of one acre

and two acre minimum size requirements. Since then areas of one-third and one-half acres have been added. This revision of the ordinance only involved about two percent of the total zoned area, while about 60 percent remained in the one and two acre districts. The major zoning difference between the two counties was that Utah County requires larger lots than Weber County for residential development. This difference may significantly alter the land development patterns between the two counties and the size of the parcel purchased.

The target population for the study included all landowners who had purchased land in rural areas of the study counties. These rural areas include unincorporated county area, unincorporated towns and incorporated towns of less than 30,000 population. The study period was limited from 1974 through 1976. During this period, no amendments to the county zoning ordinances appreciably altered the supply of land in each zoned district. Therefore the supply of land was assumed to be fixed during the study period.

Primary data were obtained by a mail questionnaire. The questionnaire was developed, pretested, and revised before mailing to the target population. Through the questionnaire, data concerning general characteristics of land buyers, characteristics of the parcel of land, nature of the agricultural productivity (if any) from the land, and effects of zoning regulations on purchasing decisions were obtained (see Appendix A). A list of addresses of landowners who had purchased land during the study period and in the study area was obtained from the Utah State Tax Commission. A cover letter was developed to explain the purpose of the study, identify the parcel of land in question,

year of sale, and county in which the parcel was located (see Appendix A). This letter was signed and mailed on March 22, 1977 to landowners on the mailing list, together with the questionnaire and a return address envelope. The questionnaires were identified by number so that a follow-up letter could be mailed to non-respondents. The follow-up letter once again identified the parcel and year of sale. This letter was mailed on April 19, 1977 (see Appendix A).

When a letter was undeliverable, a cross check with the county tax rolls was made to obtain a current mailing address. If this did not provide a current address, local telephone directories were checked. An overall return of 58 percent resulted from the first and second mailing of the questionnaire.

Upon return of the questionnaires, those with incomplete responses were eliminated from the study. A total of 46 percent of the original questionnaires mailed were returned and useable in the study. Data from the useable questionnaires were coded and punched on data processing cards for computer analysis.

Additional data were obtained from soil survey maps and current zoning district maps. A detailed soil survey map was obtained from the Soil Conservation Service for each county. Each parcel of land was then located on the soils map and land capability classifications were identified and punched on the data processing cards. In a similar manner, zoning maps were obtained from the local county offices. The parcels were located on the zoning maps and the minimum area requirements for residential development were identified and punched on the data processing cards. Computer programs were prepared and used to analyze the data at the Utah State University Computer Center.

Objective One

Data obtained from the questionnaire, soil classification, and zoning requirements were grouped into general categories signifying the characteristics of the study area, study period, and sample population. The general characteristics were divided into: (1) characteristics of the landowner, and (2) characteristics of the land parcel. The general characteristics data were grouped and mean values determined.

Objective Two

To accomplish Objective Two, the general characteristics of agricultural production and land use in the sample were summarized. Next a linear multiple regression model was developed to estimate the land buyer demand for land for agricultural uses as a result of the land ownership transfer. This demand was measured in terms of net change in acreage available for agricultural production.

Objective Three

Data from section IV of the questionnaire were summarized to determine effects of area zoning requirements on land use trends. Important factors in location decision making were summarized and those factors which were contingent on zoning regulations were identified. The influence of zoning regulations on the landowner's decision of where to locate and how much land to purchase was also summarized from the questionnaire data.

Weber and Utah County data were separated and the multiple regression model from Objective Two was used to determine if zoning

regulations altered the land use patterns. The resultant regression equations were then compared between counties to determine if land use patterns were significantly different.

Limitations of the data

The target population consisted of all land parcels which were involved in an ownership transfer. A sample population was identified by the land sales list gathered by the Utah State Tax Commission. This list included sale parcels of land which were recorded at the county level during the study period. Land transactions in which the deed was kept in escrow until the terms of the contract are met were not included in the list. The list contained only the transactions which occurred and were recorded from 1974 through 1976.

The data is only representative of the study area and no inference can be made about transactions which might have occurred during the study period but outside the study area. Likewise, no inference can be made about the agricultural production involved in transactions which occurred during the study period but were not recorded and thus not included in the mailing list.

PRESENTATION AND ANALYSIS OF DATA

General Characteristics of LandownersAnd Parcels of Land

The objective of this section was to describe the general characteristics of land buyers and parcels of land bought in rural-urban fringe areas of rapidly urbanizing areas.

The number of observations

The population was sampled by the ownership transfer list available from the Utah State Tax Commission for 1974-76. This listing contained only location of the property, date of transaction, and name and mailing address. No other information was included. Each parcel of land identified by this list was located on a county map. Only sale parcels which were located in rural unincorporated areas or in incorporated towns of less than 30,000 population were included in the sample. In the study area, 309 such land transactions were recorded to the Tax Commission from 1974 through 1976.

The questionnaire was mailed to the grantee of these land transactions.¹ Of the original list, it was not possible to locate 20 grantees and thus a questionnaire was not sent. A total of 178 questionnaires were returned, representing 58 percent of the mailing list. Thirty-six questionnaires did not contain enough information to

¹See Appendix A for an example of the questionnaire.

be included in the study. This resulted in a usable return of 142 questionnaires, or 46 percent, and constituted the study sample.

Table 1 illustrates the study sample as to year and county, and compares the sample to the total number of parcels on the list received from the Utah State Tax Commission. Of the two subgroups, Utah County had the most active land market, recording 177 ownership transfers from 1974 through 1976, while Weber County recorded 132 transactions. From Table 1, the sample as a percentage of the total number on the original list can be determined. This is illustrated in Table 2.

Table 1. Frequency of observations, sample of population comparison, 142 sample transfers, Utah and Weber Counties, 1974-1976

Year of transfer	Weber County		Utah County	
	Number of observations Sample	List total	Number of observations Sample	List total
1974	20	47	32	63
1975	17	50	27	50
1976	13	35	33	64
Total	50	132	92	177

Utah County land buyers were more responsive to the mail questionnaire, returning 52 percent of the questionnaires mailed. Weber County returned 38 percent of the questionnaires. During the time of the mailing, Utah County was revising their zoning code and zoning was a current issue. This may account for Utah County returning

Table 2. Sample observations as a percentage of list total, 142 sample transfers, Weber and Utah Counties, 1974-1976

Year of transfer	Weber County	Utah County
	%	%
1974	43	51
1975	34	54
1976	37	52
Average	38	52

a higher percentage of the questionnaires. These data indicate that a larger percentage of Utah County is included in the sample than Weber County. If a bias was present it would be in the direction of the Utah County data. Also, no distinct trends as to increasing or decreasing frequency of ownership transfers from 1974 through 1976, in either of the counties, can be assumed from the data. For purposes of this study, data for three years were combined assuming that the factors inducing land ownership transfer were constant during that time period.

Characteristics of the land buyers

Section I of the questionnaire was used to identify certain characteristics of the land buyers which would enable a categorization and comparison of the buyers. The homogeneity of the study area was an important assumption of the study. This assumption was partially tested by the land buyer data. Of particular importance, the land buyer's age, profession and income provides this basis for analysis.

Age is a readily measurable characteristic which would serve as a measure of comparison between two areas. With comparable industrial, commercial, and social activities, it was expected that the average age of land buyers in the two sub-areas would be similar. Comparison of Utah and Weber Counties indicates that the average age of the land buyers only differed by two years. The average age of Utah County land buyers was 40, compared to 38 in Weber County. This would support the expectation that the study area was homogeneous. It also indicated that the most common land buyer is middle aged.

The most frequent profession of the landbuyer was the category of professional, technical, or managerial. Retired landbuyers accounted for a higher than anticipated percentage of the landbuyers. Table 3 illustrates the breakdown of professions in the two sub-areas. The statistical Z-values are all insignificant at the 5 percent level of significance, indicating that both samples could have been taken from the same population and that no statistical significance difference exists between the two sub-areas in this category.

From theory and research findings, it was expected that the land buyers in rapidly urbanizing areas are of higher than average income (Mills, 1972). The study data confirms these findings. The land buyers in Utah County had a mean annual income of \$20,315. Weber County land buyers averaged \$20,660 annually. This can be compared to the two-county mean annual income of \$13,470 (Department of Commerce, 1972)¹

¹The 1970 census value was adjusted by the inflation rate to determine this average value for 1974-76.

Table 3. Comparison of land buyer's profession, 142 sample transfers, Utah and Weber Counties, 1974-1976, percentage of county total in parentheses

Profession	Utah County		Weber County		Total		Z values
	Number	Percent	Number	Percent	Number	Percent	
Professional, managerial technical	45	(49)	28	(56)	73	(51)	-0.58
Clerical, sales	6	(7)	3	(6)	9	(6)	0.05
Service	7	(8)	3	(6)	10	(7)	0.10
Farm, fishery, forestry	5	(5)	2	(4)	7	(5)	0.05
Profession	5	(5)	0	(0)	5	(4)	0.50
Machine trade	3	(3)	1	(2)	4	(3)	0.08
Construction	6	(7)	4	(8)	10	(7)	-0.05
Other (retired)	15	(16)	9	(18)	24	(17)	-0.12
Total	92	(100)	50	(100)	142	(100)	<u>+1.96*</u>

*Z values of less than ± 1.96 are significant at a 5 percent level of significance.

The study incomes averaged almost double the average income of the two counties' work forces. The average income of the land buyer deviated only slightly between the two sub-areas.

From the above findings, the land buyers in the study area were categorized. The average buyer was a middle aged, above average income, professional, managerial, or technical worker. These data support the assumption that there was no significant difference between the land buyers in the two sub-areas of the study. This served as an important factor when analyzing the effects of zoning regulation on agricultural production.

Characteristics of the Land Parcel

General characteristics of the land parcel involved in ownership transfer is described in this area. The land parcel was defined as being the land, house, outbuildings, water rights, mineral rights and other amenities which were included with the sale. In particular, this section discusses areas of land in the sale parcel, price per acre, total purchase price, residential dwellings and location.

From Section II of the questionnaire, the total acreage of the sale parcel was identified. Building lots were recorded in hundredths of an acre, and no distinctions were made between lot parcels and acreage parcels. The acreage response from the questionnaire was compared with the acreage listed in the legal description for each parcel. If a discrepancy existed between the two sources of acreage information, the parcel was located on a county plat map and the area determined with an area digitizer.

A total of 667.7 acres were involved in the study. Utah County had the largest acreage involved, 388.8 acres, while Weber County had 278.9 acres (see Table 4). On the average, 4.7 acres were involved per transaction. Utah County's average parcel size was smaller than the study-wide average. Conversely, Weber County had a higher than average parcel size.

The cost per acre for land in the study area averaged \$~~4~~⁹,923.00. Price per acre for land differed significantly for the two sub-areas. Weber County land buyers were paying an average of \$14,864 per acre, while in Utah County the price averaged \$7,237 per acre.

When the land buyer purchased the parcel, 74 of the 142 observations included a house on the sale parcel. Within a year after the purchase, 20 more homes were added on the parcels. This resulted in 94 houses or 66 percent of the observation having a house on it. Of parcels that had a house, 88 percent of the landowners were living on the sale parcel.

The average parcel was located 14.1 miles from the nearest city center of over 30,000 population. The sub-areas of the sample indicated a difference as to distance from city center to the parcel. Utah County observations averaged 16.5 miles from Provo City. In Weber County the active area of land sales was located only 9.8 miles from Ogden City.

These data suggest that the population density per mile from the city center was different between the two counties. With both counties having similar populations and similar urban to rural population ratios, Weber County would be more densely populated closer to the urban center

Table 4. Total acres transferred and average acre per transaction, 142 observations, Utah and Weber Counties, 1974-1976

County	Number of transfers	Total acres transferred	Average acres per transaction
Utah	92	388.8	4.23
Weber	50	278.9	5.58
Total	142	667.7	4.70

and reduce more rapidly as distance is increased. Utah County would be less densely populated close to the urban center with less of a reduction as distance from the urban center is increased.

Land Use Transfers and Agricultural Production

The objective of this section was to describe the effect of land use transfers on agricultural production. A general review of sample data pertaining to land use and agricultural production will first be presented. Next, the net change in acreage available for agricultural production will be estimated using a linear multiple regression analysis.

General Characteristics of Land Use and Agricultural Productivity

It was hypothesized that the land use trend in the study area was affecting the local agricultural industry. It was expected that land used previously for agricultural purposes was transferred to non-agricultural uses as a result of the ownership transfer. It was also

hypothesized that when land remained in agriculture, in spite of the ownership transfer, the agricultural use was changed.

Land use

When ownership transfer occurred, there was a general land use change occurring at the same time. Previous to the time of the ownership transfer about 78 percent of the sample acreage was in agricultural use. Idle usage accounted for about 17 percent, with residential use being about 5 percent of the sample acreage. After the transaction, only about 52 percent of the sample acreage remained in agricultural use. Idle usage increased to about 37 percent of the sample and residential use increased to 11 percent.

As a result of the ownership transfer, 175.1 acres were involved in a change in usage. This represents almost 26 percent of the total acreage that resulted in a new use. Table 5 illustrates this land use transfer in more detail.

Of the 175.1 acres involved in a change of use, 174.1 acres were taken out of agricultural use. These data confirm the earlier hypothesis. However, it was expected that a large percentage of the land being taken out of agricultural production would be transferred directly to residential usage. These data reveal that only twenty-four percent of the transferred land was changed to residential usage. Over seventy-five percent of the use change went to idle usage.

A closer look at the individual data revealed several large tracts of land which were taken out of agricultural use and transferred to idle usage. The local county recorder's offices confirmed that residential subdivision plans had been submitted for approval on

Table 5. Land transfer between uses, acreage and percentage changes, 142 sample transfers, Utah and Weber Counties, 1974-1976

Land use	Previous usage		Current usage		Net change acres
	Acres	Percent	Acres	Percent	
Residential	31.7	(5)	74.2	(11)	+42.5
Agricultural	520.1	(78)	346.0	(52)	-174.1
Commercial	0.2	(t)	0.7	(t)	+5
Industrial	1.0	(t)	0		-1.0
Idle	112.7	(17)	244.8	(37)	+132.1
Other	2.0	(t)	2.0	(t)	0
Total	667.7		667.7		

(t) = less than 1 percent.

several of these parcels. It was also noted that when a larger acreage was bought than required for a house and yard that the remainder of the land was in the idle classification. This suggested that the land currently labeled as being idle was in a transition phase to residential usage.

Agricultural production

In section III of the questionnaire, the current agricultural uses of the land were measured. When the questionnaire was pretested, a question was also asked about the extent of the agricultural production before the ownership transfer. Very little response to this question and some comments written on the questionnaire indicated that the new landowner had little knowledge about the types of

agricultural production before the transfer. This question was then removed from the final draft of the questionnaire. The data contained in this area is only relative to the land after the ownership had been transferred, and no comparison is made of conditions before and after the transfer.

The largest percentage of land in agricultural production was in irrigated pasture usage. Irrigated pasture accounted for 50 percent of the sample's agricultural land. This compared with 24 percent of all agricultural land in irrigated pasture use in the total target area (USDA, 1976). Within the sample, more land was being used for irrigated pasture than would otherwise occur.

There were 36 observations that reported irrigated pasture land usage after the transfer, with 179.7 acres being used for that purpose. Each observation reporting irrigated pasture usage averaged 4.9 acres. Irrigated grain was the next most frequent use of land after the transfer. Nine land buyers reported using 114.6 acres for irrigated grains. This averaged almost 13 acres per observation. Next was dry farm pasture which averaged almost 5 acres per observation. A more detailed breakdown of the agricultural uses after the transfer is furnished in Table 6. The agricultural land use after the transfer was generally of low intensity production, requiring few machines and very little labor.

Another measure of agricultural activity is the presence of livestock. One out of every three observations had livestock on the parcel at the time of the survey. The most frequently occurring type of livestock in the sample was horses. Twenty-four of the forty-three

Table 6. Agricultural land according to uses, 142 sample observations, Utah and Weber Counties, 1974-1976

Agricultural land use	Acres	Percent	Number of observations	Acres per observation
Irrigated grains	114.6	32	9	12.7
Dry farm grains	0.0	0	0	0.0
Vegetables	4.3	1	10	0.4
Irrigated pasture	179.7	50	36	4.9
Dry farm pasture	48.9	14	10	4.9
Orchard	5.6	2	9	0.6
Timber	0.0	0	0	0.0
Idle	5.0	1	7	0.7
Other	2.5	t	1	2.5
Total	360.6		*	

t = less than 1 percent.

*Number of observations does not equal number of sample transfers.

observations having livestock recorded owning horses. This averaged two horses per observation. The next most frequent use of livestock was beef cattle. Fourteen land owners averaged five head of beef cattle each for a total of 69 head for the study (Table 7). Next was poultry and then dairy cattle.

The soil capability classification also provided a measure as to productivity potential of land being transferred. The lower the number of soil class, the higher the quality of land for agricultural purposes. A soil capability class of I would represent prime agricultural land

Table 7. Number of livestock and number of observations recording livestock, 142 sample transfers, Utah and Weber Counties, 1974-1976

Type of livestock	Utah County		Weber County		Total	
	Number	Observations	Number	Observations	Number	Observations
Dairy cows	6	4	21	2	27	6
Beef cattle	33	5	36	9	69	14
Sheep and goats	19	3	11	2	30	5
Poultry	2,320	10	150	1	2,470	11
Horses and Mules	38	16	17	8	55	24
Hogs	12	2	0	0	12	2
Mink	500	1	0	0	500	1

suiting for practically any crop grown in Utah. The average soil class for all the land in an area would provide an estimate of the potential of land for agricultural purposes.

The target area included all land in the two sub-areas not included in a city of 30,000 population or larger. Of this land, only 8 percent was class I soil, 22 percent was class II soil, and 21 percent class III soil (Table 8). When the two sub-areas were analyzed separately, Weber County had a slightly higher average soil classification than Utah County.

The sample parcels were then identified as to soil capability classification. Sixteen percent of the land experiencing ownership transfer was listed as class I land. Class II and class III land included 20 percent and 22 percent of the sample, respectively. When the sub-areas were analyzed separately, Utah County had 22 percent of the sample parcels with class I soil, while only 14 percent was class II soil. The Utah County Sample represented a higher quality of land than the target area's average soil class. In Weber County only 5 percent of the sample included class I soil, but 30 percent of the parcels were listed as class II land. In that county more class II land was involved in ownership transfer than was found in the target area (Table 9). When the sample soil was compared to the target soil, it was generally found that the sample soil was of slightly higher quality than the target area soil.

Demand for agricultural land after ownership transfer

From data presented in the previous section, two coordinates are given to identify a point on the demand function for land. This

Table 8. Soil capability classification of target area, Utah County, Weber County, and target area

Soil capability class	Utah County	Weber County	Total
	%	%	%
I	7	9	8
II	20	24	22
III	24	18	21
IV	18	17	17
V	1	0	1
VI	7	8	7
VII	16	15	15
VIII	2	9	6
None	6	1	2
Total	100	100	100

Table 9. Soil capability classification of sample data, 142 observations, Utah and Weber Counties, 1974-1976

Soil capability classification	Utah County	Weber County	Total
	%	%	%
I	22	5	16
II	14	30	20
III	25	16	22
IV	33	3	22
VI	2	2	2
VII	4	44	18
Total	100	100	100

demand function is the total demand function, which is a composite of the land demand for the residential use of the land as given by the potential land buyer, and of the demand of the landowner of this land for agricultural uses. The total supply of the land is considered as fixed, i.e., a stock. Figure 4 illustrates the determination of price and quantity given these demand schedules. The total demand is the summation of land buyer's demand and land seller's demand for the land. Price is determined where total demand equals stock, and the quantity transferred is determined where land buyers demand equals land seller's supply. In this study $P^* = \$9,923.00$ and $Q^* = 4.1$ acres.

The land buyer's demand is comprised of several other demand functions. The land buyer has a separate demand schedule for residential use, idle use, commercial use, agricultural use, etc., which are all components of his demand for land function. Data from the previous sections indicate that the average land buyer buying 4.1 acres will change part, but not all, of this acreage to a new use depending on his demand for this new use.

A mathematical model was developed to estimate the demand for agricultural land which had experienced ownership transfer. Several assumptions were used to ensure a constant state situation. First, it was assumed that the land area was fixed. During the study period no new land was annexed to the total county areas and no zoning changes appreciably altered the land availability for each major use. This resulted in a constant supply of land available for all uses.

Second, factors involved in inducing land ownership transfer remained constant over the study period. Changes in transportation,

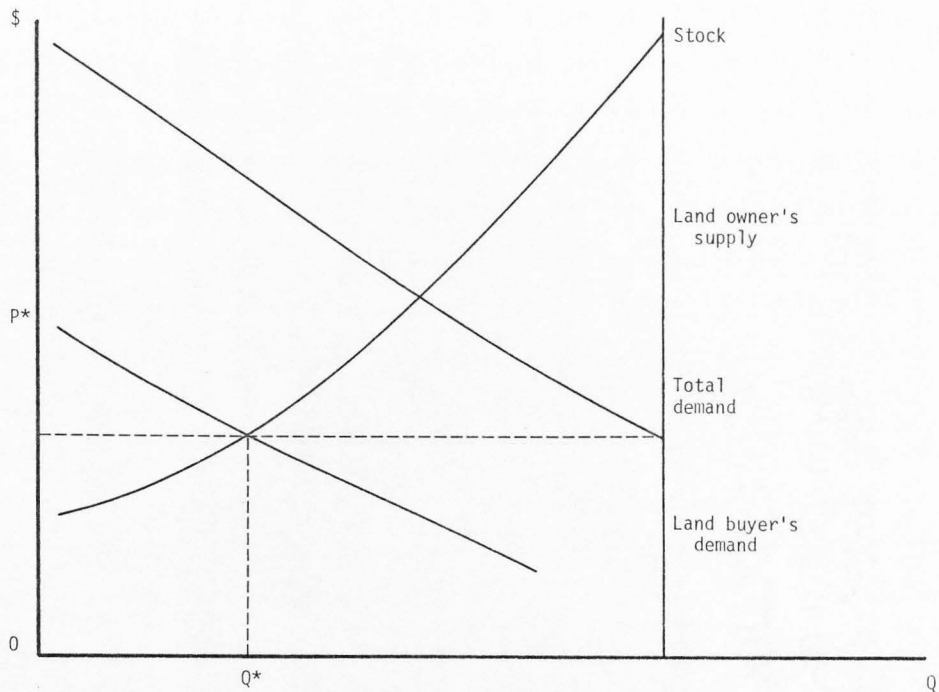


Figure 4. Price determination of a stock good.

building techniques, costs and codes, demographic characteristics, and consumer's tastes and preferences all influence what type of house, how many acres, and where residential construction will occur. Any changes in these factors over the study period would result in shifting development patterns. The homogeneity of these factors were supported by the data in the first part of this section.

Third, it was assumed that both counties have the same magnitude and diversification of agricultural production, and that any factors affecting the acreage available for agricultural production would result in similar effects in both counties. Again, this is supported by the previous data.

Fourth, land and product prices were assumed to remain constant over the study period. It was recognized that this was an unrealistic assumption due to the escalating inflation rate experienced during the study period. However, for purposes of the estimation process, the values for the three-year span are averaged together as if the price index remained constant.

The model was based on a linear multiple regression equation of the form:

$$Y = a + b_1(X_1) + b_2(X_2) + \dots + b_n(X_n)$$

where (a) is a constant term; (b_1), (b_2) and (b_n) are regression coefficients; (X_1), (X_2) and (X_n) are independent variables; and (Y) is the dependent variable. The demand for agricultural land use was measured in terms of net change in acreage available for agricultural production. The dependent variable became:

Current Agricultural Acreage - Previous Agricultural Acreage.

If the previous agricultural acreage is larger than the current agricultural acreage, the dependent variable will be negative. This loss of acreage out of agricultural usage would represent a gain of acreage to non-agricultural uses.

The first step in developing this model was to identify independent variables which were correlated to the net change in agricultural acreage. A correlation matrix was developed to the dependent variable. A total of forty-seven (47) independent variables were correlated to the dependent variable and six (6) of these variables were found to be statistically significant and considered further in the model. These variables included the categories of (1) area zoning requirement for residential dwellings, (2) soil capability classifications, (3) location of parcel within county, (4) size of parcel, (5) occupation, and (6) previous agricultural acreage.

To simplify the regression model, each of the above categories were separated into separate identifiable subgroups and only the significant subgroups were included in the model. The significant subgroups were:

- (1) Zoning requiring 1 acre for residential dwelling
- (2) Zoning requiring 2.5 acres for residential dwelling
- (3) Zoning requiring 5 acres for residential dwelling
- (4) Zoning requiring 20 acres for residential dwelling
- (5) Soil capability class I land
- (6) Soil capability class II land

- (7) Soil capability class III land
- (8) Unincorporated county area
- (9) Incorporated town of less than 5,000
- (10) Size of parcel in tenths of an acre
- (11) Farmer occupation
- (12) Previous acreage in agriculture

It was hypothesized that area zoning requirements for residential dwelling would be positively related to the land buyer's demand for agricultural land. As the area requirement for a residential dwelling becomes sufficiently large, relocated urban dwellers would purchase the land only if they could use the excess acreage for agricultural purposes. This could be used by themselves as part-time farmers or rented to neighboring full-time farmers.

Soil capability classification was expected to be positively related to the land buyer's demand for agricultural land. Soil quality is of little importance in land uses other than agriculture. If the land buyer was a farmer by occupation, a higher quality soil capability classification would increase his demand for the land. If the new land buyer were to farm the excess acreage himself or rent it to a neighbor, the agricultural value of the excess acreage is largely determined by the soil capability classification. The better the quality of the land, the higher its value for agricultural purposes.

The location of the parcel was expected to be negatively related to the land buyer's demand for agricultural land. As the area becomes more highly populated, the desirability and feasibility of farming becomes lower. In urban areas, land prices are high relative to

non-urban uses. These land prices create higher property taxes for the farmer and enhance land speculation.

As parcel size increased it was expected that less land would be transferred in use. Again, larger parcels of land are more likely to remain in agricultural use. It was also expected that the occupation of the farmer would be positively related to the land buyer's demand for agricultural land. Any other occupation would be negatively related. It was hypothesized that land that is being transferred is largely agricultural land. Therefore, previous agricultural acreage was expected to be negatively related to the land buyer's demand for agricultural land.

A regression analysis was then conducted using the significant independent variables. Data from both counties were grouped. All of the significant independent variables were first analyzed. Several of the variables, however, had statistically insignificant F ratios and a stepwise regression analysis was conducted, eliminating the independent variables according to their significance. All of the significant independent variables, except size of parcel and previous agricultural acreage were entered in the equation as a 1 or 0. If the land buyer was a farmer by occupation, a 1 was entered into the equation, all other occupations were entered as a 0. Size of parcel and previous agricultural acreage were recorded in tenths of an acre.

The order in which the independent variables were eliminated from the regression model was:

- (1) Zoning requiring 2.5 acres for residential use
- (2) Zoning requiring 1 acre for residential use

- (3) Zoning requiring 5 acres for residential use
- (4) Unincorporated county area
- (5) Soil capability classification III
- (6) Soil capability classification I
- (7) Zoning requiring 20 acres for residential use
- (8) Soil capability classification II
- (9) Unincorporated town of less than 5,000 population
- (10) Size of parcel in tenths of an acre
- (11) Farmer occupation
- (12) Previous acreage in agriculture

Zoning for 2.5 acres was eliminated first with previous acreage in agriculture being eliminated last.

Table 10 illustrates the results of the analysis. The significant variables which remained in the analysis were variables dealing with soil capability classifications, zoning, location, acreage involved, and occupation. The estimation equation became:

$$\text{Net change in agricultural acreage} = 5.92 + 1266 (\text{soil capability class I}) + 27.42 (\text{zoning requiring 20 acres for residence}) + 20.38 (\text{soil capability class II}) - 30.64 (\text{unincorporated town}) + 0.72 (\text{size of parcel}) + 101.11 (\text{farm occupation}) - 1.34 (\text{previous agricultural acreage}).$$

Unincorporated town and previous agricultural acreage were both negatively related to the land buyer's demand for agricultural land. All of the other independent variables were positively related. These data supported the hypothesis and expectations posed earlier. Using this model, it is estimated that on the average 1.23 acres were lost

Table 10. Regression analysis for net change in acreage available for agricultural production, 142 sample observations, Utah and Weber Counties, 1974-1976

Independent variable	Coefficient	F-value*
Soil capability class I	12.66	1.56**
Zoning requiring 20 acres for residential	27.42	3.08
Soil capability class II	20.38	4.44
Unincorporated town	-30.64	29.76
Size of parcel	0.72	50.90
Farm occupation	101.11	25.27
Previous agricultural acreage	-1.34	153.81
Constant term (B_0)	-5.92	

R-square = 0.819, standard error = \pm 4.5 acres, average change = -1.23 acres

*Values greater than 3.91 are statistically significant at the 5% level. Values greater than 2.75 are statistically significant at the 10% level.

**Significant at the 25% level.

out of agricultural use with each ownership transfer. The land buyer's demand for agricultural land is negative. As ownership is transferred, it is expected that about one out of every four acres will be lost from agricultural use.

The R-squared value indicates the degree of association between the independent variables and the dependent variable. Using this estimation equation a high degree of success would result when estimating the net change in acreage available for agricultural production due to ownership transfer.

Effects of Zoning Policies on Agricultural Production

The objective of this section was to determine the effects, if any, of the two different types of zoning policies on agricultural production. Data from the questionnaire were first used to describe the effects of zoning policies on purchasing decisions, second, describe its effect on agricultural production, and third, analyze the effects on the estimation equations developed in the last chapter. In each of these categories, the data were separated and a comparison between the two sub-groups was made.

Zoning and land purchasing decisions

Several questions were included in the mail questionnaire to measure the effect, if any, of the area zoning policies enforced on the land purchase. The main purpose for purchasing the land was first identified, next, several purchasing decisions were ranked in their order of importance, and finally, the effects of zoning policies on the decisions of where and how many acres to purchase were described.

Table 11 illustrates the primary purposes for which the land was purchased. Almost three-fourths of the land was purchased for residential purposes. Very little difference resulted when the data were separated by county. In Utah County more buyers purchased the land for agricultural purposes than the study average. Only 8 percent of the land in Weber County was purchased for agricultural purposes while 19 percent of the land in Utah County was purchased for agricultural purposes.

Table 11. Main purpose indicated for purchasing land, 142 sample observations, Utah County, Weber County, and total area, 1974-1976

Purpose	Total area	Utah County	Weber County
	%	%	%
Residential	72	71	72
Agricultural	15	19	8
Commercial	1	1	0
Industrial	0	0	0
Speculative	11	8	18
Other	1	1	2
Total	100	100	100

Nine possible purchasing decisions were listed in the mail questionnaire and the land buyer was asked to rank the factors as to their importance in the purchase decision. A rank of important had a value of 3, a rank moderately important had a value of 2, unimportant ranking had a value of 1, and nonresponses were valued as 0. All of the values for the responses were summed and an average value was determined. A value close to 3 indicated a generally important decision factor, whereas a value close to 1 indicated unimportant. Table 12 illustrates these decision factors.

In the study area, quality of neighborhood ranked as the most important decision factor. Next was the availability of land, followed by pretty scenery and surroundings, then ability to own desired home.

Table 12. Ranking of decision factors, 142 observations, comparison of Utah and Weber Counties, 1974-1976

Decision factors	Both	Rank value	
		Utah	Weber
Land price	1.62	1.72	1.46
Ability to own livestock	1.70	1.84	1.46
Quality of neighborhood	2.18	2.23	2.10
Availability of land	2.05	2.12	1.92
Closeness of family	1.28	1.42	1.02
Closeness to employment	1.46	1.52	1.34
Ability to own desired home	1.92	1.96	1.86
Pretty scenery and surroundings	1.94	2.01	1.80
Quality of public services	1.32	1.31	1.32

When the data were separated, the general ranking in both the counties were similar. On the average, however, Weber County buyers ranked all of the factors lower than Utah County buyers. Factors directly or indirectly related to zoning policies (i.e., land price, ability to own livestock, availability of land, ability to own desired home, and quality of public services) were ranked between unimportant to moderately important, except for availability of land which was ranked moderately important.

Zoning policies had little if any influence on were the land owner purchased the land. Sixty-five percent of all the respondents indicated that zoning policies were not an important factor when deciding where

to purchase land. The respondents also indicated that zoning policies did not influence their decision of how many acres to purchase. Only nineteen percent of all respondents indicated that zoning did restrict the number of acres purchased. In Utah County, 40 percent of the land buyers were influenced by zoning as to where to buy the parcel, and only 22 percent were influenced as to how many acres to purchase. In Weber County, 26 percent of the buyers felt that zoning policies influenced where to buy and 14 percent of the buyers were influenced by acreage requirement.

When asked if they would have located in the same area, further from the nearest city, or closer to the nearest city if no zoning laws were enforced, 81 percent of the buyers would have bought land in exactly the same area. Twelve percent of the buyers would have bought land further from the nearest city, and six percent would have purchased land closer to the city center. Table 13 illustrates the comparison between Utah and Weber Counties. Utah County buyers were mostly unaffected by zoning policies whereas one in four of the Weber County buyers would have purchased in another location in the absence of zoning.

Zoning and agricultural production

The expressed objective of zoning, written in the Uniform Zoning Code of Utah, (Mountain Area Planners, 1974) is to foster and enhance the agricultural industry, and provide measures for control and guide development. Each individual zoning ordinance is written and adopted by local governments and other variations of the code are written into them. Each governmental body will also interpret the code differently.

Table 13. Location decisions in the absence of zoning, 142 observations, Utah and Weber County comparison, 1974-1976

Location	Both	Utah Percent*	Weber
Same area	81	84	76
Further from the nearest city	12	10	16
Closer to the nearest city	6	8	4

*Values do not add to 100 due to rounding errors.

This results in a wide variety of codes being enforced in each governing district.

It was expected that large-lot zoning would cause fewer acres of land to be taken out of agricultural production. If the purpose of large lot zoning was to reduce the number of acres lost from agricultural production, zoning policies requiring sufficiently large parcels of land for a residential dwelling could be enacted. These large parcels would be too costly and large for the average land buyer. The land buyer would then seek to buy smaller parcels of land wherever they would become available. It was also expected that large-lot zoning would result in a wider dispersion of development. Speculation on premium land may cause a leapfrogging of land parcels as development occurs. The situation may also occur where the zoning area requirement is not sufficiently large enough. The land buyer would then be willing to purchase a larger lot and distances between each residential dwelling would be larger than if small lots were sold.

In Utah County, 34.4 acres were transferred out of agricultural use. Of this 34.4 acres, 25.2 acres were transferred directly into residential use, 0.5 acre went to commercial use, and 8.8 acres were transferred to idle use. In Weber County, 139.7 acres were transferred out of agricultural use. The category of idle use gained 88 percent of the land lost from agricultural use (123.3 acres). Only 17.3 acres were added to residential land as a result of the transfer (Table 14). Even though more residential land was used in Utah County, less land was lost from agriculture than in Weber County. More than four times as much agricultural land was transferred in Weber County than Utah County. This supported the speculation.

Very little difference was noted between the two sub-groups when agricultural uses for the land were analyzed. The main exceptions were irrigated grain and dry farm pasture. In Utah County there were 114.6 acres, 40 percent of the sample, being used for irrigated grains with only 6 percent of the sample in dry farm pasture usage. In Weber County, none of the sample was in irrigated grain use and 45 percent of the sample was dry farm pasture. In that county, 96 percent of the sample was used for pasture after the ownership transfer. In Utah County, only 55 percent of the land in the sample was used for pasture (Tables 15 and 16). Zoning in Weber County may have influenced the type of agricultural use the land was used for. These data indicated a lower intensity agricultural usage in Weber County than Utah County.

Another category of difference between the two sub-groups was the location of the parcel. A larger percentage of parcels were located in larger cities in Utah County, while in Weber County more parcels were

Table 14. Acreage comparison of previous and current land uses between Utah and Weber Counties, 142 sample transfers, 1974-1976

Land uses	Previous use		Current use		Change in use	
	Utah Acres	Weber Acres	Utah Acres	Weber Acres	Utah Acres	Weber Acres
Residential	15.7	16.0	40.9	33.3	+25.2	+17.3
Agricultural	315.4	204.7	281.0	65.0	-34.4	-139.7
Commercial	0.2	0.0	0.7	0.0	+0.5	0.0
Industrial	0.0	1.0	0.0	0.0	0.0	-1.0
Idle	57.5	55.2	66.2	178.6	+8.7	+123.4
Other	0.0	2.0	0.0	2.0	0.0	0.0
Total	388.8	278.9	388.8	278.9	0.0	0.0

Table 15. Agricultural land according to uses, 40 sample transfers, Weber County, 1974-1976

Agricultural land use	Acres	Percent	Number of observations	Acres per observation
Irrigated grain	0	0	0	0.0
Dry farm grain	0	0	0	0.0
Vegetables	0.5	t	1	0.5
Irrigated pasture	37.0	51	7	5.3
Dry farm pasture	32.5	45	6	5.4
Orchard	2.0	3	1	2.0
Timber	0	0	0	0.0
Idle	0.5	t	1	0.5
Other	0	0	0	0.0
Total			*	

t = less than 1 percent.

*Number of observations does not equal number of sample transfers.

Table 16. Agricultural land according to uses, 92 sample transfers, Utah County, 1974-1976

Agricultural land use	Acres	Percent	Number of observations	Acres per observation
Irrigated grain	114.6	40	9	12.7
Dry farm grain	0.0	0	0	0
Vegetables	3.8	1	9	0.4
Irrigated pasture	142.7	49	29	4.9
Dry farm pasture	16.4	6	4	4.1
Orchard	5.4	2	8	0.6
Timber	0.0	0	0	0
Idle	4.5	2	6	0.7
Other	2.5	t	1	2.5
Total			*	

t = less than 1 percent.

*Number of observations does not equal number of sample transfers.

located in unincorporated towns. In Utah County 49 percent of the parcels were located in areas in which land use planning was controlled by the local citizenry. Fifty-one percent of the parcels were controlled by the county planning commissions.

In Weber County, 65 percent of the parcels were controlled by the county planning commissions, while only 35 percent were in incorporated areas. Table 17 illustrates these data.

It was expected that with rigid zoning policies enforced by the county in unincorporated areas, small incorporated communities and towns which wished to grow would relax their zoning requirements and more of the land parcels would be located in these areas. This hypothesis is supported by the above data.

Table 17. Location of sale parcels, 142 sample transfers, comparison of Utah and Weber Counties, 1974-1976

Location	Percent of observations		
	Utah	Weber	Total sample
Incorporated city of 30,000-5,000 population	13	8	11
Incorporated city of less than 5,000 population	36	27	33
Unincorporated town	4	24	11
Unincorporated county area	47	41	45
Total	100	100	100

Zoning and net change in acreage

The study area consisted of two subgroups, Utah and Weber Counties. These subgroups were identical in all but one area. They differed in the type of rural zoning that was enforced. The first subgroup, Utah County, used a large lot type of zoning in the unincorporated county areas. This type of zoning required that large acreages be required for a residential dwelling to be erected. The acreage requirements ranged from one acre, five acres, ten acres, to twenty acres. This type of zoning is enforced mainly to preserve land for agricultural purposes. It is also used to conglomerate development. A look at the county zoning map indicated that the zoning laws and boundaries that were enforced did not try to conglomerate or control development. In this county, 123,192.15 acres were zoned for particular uses. Of this area, 58 percent of the land permitted residential development on less

than 1 acre. Of significance, however, is that almost three-fourths of this land is located in incorporated communities or towns. About 20 percent of the zoned area required more than one acre and was located in the unincorporated areas of the county. The balance of the zoned area did not permit any residential development, including industrial areas, or was included in incorporated cities or towns of 30,000 population.

The other subarea, Weber County, did not incorporate large lot zoning. In Weber County, about 29 percent of the rural land required one or less acres per residential development. Of this land, just over one-third of the land was located in incorporated towns. There was about 35 percent of the rural land located in unincorporated areas that required more than one acre for residential development, yet nothing larger than 5 acres per residence was required. A look at the county's zoning map revealed that the residential development was more concentrated towards the city center.

To analyze the effects of these differences in zoning policy on the land available for agricultural production, a linear regression analysis was used. The assumptions used in the previous section were maintained. The second assumption regarding factors which affect land ownership transfer was relaxed somewhat. It was no longer assumed that both subgroups were identical. It was recognized that a difference exists in the type of zoning enforced and that this difference could affect the development pattern.

The results of this analysis are illustrated in Table 18 for Utah County and Table 19 for Weber County. Of significance in this analysis

Table 18. Effects of zoning on acreage available for agricultural production, 92 sample observations, Utah County, 1974-1976

Independent variable	Coefficient	F-value*
Farm occupation	32.28	4.81
Total size of parcel	0.275	7.95
Previous agricultural acreage	-0.378	13.79
Constant term (B_0)	-4.19	
R-squared = 0.15		Average change = -0.37 acres

*All F-values are significant at the 5 percent level.

Table 19. Effects of zoning on acreage available for agricultural production, 50 sample observations, Weber County, 1974-1976

Independent variable	Coefficient	F-value*
Total size of parcel	0.976	549.89
Previous agricultural acreage	-1.967	2066.06
Constant term (B_0)	-1.884	

*All F-values are significant at the 1 percent level.

was the R-squared values. Compare the R-squared value of 0.15 for Utah County with 0.99 for Weber County. This indicated that the development pattern in Utah County was highly unpredictable and that the independent variables obtainable were not good estimators. In Weber County the development pattern was highly predictable, where

almost all the land was taken from agricultural use and converted to another use. In both the counties' analysis, zoning requirements for residential development were not significant independent variables as measured by the F-values.

In Utah County the average change of agricultural land was only 0.37 acres being lost out of agricultural use. This can be compared to a loss in Weber County of 2.79 acres per ownership transfer. This becomes significant when compared to the average parcel size for each county. In Utah County, 0.37 acres out of 4.23 acres were lost out of agriculture with every ownership transfer. This was a loss of about 9 percent of the land involved in transfers. In Weber County, an average of 2.79 acres out of 5.58 acres, or half of the land involved in ownership transfers, were lost out of agricultural production.

SUMMARY AND CONCLUSIONS

Extremely rapid residential development has become of major concern to landowners, farmers, and governmental leaders in many urbanizing counties situated along the Wasatch Mountain Range in the State of Utah. Increased incomes, better transportation, and the desirability of country living all create an increased demand for land in the agricultural-urban fringe areas. High land values, low returns on investment, and residential encroachment place farmers in a situation where continued agricultural production is difficult. As ownership transfer occurs, the use of the land is often changed.

This study was directed at measuring the effects of ownership transfer in rural areas of rapidly urbanizing counties on the local agricultural industry. First, the general characteristics of the land buyer and parcel of land bought were described. Next, the characteristics of the agricultural production from the transferred land was described, and finally the land buyer's demand for land for agricultural uses was estimated.

In an effort to control development, most counties in Utah have adopted some form of zoning. Zoning ordinances give county governments the power to restrict and control land uses. The second part of this study was directed toward measuring the effect of two different zoning policies on agricultural production. Once again, the major area of concern was in rapidly urbanizing areas. Two subgroups were identified where zoning policies were the only primary difference.

The effects of these zoning policies were then analyzed as to their effect on purchasing decisions, location and number of acres purchased, and on agricultural production.

Data for this study were obtained from (1) a mail questionnaire sent to grantees (buyers) of rural land from 1974 through 1976 in Utah and Weber Counties in the State of Utah, (2) soil classifications for each parcel of land obtained from a soil survey map, and (3) zoning requirements obtained from a zoning map covering the study area.

Permission was received from the Utah State Tax Commission to copy names and addresses of land buyers from 1974 through 1976 in Weber and Utah Counties. The mail questionnaire was developed, pre-tested, revised, then mailed to all the names obtained from the Tax Commission. As the questionnaires were returned, the parcel of land was located on the soil survey and zoning maps and soil classifications and zoning requirement data were added to the questionnaire data. All data were then coded and punched on data process cards for computer analysis.

The findings of the study objectives were summarized. An explanation of the results and implications of the results follow.

Objective One

During the study period, the number of ownership transfers in both counties showed no definite trends. Weber County had a gradual increase followed by a large decrease. Utah County experienced a large decrease followed by an equally large increase the next year. This indicated that the land market in the counties had been erratic but not generally

increasing or decreasing during the study period.

The new land owner, after the transaction, was most likely a professional, managerial or technical middle aged worker with an annual income of twice the average income in his area. On the average 4.7 acres were involved in each ownership transfer. Over three-fourths of the land involved in the transfer was in agricultural use and as a result of the ownership transfer, one of the four agricultural acres was transferred to a new use. This new use was generally idle and/or residential uses.

The average cost per acre for the land was \$9,923.00. Weber County land buyers were paying almost twice as much per acre for the land as the Utah County land buyers. The average parcel of land was located 14.1 miles from the nearest city center of over 30,000 population. Most of the land was in the unincorporated county areas with the next most frequent location being incorporated towns of less than 5,000 population. Implications of these data suggest that as above average income buyers move into an unincorporated area of the county, they will expect more services and facilities. These services may possibly be provided at a high cost to the local government. These factors could create an economic strain on small communities as they try to provide for these new expectations. This could possibly be an area for further study.

Objective Two

As land ownership transfers occurred, agriculture was affected. Objective Two describes the agricultural picture and the changes brought about within agriculture as a result of the transfers.

Prior to the land use transfer, 78 percent of the sample acreage was in agricultural use. After the transfer about 52 percent of the sample acreage remained in agricultural use. This resulted in a loss of 174.10 acres which were taken out of agricultural use as a result of the land ownership change.

After the ownership transfer, over half of the land remaining in agriculture was used as irrigated pasture. This is more than was found in the total population. This indicated that either (1) more irrigated pasture land was involved in the ownership transfers than other types of agricultural land, or (2) that as a result of the transfer, the use of the land became less agriculturally intensive. With the average parcel size being 4.70 acres, the new landowner seemed to reside on the one acre or less and use the balance of the acreage in low intensity agricultural production, i.e., pastures.

The above supposition is further supported by the kinds and number of livestock found on the transferred parcel. Horses were the most frequent form of livestock, averaging two head per observation reporting horses. The next most frequent livestock was beef with almost five head per observation reporting beef. This suggested that the irrigated pastures are being used largely for horses and beef cattle.

Generally, the soil capacity classification was higher for the sample parcels than for the target area. This suggests that the land that is involved in ownership transfer and subsequent use transfer is of higher than average quality when used for agricultural purposes.

The land buyer's demand for agricultural land uses was estimated using a multiple regression analysis. This demand was measured in

terms of net change in agricultural acreage as a result of the ownership transfer. It was found that on the average, 1.23 acres is lost from agricultural production with every land ownership change. With the average parcel size being 4.70 acres, the quantity of land demanded by the new land owner for agricultural usage was 3.47.

Statistically significant independent variables in this analysis included: (1) soil capability classification (positive relationship), (2) zoning requirements (positive relationship), (3) location (negative relationship), (4) size of parcel (positive relationship), (5) farm occupation (positive relationship), and (6) previous agricultural acreage (negative relationship). An R-squared value of 0.819 indicated a high degree of predictability.

Objective Three

One of the expressed purposes of rural zoning policies is to protect and foster the agricultural industry. Objective Three measured the effects of two types of zoning policies on purchasing decisions and on the local agricultural industries.

Two sub-areas of the study were identified as to zoning policies. Utah County enforced a form of large lot zoning in the unincorporated areas of the county, and Weber County enforced a policy not involving large lot zoning.

Factors involving zoning were unimportant to moderately important when ranked with other factors affecting the purchasing decision. Three out of every four land buyers purchased the land for residential use and the major factors affecting his purchasing decision was the quality of the neighborhood and the availability of land. Of least importance

was closeness to family and quality of public services. These results were changed very little when the two types of policies were analyzed individually. However, in Weber County, the land buyers consistently ranked all the decision factors slightly lower than the land buyers in Utah County.

Zoning policies did not influence the land buyer as to the size and location of the parcel. Sixty-five percent of the land buyers indicated that the zoning policies had no influence on where they purchased land, eighty-one percent indicated that if there were no zoning policies enforced they would have purchased in the same location. Only nineteen percent of the land buyers indicated that the zoning policy influenced how many acres they purchased.

When the counties were analyzed separately, Weber County land buyers were less influenced by the zoning policies than the Utah County land buyers. However, in the absence of zoning laws, Weber County land buyers would have purchased land further from the city center more often than the Utah County land buyer. These results suggest that the zoning policies enforced in Weber County concentrated development more than Utah County's zoning policies.

In Utah County, where large lot zoning was enforced in the unincorporated county areas, the average parcel was located more often in incorporated cities. The area zoning requirements in these incorporated cities were generally less than one-half acre. In Weber County, the sale parcel was located more often in the unincorporated county area. In these areas, the land buyer could purchase parcels as small as one-fourth acre.

Differences in area zoning policies may have affected the local agricultural industries. In Weber County, 13.7 acres were taken out of agricultural use, compared to 34.4 acres in Utah County. In Utah County only 9 percent of the land involved in agricultural uses was transferred in use. Weber County averaged almost 50 percent.

After the ownership transfer, the agricultural use of the land in Weber County was less intense, i.e., pastures, than in Utah County. Ninety-six percent of the transferred agricultural land was used for pasture in Weber County. Utah County had 55 percent in pasture use. There was no significant difference between the two subgroups as to types of livestock on the parcel after the ownership transfer. Weber County, however, did show a higher percentage of horses than the average. Generally agricultural production from transferred parcels in Utah County was of higher value and intensity than in Weber County.

Large lot zoning may tend to push development further from the city center. In Utah County the average distance from the nearest city of over 30,000 population was 16.5 miles. In Weber County the average distance was 9.8 miles.

The estimation equation developed in Objective Two was used on the subgroup data individually. A comparison between the two estimation equations and especially the R-squared values indicated that the pattern of development in the two counties was extremely different. Weber County's development pattern was highly predictable from the estimation equation, whereas Utah County's pattern couldn't be estimated with any reliability.

No inference could be made from the sample data as to which type of zoning protected the agricultural industry best. The observations from

the study may have resulted in spite of the zoning differences. Care must be taken when interpreting the comparisons between the two types of zoning. More study is needed in this area.

General conclusion

The general hypothesis that land was being taken out of agricultural production as a result of increasing ownership transfers was confirmed. The extent of the loss is significant in that one-fourth of all the land involved in ownership transfers was taken from agricultural production. Agricultural land involved in ownership transfer was transferred into lower intensity agricultural production and the land taken from agriculture was eventually being transferred to residential use with idle usage as a transitory stage.

Generally the large lot zoned County had a wider dispersion of development and had less land per transfer taken out of agricultural production. The nonlarge lot zoned areas had development closer to the city center but more land was lost out of agricultural production with each transfer. Zoning policies, as they are written, can protect agricultural production only inasmuch as the policies are interpreted and enforced. No inference was made as to the superiority of either of the two forms of zoning in protecting the local agricultural industries.

As small communities are built up, problems of public utilities, roads, irrigation systems, recreation facilities, and urban encroachment on farm land will continue to create serious problems for governmental leaders, residential landowners, and farmers alike. More research is needed in this area.

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APPENDIX

Appendix AMail Questionnaire and Cover Letters Mailed toLand Buyers Recorded at the Utah State TaxCommission for the Years 1974-1976

QUESTIONNAIRE

INSTRUCTIONS: Fill in the blank or check the appropriate blanks as directed in each question. Answer the questions with reference to the parcel of land identified by the cover letter.

I. CHARACTERISTICS OF THE LAND OWNER

1. Land owner's age? (Check appropriate blank)
- | | |
|---|---|
| <input type="checkbox"/> Under 25 years | <input type="checkbox"/> 46-50 years |
| <input type="checkbox"/> 25-30 years | <input type="checkbox"/> 51-55 years |
| <input type="checkbox"/> 31-35 years | <input type="checkbox"/> 56-60 years |
| <input type="checkbox"/> 36-40 years | <input type="checkbox"/> 61-65 years |
| <input type="checkbox"/> 41-45 years | <input type="checkbox"/> more than 66 years |
2. Land owner's occupation? (Check appropriate blank)
- | | |
|---|--|
| <input type="checkbox"/> Professional, technical
or managerial | <input type="checkbox"/> Processing |
| <input type="checkbox"/> Clerical or sales | <input type="checkbox"/> Machine trade |
| <input type="checkbox"/> Service | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Farm, fishery, or forestry | <input type="checkbox"/> Other (Specify) |
3. Land owner's average annual income? (Check appropriate blank)
- | | |
|--|---|
| <input type="checkbox"/> \$ 0- 5,000 | <input type="checkbox"/> \$20,001-25,000 |
| <input type="checkbox"/> 5,001-10,000 | <input type="checkbox"/> 25,001-30,000 |
| <input type="checkbox"/> 10,001-15,000 | <input type="checkbox"/> 30,001-50,000 |
| <input type="checkbox"/> 15,001-20,000 | <input type="checkbox"/> more than 50,001 |

II. CHARACTERISTICS OF PROPERTY BOUGHT

1. Total number of acres in parcel purchased?
 acres
2. Total purchase price of parcel? (Including costs for residence, other buildings, equipment, water rights, or other non-land items)
\$ total cost
3. Price per acre for just the land? (Not including costs for residence, other buildings, equipment, etc.)
\$ per acre
4. When you purchased this property was there a home located on it?
 Yes No
5. If the answer to question #4 is "yes", what was the cost of the home at that time?
\$ cost
6. If a house has been constructed on this property since you purchased it what year was it constructed and what was the total cost?
 year constructed \$ total cost
7. Do you presently reside on this property?
 Yes No
8. What is the distance from this property to the nearest city of more than 30,000 population. (Distance to Ogden or Provo, whichever is closest)
- | | |
|--|--|
| <input type="checkbox"/> Within city limits of | <input type="checkbox"/> 11 miles-15 miles |
| <input type="checkbox"/> city over 30,000 pop. | <input type="checkbox"/> 16 miles-30 miles |
| <input type="checkbox"/> less than one mile | <input type="checkbox"/> 31 miles-50 miles |
| <input type="checkbox"/> 1 mile-5 miles | <input type="checkbox"/> more than 51 |
| <input type="checkbox"/> 6 miles-10 miles | |
9. Indicate which area best describes where this land is located.
- | |
|---|
| <input type="checkbox"/> Incorporated city of more than 30,000 population |
| <input type="checkbox"/> Incorporated city of 5,000 to 30,000 population |
| <input type="checkbox"/> Incorporated town of less than 5,000 population |
| <input type="checkbox"/> Unincorporated town |
| <input type="checkbox"/> Unincorporated county area |

(OVER)

III. CHARACTERISTICS OF AGRICULTURAL PRODUCTION

- What is the current use of this land? (Indicate the number of *acres* in each use)

<input type="checkbox"/> Residential	<input type="checkbox"/> Industrial
<input type="checkbox"/> Agricultural	<input type="checkbox"/> Idle
<input type="checkbox"/> Commercial	<input type="checkbox"/> Other (Specify)
- What was this land used for before you bought it? (Indicate the number of *acres* in each use)

<input type="checkbox"/> Residential	<input type="checkbox"/> Industrial
<input type="checkbox"/> Agricultural	<input type="checkbox"/> Idle
<input type="checkbox"/> Commercial	<input type="checkbox"/> Other (Specify)
- If any of this land is currently used for agricultural purposes indicate the number of *acres* in each use.

<input type="checkbox"/> Irrigated grain	<input type="checkbox"/> Orchard
<input type="checkbox"/> Dry farm grain	<input type="checkbox"/> Timber
<input type="checkbox"/> Vegetables (truck crops)	<input type="checkbox"/> Idle
<input type="checkbox"/> Irrigated pasture or forage	<input type="checkbox"/> Other (Specify)
<input type="checkbox"/> Dry farm pasture or forage	
- Do you have any livestock on this land? (Now or anytime during the year)

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------
- If the answer to question #4 is "yes" what type of livestock is there? (Indicate the annual average *number* of livestock in each category applicable)

<input type="checkbox"/> Dairy cattle	<input type="checkbox"/> Horses or Mules
<input type="checkbox"/> Beef cattle	<input type="checkbox"/> Hogs
<input type="checkbox"/> Sheep or goats	<input type="checkbox"/> Other (Specify)
<input type="checkbox"/> Poultry	
- What is the current market dollar value of the gross agricultural production *per acre* from this land? (Indicate *dollar value* in each blank applicable. If no agricultural production occurs indicate "none".)

\$ <input type="checkbox"/> Irrigated grains	\$ <input type="checkbox"/> Beef cattle
<input type="checkbox"/> Dry farm grains	<input type="checkbox"/> Sheep or goats
<input type="checkbox"/> Vegetables (truck crops)	<input type="checkbox"/> Poultry
<input type="checkbox"/> Irrigated pasture or forage	<input type="checkbox"/> Horses or mules
<input type="checkbox"/> Dry farm pasture or forage	<input type="checkbox"/> Hogs
<input type="checkbox"/> Orchard	<input type="checkbox"/> Other (Specify)
<input type="checkbox"/> Timber	<input type="checkbox"/> None
<input type="checkbox"/> Dairy cattle	

IV. CHARACTERISTICS OF PURCHASING DECISIONS

- What is the primary use for which this land was purchased?

<input type="checkbox"/> Residential	<input type="checkbox"/> Industrial
<input type="checkbox"/> Agricultural	<input type="checkbox"/> Speculative
<input type="checkbox"/> Commercial	<input type="checkbox"/> Other (Specify)
- Did the zoning regulations in your county influence your decision of *where* to purchase land?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------
- Did the zoning regulations in your county influence your decision of *how many acres* of land to purchase?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------
- In the absence of zoning regulations where would you have purchased land?

<input type="checkbox"/> In the same area	<input type="checkbox"/> Closer to the nearest city
<input type="checkbox"/> Further from the nearest city	<input type="checkbox"/> Other (Specify)
- In the absence of zoning regulations *how many acres* of land would you have purchased?

<input type="checkbox"/> Less than 1/2 acre	<input type="checkbox"/> 6 acres-10 acres
<input type="checkbox"/> 1/2 acre-1 acre	<input type="checkbox"/> 11 acres-15 acres
<input type="checkbox"/> 1 acre-2 acres	<input type="checkbox"/> 16 acres-20 acres
<input type="checkbox"/> 2 acres-5 acres	<input type="checkbox"/> More than 20 acres
- In deciding where and how much land to purchase, which of the following factors were important? (Place an (I) in the blanks by the reasons which were *important* in this decision, place an (M) in the blanks by the reasons which were *moderately important*, and an (U) in the blanks by the reasons which were *unimportant*.)

<input type="checkbox"/> Cheaper land	<input type="checkbox"/> Closeness to employment
<input type="checkbox"/> Ability to own livestock	<input type="checkbox"/> Ability to own desired home
<input type="checkbox"/> Quality of neighborhood	<input type="checkbox"/> Pretty scenery & surroundings
<input type="checkbox"/> Availability of land	<input type="checkbox"/> Quality of public services
<input type="checkbox"/> Closeness to family	<input type="checkbox"/> Other (Specify)

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

COLLEGE OF AGRICULTURE
COLLEGE OF BUSINESSDEPARTMENT OF
ECONOMICS
UMC 35

March 22, 1977

Dear Land Owner:

The Economics Department at Utah State University is conducting an analysis of the effects of zoning regulations on agricultural production in selected counties of Utah. You are undoubtedly aware of the rapid population growth in your county. This accelerating expansion is creating problems for your local governmental leaders. Our study is aimed at analysing these problems which affect you as a land owner, and provide guidelines for governmental officials.

Public records indicate that you purchased a parcel of land located during 19 in County Utah. Please complete the enclosed questionnaire with this parcel of land in mind and return it in the enclosed postage paid envelope. It will only take a few minutes to fill out the questionnaire.

I assure you your answers will be held strictly confidential. Information from yourself and other land owners in the State will be grouped and summarized in such a way that no individual's information will be revealed.

Your cooperation will be greatly appreciated.

Sincerely,

Lynn H. Davis, Professor
Agricultural Economics

Enclosures

P.S. It is extremely important that we receive your response since we are only taking a small sample of the land owners in your county.

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

COLLEGE OF AGRICULTURE
COLLEGE OF BUSINESSDEPARTMENT OF
ECONOMICS
UMC 35

April 19, 1977

Dear Land Owner:

This is a follow-up letter concerning the questionnaire sent to you on or around March 22, 1977. If you have recently returned the completed questionnaire to my office, thank you for your time and cooperation.

If you didn't complete the original questionnaire sent to you, please fill out the enclosed questionnaire and return it in the postage paid envelope.

Again, please keep in mind that we are interested in the parcel of land located _____ in _____ County, Utah.

Thank you. Your cooperation will be appreciated.

Sincerely,

Lynn H. Davis, Professor
Agricultural Economics

Enclosures

LHD/kp